

**Analyzing Software Risks and Risk Management Dimensions for Improving Firm Performance in SE IT Organizations**

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Abstract-Though the risk management concept is as old as management concept, but has been neglected until recently it gained the importance in the light of financial crisis and global recession. But, the existing business literature on risk management majorly focuses on small organizations skewed towards financial organizations. SEs too face many risks and to be managed so that they are survived and contribute to the development of economy. Financial risk, operational risk, internal risks, external risks to name a few. So, the aim of this research was to explore the current state of risk management in Pune district, Maharashtra, India, and to identify the most significant parameters of risk management of an SE IT Project Organization. A questionnaire was developed to assess the SEs whether they have identified their risks and if so, how they are managing their risks were collated. Second part of the questionnaire addresses the influence of risk management on organizational performance. The study enables in understanding on the various dimensions of risk management, which acts as predominant source of literature for body of knowledge. The parameters that constitute RM in SEs were empirically tested. Further the influence of these RM dimensions was tested on firm performance. The finds out the most significant RM dimensions and the most influenced factors of firm performance i.e non-financial firm performance. The results of the study were culminated into a structured RM assessment model for SE sector, which will contribute in reducing the number of SE failures and thereby to the economy as a whole. Software risks are uncertain events in the process of software project management and development, and may bring harm or loss to the project plans and system quality. Project managers must identify the risk, analyze them and take action to manage the risks. This paper introduces the concepts of software risk, risk analysis and risk management. It discusses the processing methods of software risks and the means of estimating and managing risks. It mainly analyses the relationship of software risks and development process models. Risk management activities involve several important steps, including identification of the risks, analyzing them, and assigning priorities. Researching on software risk analysis and management has a great role for software production and software engineering.

Keywords-Risk Management, Software Risk, Small Enterprises (SEs), IT Project Management, Risk Analysis, Organizational Performance, Non-Financial Performance, Risk Identification,

## I INTRODUCTION

Software product is a logical product and produced by people through intellectual activities [1]. Software production is accompanied by risks and crisis [2]. Along with the increasingly complex software projects, software production and management are increasingly complex, software risks also will increase. The purpose of the study is to explore characteristic of software risks, risk treatment strategies, and techniques. Project managers must take steps to ensure that their projects are done on time and within effort and cost constrains. When unwelcome events may occur during development, managers make plans to avoid these events, minimize their negative consequences [4]. A risk is an unwanted event that has negative consequences [1,5]. Project managers must identify the risk, analyze them and take action to manage the risks. In this paper, starting from the concept of software risks, we study and explore the methods and means of software risk analysis and risk management. Software Risks, Risk Analysis and Risk Management Software development is a risky businesses, software risk hinders or delays the completion of tasks or projects. People usually think: software risks are uncertain events in the process of software project management and development, and may cause harm or loss to the project plans and system quality. A risk is an unwanted event that has negative consequences. Software risk can also be expressed in Eq.1. Risk = { ( Ri, Li, Xi) } (1) Among them, Risk represents a software risk set. Ri represents software risks, Li represents the probability of occurrence of a risk, Xi represents risk results. The software risk actually is a collection of risks and its effects [6]. Software risk mainly has three different types: project management risks, technology risks and risks of product quality. The three kinds of risks are often linked together. There are a lot of risks in the software development process, some risks are hard to imagine, and difficult to estimate [7].

For software risks, we must carry on the risk analysis and risk management in software engineering activities. The process of risk identification, risk assessment and risk prediction is called risk analysis. The process of risk planning, risk control and risk regulation is referred to as risk management. Software Risk Management Strategies, Risk Identification Software Risk Management Strategies. Since the risks are unwanted events that have harmful effects on the system, so it must be taken seriously, and we must take effective risk management strategies. Like the deadlock problem in operating systems, software risks are also a kind of uncertain factors, and may or not happen. Thus risk management strategies have four kinds of methods: avoiding, restricting, reducing and monitoring [2,8]. Avoiding risks: by establishing a risk mitigation plan or changing the design, some risks can be avoided. Restricting risks: by constraints of some risks, that is, to make the risk impact only a small part of the system or programs. Reducing risks: when a risk occurs, we take some steps to alleviate the adverse consequences, and bottom out its negative effects. Monitoring risks: we should establish risk monitoring mechanism, for some unavoidable and unwanted events, to closely monitor and prevent it happening.

Software Risk Identification. Identification of software risks is trying to determine the various risk factors and events in the system, and predict its consequences. Identifying risks need to check all the documents in the system and all kinds of constraint conditions, and determine what special factors will threaten the project plans, what negative events might happen in the future, and where they might occur [9]. Managers can confirm the risks from the following

several aspects: project risks, risks of costs and benefits, risks of development process, technology and environmental risks, the risks associated with the developers, and quality risks. The managers analyze the risks they have identified, so that they can understand as much as possible about when, why, and where they might occur.

## II LITERATURE REVIEW

**Risk Management Planning** dealing with potential threats, including how much time and money will be needed. The PMBOK Handbook [12] says that this step results in a document called the Risk Management Plan, which describes the Risk Management policies, costs, responsibilities, and timetable. There are two parts to this action: naming the risks and figuring out how big they are. The first method tries to find out about all the possible outcomes and events in a project or organization. The second method sorts and ranks the risks found to help make decisions.

**Seema Sharma (2016)** : In this paper, we'll look at how early risk assessment is affected by human error when it comes to managing software projects. Human error has become the focus of early risk assessment in large software projects, and data suggest that it is a major cause of software problems (accounting for more than 80% of economic losses). Because people aren't willing to share information and data about security risks in online software applications, there hasn't been a lot of experimental research on the effects of human mistakes in this area, especially at the organizational level.

**Robin Gandhi (2018)** Normal operating procedures must be changed to account for the growing use of OSS in businesses and other organisations in order to manage the new risks that come with it. Open data standards set up by the community to describe, evaluate, and report problems with Open Source Software (OSS) could change these methods.

**Nguyen Duc (2019)**: Reusing software components from outside suppliers is one of the most important ways to improve the quality of software systems and shorten the time it takes to get them on the market. These parts, which are also called "Off-the-Shelf" (OTS) parts, can be further broken down into "Commercial Off-the-Shelf" (COTS) and "Open Source" (OSS) parts (Open-Source Software).

**Chung Min Tae (2020)**: Large projects for financial software can't be finished without the right ways to manage them. Setting a baseline based on scope, time, and cost makes it possible to track and control a project in a systematic way. So, risks must be managed so that they can be expected and plans can be made for them during the project.

**Chike F. (2017)**: Small and medium-sized businesses (SMEs) in the construction industry are especially at risk if they don't have a good plan for managing risks. Market research and industry surveys show that small and medium-sized businesses (SMEs) don't do well because

they can't handle operational risk worries well. The main goal of the study is to improve the performance of small and medium-sized enterprises (SMEs) in the construction industry by making risk management software that will help SMEs find, analyse, and deal with risks before they happen.

**M. Segarra Cañamares (2016)** Prospective data analysis of 106 small and medium-sized businesses (SMEs) in the Autonomous Community of Castile-La Mancha looks at how occupational risk-prevention measures are used and how they fit into the management systems of SMEs in the Spanish Construction Industry (Spain).

**Odeyinka, H. A (2006):** In the construction industry, the word "risk" is often used to describe any unplanned event that could affect the project's timeline, budget, or quality. Construction projects have risks, just like everything else people do, and there are many different things that add to those risks. Using a list of risk factors and a questionnaire, the study tried to figure out how important the different risk factors were. Construction professionals from contracting companies, consulting firms, and government agencies were asked to fill out a questionnaire on their own time. The data from the survey were looked at using the relative index method. Multiple regression models were used to figure out how much each risk factor affected the overall cost of building. The poll found that the top three sources of building risk are money, politics, and the weather. The regression model found that financial risk, as shown by fluctuation claims, variation claims, and loss and expenditure claims, contributed to construction cost overrun. This shows that financial risks have an effect on construction costs.

### Iii RESEARCH METHEDODOLOGY

#### Sample Design

In any such survey-based research, sampling design has its own relevance as it is a systematic approach to select the appropriate means from which the responses are likely to be compiled. Sampling is the procedure of short-listing respondents or group of them from a uniform population so that the researcher can generalize the outcome based on the responses gathered (Sachdeva, J., K., 2010).

#### Population of the study

The Unit of Analysis in the present study is the Micro, Small and Medium enterprise in the manufacturing sector. According to Malhotra (1999), population is the aggregate of all the elements that share some common set of characteristics and that comprise the universe for the purpose of the research problem.

In the present study population is finite and comprises of all Small Scale IT Organizations in Pune District, Maharashtra. As per the directory of “Small Scale IT Organizations –the total number of Small Scale IT Organizations in the Pune District is 3,200 which is considered as the population for the current study.

#### Sampling Frame

The study is conducted in Pune district of the Maharashtra state considering the time and cost involved in collecting data. There was no single source which covered cross section of Small Scale IT Organizations from the various industrial sectors/thrust sectors of Pune District, Maharashtra. Therefore, there was no sampling frame available for the current study. Although, from the conceptual perspective, only those Small Scale IT Organizations have been considered, which have completed 5 years of existence. This is based on many previous studies, which have mentioned that majority of the Small Scale IT Organizations failures happen in the first 5 years of existence. (Berger and Udell, 2001; Reynolds and Lancaster, 2006; Bank of England, 2001, Idemobi 2012).

#### Sampling Technique

Sampling techniques can be broadly classified into probability and non-probability methods. Probability sampling technique is also referred as random sampling technique wherein the probability of each sample getting selected is equal. In non probability sampling technique, the probability of each sampling element getting selected is not equal.

In the current study, both probability and non-probability sampling technique have been employed. As the population size is huge, the required sample size is large; it was not practically feasible to stick to solely one method sampling technique. Initially researcher attempted to collect the data using reference based, which is snowball sampling technique of non-probability sampling technique.

### IV DATA ANALYSIS & INTERPRETATION

#### Introduction

In the current chapter firstly, an attempt has been made to systematically describe the demographic factors of respondents Small Scale IT Organizations. Later in order to assess the reduction of measurement errors that might arise from the content of questionnaire, reliability test has been carried out on the items. One-way analysis of variance has been carried out to assess the difference in means of respondents. A detailed descriptive analysis also has been carried on each of the risk management parameters. Exploratory Factor Analysis has been carried out. Later Confirmatory Factor Analysis also has been computed in Statistical tools.

Meanwhile convergent and discriminate validity of the constructs also has been assessed. Finally, the overall model fit of the conceptual framework is evaluated through Analytical tools.

#### Descriptive Analysis on demographic details of respondents

The profile of the Small Scale IT Organizations has been collated in two major heads being the personal profile and Organization profile. The research focuses on more the business profile of Small Scale IT Organizations rather than personal profile of Small Scale IT Organizations. Apart from the education of Small Scale IT Organizations of the current Respondents, the other information pertaining to business profile of Small Scale IT Organizations constituted elements like: year of establishment of the business, which will give the information on number of years the business is old, type of business constitution, whether the company is part of group or not, number of employees, investment in the Organization.

#### Sample Profile

The researcher distributed 500 questionnaires to the 105 Small Scale IT Organizations who agreed to participate. After two rounds of reminders, 475 filled questionnaires were collected back from 100 Small Scale IT Organizations. Detailed examination of the data based on grossly missing or inappropriate values resulted in the deletion of 25 records. Thus the final data set had 450 usable records representing 450 projects from 100 companies. Table 1 gives sample collection details.

“The essence of risk management lies in maximizing the areas where we have some control over the outcome while minimizing the areas where we have absolutely no control over the outcome.”

**Table 1: The sample collection details**

| <b>Corporate IT Parks</b>                | <b>No of companies agreeing to participate</b> | <b>No. of companies participated</b> | <b>No. of responses (projects represented)</b> | <b>Final no. of records</b> |
|--|--|--------------------------------------|--|-----------------------------|
| <b>Hinjawadi IT Park</b>                 | 15   | 85                                   | 84   | 78                          |
| <b>Ozone IT Park, Pune (SP Infocity)</b> | 15   | 75                                   | 71   | 71                          |
| <b>EON IT Park:</b>                      | 15   | 70                                   | 68   | 65                          |

|                                   |            |            |            |            |
|-----------------------------------|------------|------------|------------|------------|
| <b>Rajiv Gandhi Infotech Park</b> | 15         | 75         | 73         | 71         |
| <b>MIDC Pune Infotech Park</b>    | 15         | 75         | 70         | 68         |
| <b>ICC Tech Park</b>              | 10         | 45         | 44         | 37         |
| <b>Hadapsar Industrial Estate</b> | 15         | 75         | 65         | 60         |
| <b>TOTAL</b>                      | <b>100</b> | <b>500</b> | <b>475</b> | <b>450</b> |

On checking the sample data, it was found that the following groups are sufficiently represented: (a) Project representatives in different roles (b) different types of projects (c) organizations of different sizes. Sample details in terms of project and organizational characteristics were analyzed. The details are reported in the form of a series of tables. From these tables given below, it is clear that the sample possessed considerable diversity.

**Table 2 role of the respondent**

| <b>Role/Responsibility</b> | <b>Number</b> | <b>Percent (%)</b> |
|----------------------------|---------------|--------------------|
| Project Leader             | 79            | 18%                |
| System Analyst             | 43            | 10%                |
| Project Manager            | 48            | 11%                |
| Project Member             | 197           | 44%                |
| QA Member                  | 31            | 7%                 |
| Implementation Member      | 33            | 7%                 |
| Others                     | 19            | 4%                 |
| <b>TOTAL</b>               | <b>450</b>    | <b>100%</b>        |

Table 2 shows the role of the respondent in the project. Most of the respondents were project members or project leaders

As seen in table 3, majority of the sample projects came from Business Application domain, followed by the Engineering Applications and Web Applications. This is in line with the industry trend.

**Table 3 Type of the project in the sample**

| Domain                  | Number     | Percent (%) |
|-------------------------|------------|-------------|
| Business Application    | 189        | 42%         |
| Engineering Application | 114        | 25%         |
| System Software         | 48         | 11%         |
| Web Application         | 78         | 17%         |
| Others                  | 16         | 4%          |
| Missing Values          | 5          | 1%          |
| <b>TOTAL</b>            | <b>450</b> | <b>100%</b> |

### Reliability Analysis

The reliability of the instrument developed in the current study was tested by computing Cronbach alpha ( $\alpha$ ) value for each of the five risk factors as well as for the entire set. The item-total correlation was tested for each risk item under each factor. Based on a detailed scrutiny of the item correlation matrix of the items, the following items were removed from further analysis.

1. Members who had developed the system specifications were doing the coding
2. Performance measurements of individual members was incorrectly done
3. The project necessitated working on outdated technologies

There are several methods to establish the reliability of a measuring instrument. These include test-retest method, equivalent forms, split-halves method and internal consistency method. Of all these methods, the internal consistency method is the most popular method, especially in field studies. The advantage of this method is that it requires only one administration, and consequently this method is considered to be the most general form of reliability estimation. In this method, reliability is operationalized as ‘internal consistency’, which is the degree of inter-correlation among the items that constitute the scale. The internal consistency can be estimated using a reliability coefficient called Cronbach’s alpha ( $\alpha$ ). An alpha value of 0.70 or above is considered to be the criterion for demonstrating strong internal consistency of established scales.

**Table 4 Reliability Analysis with Cronbach Alpha ( $\alpha$ )**

| Sr, No.        | Factors                         | Cronbach Alpha ( $\alpha$ ) | No. of items |
|----------------|---------------------------------|-----------------------------|--------------|
| 1              | Team Risk                       | 0.716                       | 7            |
| 2              | Complexity Risk                 | 0.760                       | 3            |
| 3              | User Risk                       | 0.738                       | 4            |
| 4              | External Risk                   | 0.751                       | 4            |
| 5              | Project Planning Execution Risk | 0.840                       | 7            |
| <b>Overall</b> |                                 | <b>0.970</b>                | <b>25</b>    |

The final values of Cronbach alpha for the risk factors are presented in above Table. As seen from the table, all the factors had Cronbach alpha value above 0.7, which testified the reliability of the instrument.

Cronbach alpha ( $\alpha$ ) values were computed for the risk management factors also. Shows in below table the final reliability scores obtained for Risk Management which comprises of four factors. All factors as well as the overall scale were seen to have Cronbach alpha above the acceptable threshold of 0.7.

**Table 5 Reliability Analysis with Cronbach Alpha ( $\alpha$ )**

| Sr, No.        | Management           | Cronbach Alpha ( $\alpha$ ) | No. of items |
|----------------|----------------------|-----------------------------|--------------|
| 1              | Execution Management | 0.737                       | 9            |
| 2              | User Coordination    | 0.820                       | 4            |
| 3              | Project Planning     | 0.682                       | 5            |
| 5              | HR Management        | 0.794                       | 7            |
| <b>Overall</b> |                      | <b>0.941</b>                | <b>25</b>    |

One Way Analysis of Variance (ANOVA)

The one-way analysis of variance (ANOVA) is used to determine whether there are any statistically significant differences between the means of three or more independent (unrelated) groups. Naresh Malhotra in his book “Marketing Research – An applied orientation” explained that analysis of variance (ANOVA) examines the differences in the mean values of dependent variable associated with the effect of the independent variables.

One-way Analysis of variance is a statistical tool wherein researcher can assess differences in the mean values of the dependent variable for several categories of a single independent variable (Bechwati, 2013). For the current research, it has been considered that the data constituting demographic factors are categorical and the opinion of IT projects In Small Scale IT Organizations on risk management parameters is metric.

Hypothesis Testing

This section presents the output of the hypotheses testing. The result of the testing of each hypothesis is presented under separate subsection.

**H1: Risk management has significant negative relationship with risk**

H1 is the alternate hypothesis stated to test the null hypothesis that risk management has no significant relationship with risk. Correlation values were computed for each pair of the five risk dimensions and four risk management dimensions. The significance is tested at 5% significance (1-tail) level.

**Table 6 t-test**

|  |             | <b>Execution Management</b> | <b>User Coordination</b> | <b>Project Planning</b> | <b>HR Management</b> |
|--|-------------|-----------------------------|--------------------------|-------------------------|----------------------|
| <b>Team Risk</b>                       | Correlation | 0.6723                      | 0.5758                   | 0.7048                  | 0.6284               |
|  | t-value     | 0.3679                      | 0.2633                   | 0.0080                  | 0.0048               |
| <b>Complexity Risk</b>                 | Correlation | 0.7053                      | 0.5291                   | 0.4543                  | 0.5192               |
|  | t-value     | 0.4299                      | 0.4384                   | 0.0445                  | 0.0350               |
| <b>User Risk</b>                       | Correlation | 0.5880                      | 0.8862                   | 0.5986                  | 0.7183               |
|  | t-value     | 0.0150                      | 0.0608                   | 0.4969                  | 0.4883               |
| <b>External Risk</b>                   | Correlation | 0.7361                      | 0.6304                   | 0.5170                  | 0.6190               |
|  | t-value     | 0.1328                      | 0.2601                   | 0.1744                  | 0.1536               |
| <b>Project Planning Execution Risk</b> | Correlation | 0.8269                      | 0.6527                   | 0.6283                  | 0.8524               |
|  | t-value     | 0.0324                      | 0.1074                   | 0.3522                  | 0.3298               |

## Hypothesis 1

H0: There are no significant difference between the mean scores of the risk Factor on risk management parameters.

H1: There are significant difference between the mean scores of the risk Factor on risk management parameters.

### 1. ANOVA Test for Organization Team risk factor on Risk Management Parameters

|                       | Sum of Squares | df   | Mean Square | F-value | P-value | F critical |
|-----------------------|----------------|------|-------------|---------|---------|------------|
| <b>Between Groups</b> | 4.167          | 4    | 1.04        | 2.71    | 0.028   | 2.375      |
| <b>Within Groups</b>  | 861.7          | 2245 | 0.38        |         |         |            |
| <b>Total</b>          | 865.9          | 2249 |             |         |         |            |

**Interpretation:** The ANOVA test indicates p value to be 0.028 which is being less than 0.05 level of significance. There is no significant difference between the mean scores of the risk Factor on risk management parameters.

### 2. ANOVA Test for Organization Complexity Risk factor on Risk Management Parameters

|                       | Sum of Squares | df   | Mean Square | F-value | P-value | F critical |
|-----------------------|----------------|------|-------------|---------|---------|------------|
| <b>Between Groups</b> | 3.436          | 4    | 0.859       | 2.026   | 0.088   | 2.375      |
| <b>Within Groups</b>  | 951.51         | 2245 | 0.423       |         |         |            |
| <b>Total</b>          | 954.95         | 2249 |             |         |         |            |

**Interpretation:** The ANOVA test indicates p value to be 0.088 which is being more than 0.05 level of significance. There is significant difference between the mean scores of the risk Factor on risk management parameters.

**3. ANOVA Test for Organization User Risk factor on Risk Management Parameters**

|                       | Sum of Squares | df   | Mean Square | F-value | P-value | F critical |
|-----------------------|----------------|------|-------------|---------|---------|------------|
| <b>Between Groups</b> | 3.425          | 4    | 0.856       | 2.155   | 0.072   | 2.376      |
| <b>Within Groups</b>  | 891.806        | 2245 | 0.397       |         |         |            |
| <b>Total</b>          | 895.231        | 2249 |             |         |         |            |

**Interpretation:** The ANOVA test indicates p value to be 0.072 which is being less than 0.05 level of significance. There is significant difference between the mean scores of the risk Factor on risk management parameters. .

**4. ANOVA Test for Organization External Risk factor on Risk Management Parameters**

|                       | Sum of Squares | df   | Mean Square | F-value | P-value | F critical |
|-----------------------|----------------|------|-------------|---------|---------|------------|
| <b>Between Groups</b> | 2.874          | 4    | 0.719       | 1.781   | 0.130   | 2.376      |
| <b>Within Groups</b>  | 905.922        | 2245 | 0.404       |         |         |            |
| <b>Total</b>          | 908.796        | 2249 |             |         |         |            |

**Interpretation:** The ANOVA test indicates p value to be 0.130 which is being less than 0.05 level of significance. There is significant difference between the mean scores of the risk Factor on risk management parameters.

**5. ANOVA Test for Organization Project Planning Execution Risk factor on Risk Management Parameters**

|                       | Sum of Squares | df   | Mean Square | F-value | P-value | F critical |
|-----------------------|----------------|------|-------------|---------|---------|------------|
| <b>Between Groups</b> | 3.067          | 4    | 0.767       | 1.989   | 0.094   | 2.376      |
| <b>Within Groups</b>  | 865.529        | 2245 | 0.386       |         |         |            |
| <b>Total</b>          | 868.596        | 2249 |             |         |         |            |

**H2: Risk has significant negative relationship with project outcome**

**Hypothesis 2**

H0: There is no significant difference between the mean scores of the risk Factor on project outcome

H1: There is significant difference between the mean scores of the risk Factor on project outcome

**6. ANOVA Test for Organization Project Risk has significant negative relationship with project outcome**

|                       | Sum of Squares | df  | Mean Square | F-value | P-value | F critical |
|-----------------------|----------------|-----|-------------|---------|---------|------------|
| <b>Between Groups</b> | 0.319          | 1   | 0.3190      | 1.057   | 0.303   | 3.851      |
| <b>Within Groups</b>  | 270.8          | 898 | 0.3015      |         |         |            |
| <b>Total</b>          | 271.153        | 899 |             |         |         |            |

**H3: Risk management has significant positive relationship with project outcome**

**Hypothesis 3**

H0: There is no significant difference between the mean scores of the risk Management on project outcome

H1: There is significant difference between the mean scores of the risk Management on project outcome

**7. ANOVA Test for Organization Project Risk management has significant positive relationship with project outcome**

|                       | Sum of Squares | df  | Mean Square | F-value | P-value | F critical |
|-----------------------|----------------|-----|-------------|---------|---------|------------|
| <b>Between Groups</b> | 0.200          | 1   | 0.2002      | 0.704   | 0.401   | 3.851      |
| <b>Within Groups</b>  | 255.067        | 898 | 0.2840      |         |         |            |
| <b>Total</b>          | 255.26         | 899 |             |         |         |            |

**Interpretation:** The ANOVA test indicates p value to be 0.401 which is being more than

**H4: There is a significant variation in risk across categories of project characteristics**

**Hypothesis 4**

H0: There is no significant difference between the mean scores of risk across categories of project characteristics

H1: There is significant difference between the mean scores of the risk across categories of project characteristics

**8. ANOVA Test for Organization variation in risk across categories of project characteristics**

|                       | Sum of Squares | df  | Mean Square | F-value | P-value | F critical |
|-----------------------|----------------|-----|-------------|---------|---------|------------|
| <b>Between Groups</b> | 1.609          | 1   | 1.609       | 4.782   | 0.0290  | 3.851      |
| <b>Within Groups</b>  | 302.18         | 898 | 0.336       |         |         |            |
| <b>Total</b>          | 303.79         | 899 |             |         |         |            |

**H5: There is a significant variation in risk across categories of organizational characteristics**

**Hypothesis 5**

H0: There is no significant variation in risk across categories of organizational characteristics

H1: There is significant variation in risk across categories of organizational characteristics

**9. ANOVA Test for Organization variation in risk across categories of organizational characteristics**

|                       | Sum of Squares | df  | Mean Square | F-value | P-value | F critical |
|-----------------------|----------------|-----|-------------|---------|---------|------------|
| <b>Between Groups</b> | 1.33           | 1   | 1.325       | 4.155   | 0.042   | 3.852      |
| <b>Within Groups</b>  | 286.41         | 898 | 0.319       |         |         |            |
| <b>Total</b>          | 287.73         | 899 |             |         |         |            |

| Hypothesis          | Independent Variable      | Dependent Variable           | Relation Type | Null Hypothesis Rejected or Accepted |
|---------------------|---------------------------|------------------------------|---------------|--------------------------------------|
| <b>Hypothesis 1</b> | Risk Factors              | Management Risk              | No Relation   | Rejected                             |
| <b>Hypothesis 2</b> | Project Risk              | Project outcome              | Relation      | Accepted                             |
| <b>Hypothesis 3</b> | Management Risk           | Project outcome              | Relation      | Accepted                             |
| <b>Hypothesis 4</b> | Risk Factors              | Project characteristics      | No Relation   | Rejected                             |
| <b>Hypothesis 5</b> | Risk Factors & Management | Organization characteristics | No Relation   | Rejected                             |

**V CONCLUSION**

India has become the major destination of software development and there is no dearth of software projects. However, the study on risk, risk management and project outcome with respect to software development projects was not easy. Lack of published material in the Indian

context was the first challenge. This was overcome by the use of international literature and local expert opinion. Data collection posed the next major challenge. The delicacy of revealing project related information and opinion posed a major hurdle. The senior management of the organization had to be taken into confidence with regard to the confidentiality and the strictly academic nature of the study. The participating companies were promised a consolidated report of the research.

The study has identified major risk and risk management factors in the Indian context. Models grounded in theory are developed and empirically validated. The findings of the study could be used by practicing managers for better risk management. The models developed in this research can be refined and improved further by future researchers. The objectives laid down in the beginning of the research could be finally achieved to a high degree of satisfaction. As in all research, this work too has its limitations mentioned earlier.

#### Findings of the study

Failure of software development projects is a common problem reported from organizations across the small scale organization. These failures can be attributed to various risk factors present in the software development projects. Experts in the area recommend that risk associated with software development projects must be identified and managed throughout the course of a development project. Various research studies have looked at the presence of risk and risk management in software development.

#### Findings from the Data Analysis

- To understand the risk management practices carried out by the Small Enterprises it is important to know the number of years SSITs are being operational. 74 (16 percent) of the respondent SSITs are with minimum 5 years of existence and maximum of 10 years. 134 (33 Percent) of the organisations are 11 to 15 years old. 118 (26 Percent) of the organisations are 16 to 20 years old and 76 (17 Percent) organisations are above 20 years old.
- It is important to know the business constitution for studying the risk management practices carried out by them. Out of 450 SSITs, 259 (57 Percent) of the SSITs are sole proprietorship. 46 (10.2 Percent) of the SSITs are having the business constitution as partnership, 78 (17 Percent) of the SSITs are Joint family Concern. 67 (14.9 Percent) of the SSITs are having the business constitution as Private Limited Company.
- The level of education of the SSIT owner-managers will assist to understand their perception towards risk and risk management. 82 (18 Percent) of the owner-managers have SSLC or below SSLC level education. 112 (24 Percent) of the owner-managers have Diploma holders. 97 (21 Percent) of the owner-managers have bachelor degree. 123 (27 Percent) of the owner-managers have Engineering degree. 22 (4.9 Percent) of the owner

mangers have done post-graduation and 14 (3.1 Percent) of the people have done other courses.

- It is also important to know that whether an SSIT is a standalone organisation or it belongs to a group. Out of 450 samples, 322 (72 Percent) organisations were independent organisations. 89 (20 Percent) of the organisations belonged to a group and they were the parent company. 39 (8 Percent) of the organisations also belong to the group, but they were acting as subsidiary.
- It is crucial to understand the revenue of these SSITs which will indicate the level of financial size of the enterprise. 126 (28 Percent) of the units have up to Rs. 10 crores revenue. 98 (21 Percent) of the units have above Rs. 11 crores and up to Rs. 20 Crore. 113 (25 Percent) of the units have above Rs. 21 crore and up to 30 crore revenue. 67 (15 Percent) of the units have revenue of above Rs. 31 crore and up to Rs. 40 crore and 46 (11 Percent) of the units have revenue above Rs. 40 crore.
- Test for assessing the difference between mean scores of different factors of SSIT profile on Parameters of Risk Management has been computed using one way analysis of variance. The different factors of SSIT profile assessed are: Business age i.e. Number of years of existence of the enterprise, the business constitution i.e type of SSIT ownership, education of owner, whether SE unit is part of group or an independent unit, generation of current owner, number of employees working in the organisation, As a result it has been found that there is no difference in mean scores of different factors of SSIT profile on parameters of Risk management. These findings are in line with the previous researchers such as Jayathilake, P. M. B. (2012) and Kozubíková et al (2015)
- It is found that questionnaire for the study is internally consistent as the reliability test indicated by Cronbach's Alpha value is 0.970 which is above the acceptable limit of 0.70. The data compiled has no missing values and nor has any duplicate cases.
- The factors were grouped under financial risk, operational risk, internal risk, external risk, risk evaluation, risk control and risk monitoring.

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