International Journal on
Information Technology
(IREIT)

Contents

Power Protection and Management Course for an Electrical Engineering Technology Program 278
by Francisco J. Perez-Pinal, Jose C. Nuñez-Perez, Ismael Araujo-Vargas

Development of Machine Learning Models to Predict Student Performance in Computer Literacy Courses 285
by George Anderson, Oduronke T. Eyitayo

The Use of GIS in Tourism Supply and WEB Portal Development 292
by Verka Jovanovic, Angelina Njegus

Managing Software Project Risks (Implementation Phase) with Proposed Stepwise Regression Analysis Techniques 300
by Abdelrafe Elzamly, Burairah Hussin

Praise Worthy Prize

Praise Worthy Prize

International Journal on Information Technology (I.RE.I.T.) Vol. 1, N. 5
ISSN 2281-2911
September 2013

Managing Software Project Risks (Implementation Phase) with Proposed Stepwise Regression Analysis Techniques

Abdelrafe Elzamly[1,2], Burairah Hussin[2]

Abstract – *Regardless how much effort we put for the success of software projects, many software projects have very high failure rate and risks are everywhere in life. Risk is not always avoidable, but it is controllable. The aim of this paper is to present new techniques by which we can study the impact of different risk management techniques and different risk factors on software development projects. The new technique uses the stepwise regression to managing the risks in a software project and reducing risk with software process improvement. Top ten software risk factors (Implementation phase) and thirty control factors were presented to respondents. The results show that all risks in software projects were important in software project manager perspective, whereas all controls are used most of time, and often. These tests were performed using regression analysis to compare the controls to each of the risk factors to determine if they are effective in mitigating the occurrence of each risk factor and selecting best model. We referred the risk management techniques were mitigated on ten top software risk factors in Table XLVI. The study has been conducted on a group of software project managers. Successful project risk management will greatly improve the probability of project success.* ***Copyright © 2013 Praise Worthy Prize S.r.l. - All rights reserved.***

Keywords*:* *Software Project Management, Risk Management, Software Risk Factors, Implementation Phase, Risk Management Techniques, Stepwise Regression Analysis Techniques*

I. Introduction

Despite much research and progress in the area of software project management, software development projects still fail to deliver acceptable systems on time and within budget. For some of these reasons corrective action is often difficult to cost-justify or to implement efficiently in practice [1]. Much of the failure could be avoided by managers pro-actively planning and dealing with risk factors rather than waiting for problems to occur and then trying to react. Project management and risk management has been proposed as a solution to preserve the quality and integrity of a project by reducing cost escalation [2]. Due to the involvement of risk management in monitoring the success of a software project, analyzing potential risks, and making decisions about what to do about potential risks, the risk management is considered the planned control of risk. Integrating formal risk management with project management is a new phenomenon in software engineering and product management community.

It requires that project managers need to be involved in a project from the concept phase to the product's retirement [3]. In addition, risk is an uncertainty that can have a negative or positive effect on meeting project objectives. Risk management is the process of identifying, analyzing and controlling risk throughout the life of a project to meet the project objectives [2].

Clearly, the success or failure of software projects are generally assessed in three dimensions: budget, schedule, product functionality and quality [4].

However, the goal of risk management at early identification and recognition of risks and then actively changes the course of actions to mitigate and reduce the risk [5]. In the process of understanding the factors that contribute to software project success, risk is becoming increasingly important. This is a result of the size, complexity and strategic importance of many of the information systems currently being developed.

Today, we must think of risk is a part of software project lifecycle and is important for a software project survival [6]. On the other hand, risk management aims to read risks as improvement opportunities and provide inputs to growth plans [6]. Also software projects are difficult to manage and too many of them end in failure [7]. Masticola described risk management to mean any activity that is intended to help software project managers to understand and manage the risk of serious budget overruns in software projects [1].

In our paper, we identified risk factors and risk management techniques that are guide software project managers to understand and mitigate risks in software development projects. However, Software Development Life Cycle according to [8], is the process of creating or altering systems, and the models and methodologies that people use to develop these systems.

Manuscript received and revised August 2013, accepted September 2013

Also it includes these phases as follow [8]: Planning, analysis, design, implementation, and maintenance.

In addition, we focused on implementation phase: It involves the actual construction and installation of a system. This involves putting together the different pieces that will create the system. According to Taylor we should be applied techniques consistently throughout the software project risk management process [9]. Risk management is a practice of controlling risk and practice consists of processes, methods, and tools for managing risks in a software project before they become problems [10]. Therefore, Boehm talked about value-based risk management, including principles and practices for risk identification, analysis, prioritization, and mitigation [11]

The objective of this study is: To identify the risk factors of software projects in the Palestinian software development organizations, to rank the software risk factors according to their importance, severity and occurrence frequency based on data source, to identify the activities performed by software project managers to manage the software project risks which identified. The organization of this paper as will be as follows. Section 2 presents an overview of the literature. Section 3 introduces the software risk factors (Implementation phase) relevant to the study. Section 4 introduces the common risk management techniques to these risks. Section 5 presents the empirical work. Section 6 concludes the article and glimpses on future work.

II. Literature Review

Taylor [12] describes key risks identified by a group of Hong Kong project managers working for vendor IT firms who offered package implementation solutions both locally and overseas. In that study a number of new risks from the vendor perspective have been identified, which indicate that vendor project managers typically have a broader focus on risks than their in-house counterparts. Addison and Vallabh [13] focused on experienced project manager's perceptions of software project risks and controls.

This work reports on the more significant risks and controls that are utilized to reduce the occurrence of the risk factors. The effectiveness of various controls to reduce the occurrence of risk factors was also identified and discussed.

Wallace and Keil [14] explored how different types of risk influence both process and product outcomes in software development projects by analyzing input from more than 500 software project managers representing multiple industries. Liu et al. [15] Presented a systematic literature review which purposed is to obtain the state of the art of the applications of Software Process Simulation Modeling (SPSM) in software risk management. Odzaly et al. [16] found good awareness of risk management, but low tool usage.

They offer evidence that the main barriers to performing risk management are related to its perceived high cost and comparative low value.

Confirmed barriers that prevent or reduce its application, the main ones being related to the extent of human effort required or the perceived value of that effort.

Despite this, none of their sample used dedicated risk management tools. Hence, as future research they investigated how routine risk management actions can be carried out by tools, preferably autonomically. Bannerman [17] described project structure is a little like infrastructure. It is assumed to be there but, otherwise, it is usually ignored in everyday conscious activity.

That paper has reported preliminary work in highlighting the potential role and importance of the structural context of projects in successfully delivering software, and has suggested some initial approaches to managing the associated risks. Zazworka and Ackermann [18] presented a software visualization tool (CodeVizard) that helped researchers and managers to analyzed software repository data.

The tool focused on identifying areas of risks in software development projects, such as: Code Smells, degrading architectures, increasing software complexity, lack of documentation, process violations, and issues of code ownership. CodeVizard has been used to support six empirical studies. Islam [19] contributed for a goal-driven software development risk management model to assess and manage software development risk within requirement engineering phase.

They focused to identify the early software development risk factors from Bangladesh having limited IT infrastructure facilities. Furthermore, little work has been undertaken on the potential effects of these risk factors. To address this issue, their survey study not only identifies the risk factors but also quantify the potential effects of these factors. Also they implement the proposed model to running software development projects. Elzamly and Hussin [20] improved quality of software projects of the participating companies while estimating the quality–affecting risks in IT software projects. The results show that there were 40 common risks in software projects of IT companies in Palestine.

The amount of technical and non-technical difficulties was very large. The most of the risks were very important. The study has been conducted on a group of managers to improve the probability of project success.

Dhlamini [21] demonstrated the need for risk management tools in software project since the complexity of risk management increases with the complexity of the developed system. The need for risk management tools which are intelligent has also been demonstrated such tools would have the capacity to be used with any development methodology, whether traditional, agile, or even a combination of them. They also proposed two frameworks for the development of intelligent risk management tools; neural networks and intelligent agent based. Melo and Sanchez [22] presented managing software maintenance is rarely a precise task due to uncertainties concerned with resources and services descriptions.

TABLE I
TOP TEN SOFTWARE RISK FACTORS IN SOFTWARE PROJECT LIFECYCLE (IMPLEMENTATION PHASE) BASED ON RESEARCHERS

Dimension	No	Software risk factors	frequency
Implementation	1	Failure to gain user commitment	5
	2	Personnel shortfalls	4
	3	Failure to utilize a phased delivery approach	2
	4	Too little attention to breaking development and implementation into manageable steps	2
	5	Inadequate training team members	1
	6	Inadequacy of source code comments	1
	7	Inadequate test cases and generate test data	1
	8	Real-time performance shortfalls	1
	9	Test case design and Unit-level testing turns out very difficult	1
	10	Lack of adherence to programming standards	1
		Total frequency	19

This paper presents a knowledge-based representation (Bayesian Networks) for maintenance project delays based on specialists experience and a corresponding tool to help in managing software maintenance projects. Khanfar et al. [23], we put for the success of software projects, many software projects have very high failure rate. In addition, we presented a new technique by which we can study the impact of different control factors and different risk factors on software projects risk. The new technique uses the chi-square ($\chi 2$) test to control the risks in a software project. Fourteen risk factors and eighteen control factors were used. The study has been conducted on a group of managers. However, we also used new techniques the regression test and effect size test proposed to managing the risks in a software project and reducing risk with software process improvement. Fourteen risk factors and eighteen control factors were used in this paper.

The nine of fourteen factors mitigated by using control factors. The study has been conducted on a group of managers [24]. According to [25] risk management consists of the processes, methodologies and tools that are used to deal with risk factors in the Software Development Life Cycle (SDLC) process of Software Project. Also dash described risk management is defined as the activity that identifies a risk; assesses the risk and defines the policies or strategies to alleviate or lessen the risk. Also Oracle Corporation described risk management solutions enable a standardized approach for identifying, assessing and mitigating risk throughout the software project lifecycle [26]. Finally, risk management is the process of identifying, analyzing and controlling risk throughout the life of a software project to meet the goals.

III. Top 10 Software Risk Factors (Implementation Phase)

We displayed the top software risk factors in software development project lifecycle (Implementation phase) that most common used by researchers when studying the risk in software projects. However, the list consists of the 10 most serious risks to a project ranked from one to ten, each risk's status, and the plan for addressing each risk.

These factors need to be addressed and thereafter need to be controlled. Consequently, we presented 'top-ten' based on survey Boehm's 10 risk items 1991 on software risk management [27], the top 10 risk items according to a survey of experienced project managers, Boehm's 10 risk items 2002 and Boehm's 10 risk items 2006-2007, Miler [4], The Standish Group survey [28], Addison and Vallabh [13], Addison [29], Khanfar, Elzamly et al. [23], Elzamly and Hussin [24], Elzamly and Hussin [20], Aloini et al.[30], Han and Huang [31] [32], Aritua et al. [33], Schmidt et al. [34], Mark Keil et al. [7], Nakatsu and Iacovou [35], Chen and Huang [36], Mark Keil et al. [37], Wallace et al. [38], Sumner [39], Boehem and Ross [40], Ewusi-Mensah [41], Pare et al. [42], Houston et al. [43], Lawrence et al.[44], Shafer and Officer [45], hoodat and Rashidi [46], Jones et al. [47], Jones [48], Taimour [49], and another scholars, researchers in software engineering to obtain software risk factors and risk management techniques, these software project risks are shown in Table I.

IV. Risk Management Techniques

Through reading the existing literature on software risk management, we listed thirty control factors that are considered important in reducing the software risk factors identified; these controls are:

C1: Using of requirements scrubbing, C2: Stabilizing requirements and specifications as early as possible, C3: Assessing cost and scheduling the impact of each change to requirements and specifications, C4: Develop prototyping and have the requirements reviewed by the client, C5: Developing and adhering a software project plan, C6: Implementing and following a communication plan, C7: Developing contingency plans to cope with staffing problems, C8: Assigning responsibilities to team members and rotate jobs, C9: Have team-building sessions, C10: Reviewing and communicating progress to date and setting objectives for the next phase, C11: Dividing the software project into controllable portions, C12: Reusable source code and interface methods, C13: Reusable test plans and test cases, C14: Reusable database and data mining structures, C15: Reusable user documents early, C16: Implementing/Utilizing automated version control tools, C17: Implement/ utilize benchmarking and tools of technical analysis, C18: Creating and analyzing process by simulation and modeling, C19: Provide scenarios methods and using of the reference checking, C20: Involving management during the entire software project lifecycle, C21: Including formal and periodic risk assessment, C22: Utilizing change control board and exercise quality change control practices, C23: Educating users on the impact of changes during the software project, C24: Ensuring that quality-factor deliverables and task analysis, C25: Avoiding having too many new functions on software projects, C26: Incremental development(deferring changes to later increments), C27: Combining internal evaluations by external reviews, C28: Maintain proper documentation of each individual's work, C29: Provide training in the new technology and organize domain knowledge training, C30: Participating users during the entire software project lifecycle.

The literature review revealed the following question: Do experienced project managers control software project risk factors by using the controls identified in this paper? To answer this question, the following objectives for the empirical work have been set forth: Identify the risk factors of software projects in the Palestinian software development organizations, to rank the software risk factors according to their importance, severity and occurrence frequency based on data source, to identify the activities performed by software project managers to manage the software project risks which identified.

V. Empirical Strategy

Data collection was achieved through the use of a structured questionnaire and historical data for assist in estimating the quality of software through determine risks that were common to the majority of software projects in the analyzed software companies. Top ten software risk factors and thirty control factors were presented to respondents. The method of sample selection referred to as 'snowball' and distribution personal regular sampling was used. This procedure is appropriate when members of homogeneous groups (such as software project managers, IT managers) are difficult to locate.

The seventy six software project managers have participated in this study. The project managers that participated in this survey are coming from specific mainly software project manager in software development organizations.

Respondents were presented with various questions, which used scales1-7. For presentation purposes in this paper and for effectiveness, the point scale as the following: For choices, being headed 'unimportant' equal one and 'extremely important' equal seven.

Similarly, seven frequency categories were scaled into 'never' equal one and 'always' equal seven. All questions in software risk factors were measured on a seven–point Likert scale from unimportant to extremely important and software control factors were measured on a seven–point Likert scale from never to always.

Therefore, the more extreme categories were combined in a way such that seven-point scale has been reduced to five-point scale as the following: A category called 'somewhat important' was created, combining the two ratings very slightly important' and 'slightly important'.

Similarly, a category called 'very important' combined the two ratings 'very important' and 'extremely important'. Similarly, seven frequency categories were re-scaled into five sub-categories for presentation purposes. 'rarely' combined the two ratings 'rather seldom' and 'seldom'. 'never', 'Sometimes' and 'often' was unchanged, while 'most of the time', combined the two ratings 'usually' and 'always'.

However to describe "software Development Company in Palestine" that have in-house development software and supplier of software for local or international market, we depended on Palestinian Information Technology Association (PITA) Members' webpage at PITA's website [PITA 2012www.pita.ps/], Palestinian investment promotion agency [PIPA 2012 http://www.pipa.gov.ps/] to select top IT manager, software project managers.

In order to find the relation among risks that the software projects confronts and the counter measures that should be done to reduce risks, many researchers used different statistical methods. In this thesis, we used correlation analysis, regression analysis models based on stepwise selection method and Durbin–Watson Statistic.

Correlation analysis:

Clearly, the preceding analysis states that there are correlations between determining variables besides correlation between risk factors and all determining control factors [50].

However, the equation of Correlation Coefficient is the following as [51]-[52]:

$$r = \frac{n\left[\sum(X_i \cdot Y_i)\right]-\left(\sum X_i\right)\left(\sum Y_i\right)}{\sqrt{\left[n\left(\sum X_i^2\right)-\left(\sum X_i\right)^2\right]\left[n\left(\sum Y_i^2\right)-\left(\sum Y_i\right)^2\right]}} \quad (1)$$

Regression analysis model:

Regression modeling is one of the most widely used statistical modeling technique for fitting a response (dependent) variable as a function of predictor (independent) variables [52].

Indeed, software risk factor is dependent variable while control factors are independent variables.

A linear equation between one and many independent variables (multiple regression) may be expressed as:

$$Y=b_0+b_1x_1+b_2x_2+\ldots+b_nx_n \quad (2)$$

where b_0, b_1, b_2, ...and b_n are constants; x_1, x_2,..... and x_n are the independent variables, and y is the dependent variable.

The values of b_0, b_1, b_2,....and b_n of the multiple regression equation may be obtained solving the next linear equations system [52].

Stepwise regression (adds and removes variables):

According to [53]-[54], stepwise regression method (SRM) combines and alternates between forward selection and backward elimination.

At each step, the best remaining variable is added, provided it passes the significant at 5% criterion, then all variables currently in the regression are checked to see if any can be removed, using the greater than 10% significance criterion.

In addition [54], the MSRA method is a stepwise optimization process of the multiple regression analysis method.

Also, a stepwise-regression method that systematically adds and removes modal components based on statistical test to automatically identify the risks for a large scale data in operation [55].

Therefore [53], It is particularly useful when we need to predict a set of dependent variables from a (very) large set of independent variables.

Coefficient of determination:

Coefficient of determination (r^2) is the proportion of variation in the observed values of the response variable that is explained by the regression [52]:

$$r^2 = \frac{RSS}{TSS} = \frac{\sum\left(y' - y_{avg}\right)^2}{\sum\left(y - y_{avg}\right)^2} \quad (3)$$

According to [52], regression sum of squares (RSS): The variation in the observed values of the response variable that is explained by the regression, total sum of squares (TSS): The variation in the observed values of the response variable.

The Durbin–Watson statistic:

Durbin–Watson is a number that tests for autocorrelation (the relationship between values separated from each other by a given time lag) in the residuals (prediction errors) from a statistical regression analysis (http://www.investopedia.com/terms/d/durbin-watson-statistic.asp/2013/2/26).

Consequently, we will avoid using independent variables that have errors with a strong positive or negative correlation, because this can lead to an incorrect forecast for the dependent variable.

However, the value D always lies between 0 and 4 the Eq. (4) defined D-W statistic as:

$$d = \frac{\sum\left(e_i - e_{i-1}\right)^2}{\sum e_i^2}, \text{ for } n \text{ and } K-1 \; d \cdot f \quad (4)$$

where i is the number of observations.

Importance of risk factors in Implementation phase:

All respondents indicated that the risk of "Inadequacy of source code comments" was the highest risk factors and important. In fact, all risk factors important, aggregating the responses resulted in the following ranking of the importance of the listed risks (in order of importance): Risk 6, Risk 3, Risk 2, Risk 10, Risk 1, Risk 4, Risk 9, Risk 5, Risk 7 and Risk 8.

TABLE II
MEAN SCORE FOR EACH RISK FACTOR (IMPLEMENTATION PHASE)

Risk	N	Mean	Std. Deviation	% percent
r6	76	3.671	0.661	73.421
r3	76	3.658	0.793	73.158
r2	76	3.632	0.746	72.632
r10	76	3.553	0.79	71.053
r1	76	3.553	0.807	71.053
r4	76	3.513	0.757	70.263
r9	76	3.5	0.808	70
r5	76	3.487	0.808	69.737
r7	76	3.474	0.739	69.474
r8	76	3.474	0.774	69.474
total	76	3.551	0.562	71.026

Ranking of importance of risk factors for project managers' experience:

As we see the results in Table III show that most of the risks are important the overall ranking of importance of each risk factor for the three categories of project managers' experience.

TABLE III
THE OVERALL RISK RANKING OF EACH RISK FACTOR

Phase	Risk	Experience 2-5 years	Experience 6-10 years	Experience >10 years
Implementation	R 1	r6	r6	r3
	R 2	r2	r3	r10
	R 3	r3	r1	r9
	R 4	r7	r2	r2
	R 5	r10	r8	r4
	R 6	r5	r10	r1
	R 7	r1	r9	r5
	R 8	r4	r4	r7
	R 9	r8	r7	r6
	R 10	r9	r5	r8

Frequency of occurrence of controls:

Table IV shows the mean and the standard deviation for each control factor. The results of this paper show that most of the controls are used most of the time and often.

The overall ranking of importance of each control factor for the three categories of project managers' experience. It shows that the controls (29, 30, 17, 18, 28, 16, 27, 19, 20, 26, 26, 8, 25, 23, 21, 15, 24) are the most frequently used by the least experienced (2–5 years) project managers, whereas the controls (22, 9, 7, 13, 14, 11, 5, 4, 3, 12) are used often and sometimes by them.

Also the controls (30, 10, 29, 22, 20, 21, 25, 27, 19, 5, 15, 6, 28, 26, 9, 8) are the most frequently used by the experienced (6–10 years) project managers, whereas remained the controls are used often by them. Also all the controls are the most frequently used by the most experienced (10 and above years) project managers.

TABLE IV
THE MEAN SCORE FOR EACH CONTROL FACTOR

Control	Mean	Std. Deviation	% percent
c29	4.408	0.803	88.15789
c30	4.368	0.907	87.36842
c20	4.184	0.668	83.68421
c27	4.171	0.755	83.42105
c21	4.171	0.7	83.42105
c19	4.158	0.612	83.15789
c28	4.158	0.767	83.15789
c25	4.132	0.718	82.63158
c26	4.118	0.653	82.36842
c23	4.105	0.741	82.10526
c22	4.092	0.786	81.84211
c18	4.079	0.726	81.57895
c10	4.079	0.726	81.57895
c17	4.066	0.718	81.31579
c24	4.066	0.639	81.31579
c8	4.066	0.736	81.31579
c5	4.053	0.728	81.05263
c11	4.039	0.756	80.78947
c15	4.039	0.621	80.78947
c9	4.039	0.756	80.78947
c14	4.013	0.683	80.26316
c7	4.013	0.721	80.26316
c16	4	0.693	80
c12	3.987	0.841	79.73684
c6	3.987	0.739	79.73684
c4	3.987	0.757	79.73684
c3	3.974	0.783	79.47368
c2	3.934	0.66	78.68421
c1	3.895	0.665	77.89474
c13	3.868	0.754	77.36842

TABLE V
OVERALL CONTROL FACTOR RANKING

Control	Experience 2-5 years	Experience 6-10 years	Experience >10 years
C1	c29	c30	c29
C2	c30	c10	c30
C3	c17	c29	c7
C4	c18	c22	c23
C5	c28	c20	c21
C6	c16	c21	c2
C7	c27	c25	c27
C8	c19	c27	c24
C9	c20	c19	c20
C10	c26	c5	c11
C11	c8	c15	c28
C12	c25	c6	c26
C13	c23	c28	c3
C14	c21	c26	c6
C15	c15	c9	c19
C16	c24	c8	c12
C17	c22	c11	c10
C18	c9	c4	c5
C19	c7	c24	c25
C20	c13	c14	c14
C21	c14	c23	c1
C22	c11	c12	c9
C23	c5	c18	c22
C24	c4	c17	c4
C25	c3	c3	c18
C26	c12	c16	c15
C27	c10	c2	c13
C28	c6	c1	c8
C29	c1	c7	c17
C30	c2	c13	c16

Relationships between risks and control variables:

Regression technique was performed on the data to determine whether there were significant relationships between control factors and risk factors. The pairings resulted in high values of R^2, so interpretation of relationships between the variables is cautious and findings are reported conservatively.

These tests were performed using regression analysis, to compare the controls to each of the risk factors to determine if they are effective in mitigating the occurrence of each risk factor.

Relationships between risks and controls, which were significant and insignificant, any control is no significant, we are not reported according to the best model.

R1: Risk of 'Failure to Gain User Commitment' Compared to Controls:

Tables VI to IX show that the significant value is less than the assumed value at the $\alpha = 0.05$ level of significance, so there is a positive relation among controls 3, 5, 7, 8, 9, 11 and risk 1.

Also the control 3 has an impact on the risk 1. In addition, the results show that control 3 has a positive impact value of 0.292 and the value of R^2 is 0.085.

This interprets as a percentage of 8.5 % from the dependent variable of risk 1.

Also the Durbin–Watson statistic (D) is 1.744 and (d_u=1.652, d_L=1.598) based on K=1, N=76, at α=0.05; there is evidence of no autocorrelation because this rule ($d_U < D < 2+d_L$: No autocorrelation).

TABLE VI
THE VALUE OF CORRELATION

C3	C5	C7	C8	C9	C11	C29
.292*	.229*	.241*	.238*	.289*	.266*	0.255*

* Correlation is significant at the 0.05 level (2-tailed).
**Correlation is significant at the 0.01 level (2-tailed).

TABLE VII
THE VALUE OF CORRELATION, R SQUARE AND ADJUSTED R SQUARE (MODEL SUMMARY)

Model	R	R Square	Adjusted R Square	Durbin-Watson
1	.292[a]	.085	.073	1.744

a . Predictors: (Constant), c3

TABLE VIII
AN ANALYSIS OF VARIANCE (ANOVA[b])

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4.147	1	4.147	6.874	.011[a]
	Residual	44.642	74	.603		
	Total	48.789	75			

a . Predictors: (Constant), c3 b. Dependent Variable: r1

TABLE IX
THE COEFFICIENTS AND DISTRIBUTED T (COEFFICIENTS[a])

Model		Unstandardized Coefficients	Standardized Coefficients	T	Sig.
		B	Beta		
1	(Constant)	3.204		6.136	.000
	c3	.273	.292	2.622	.011

a. Dependent Variable: r1

R2: Risk of 'Personnel Shortfalls' Compared to Controls:

Tables X to XIII show that the significant value is less than the assumed value at the α = 0.05 level of significance, so there is a positive relation among controls 1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 19, 27, 28, 29, 30 and risk 2.

Also the control 3 has an impact on the risk 2. In addition, the results show that the control 3 has positive impact value of 0.426 and the value of R^2 is 0.181. This interprets as a percentage of 18.1 % from the dependent variable of risk 2.

Also the Durbin–Watson statistic (D) is 1.902 and (d_u=1.652, d_L=1.598) based on K=1, N=76, at α=0.05; there is evidence of no autocorrelation because this rule (d_U < D < 2+ d_L: No autocorrelation).

TABLE X
THE VALUE OF CORRELATION

C1	C2	C3	C4	C5
.267*	.320**	.426**	.317**	.347**
C9	C7	C8	C10	C11
.363**	.367**	.247*	.274*	.284*
C19	C27	C28	C29	C30
.245*	.241*	.247*	.329**	.235*

TABLE XI
THE VALUE OF CORRELATION, R SQUARE AND ADJUSTED R SQUARE (MODEL SUMMARY)

Model	R	R Square	Adjusted R Square	Durbin-Watson
1	.426ª	.181	.170	1.902

a. Predictors: (Constant), c3

TABLE XII
AN ANALYSIS OF VARIANCE (ANOVAᵇ)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7.552	1	7.552	16.373	.000ª
	Residual	34.132	74	.461		
	Total	41.684	75			

a. Predictors: (Constant), c3 b. Dependent Variable: r2

TABLE XIII
THE COEFFICIENTS AND DISTRIBUTED T (COEFFICIENTSª)

Model		Unstandardized Coefficients B	Standardized Coefficients Beta	T	Sig.
1	(Constant)	2.811		6.158	.000
	c3	.368	.426	4.046	.000

a. Dependent Variable: r_2

R3: Risk of 'Failure to Utilize A Phased Delivery Approach' Compared to Controls:

Tables XIV to XVII show that the significant value is less than the assumed value at the α = 0.05 level of significance, so there is a positive relation among controls 1, 3, 4, 5, 6, 7, 8, 9, 10, 11, 21, 29, 30 and risk 3.

Also the control 7 has an impact on the risk 3.

In addition, the results show that the control 7 has positive impact value of 0.365 and the value of R^2 is 0.133.

This interprets as a percentage of 12.1 % from the dependent variable of risk 3.

Also the Durbin–Watson statistic(D) is 1.877 and (d_u=1.652, d_L=1.598) based on K=1, N=76, at α=0.05; there is evidence of no autocorrelation because this rule (d_U < D < 2+d_L: No autocorrelation).

TABLE XIV
THE VALUE OF CORRELATION

C1	C3	C4	C5	C6	C7	C8
.233*	.344**	.299**	.281*	.341**	.365**	.284*
C9	C10	C11	C21	C29	C30	
.357**	.297**	.306**	.250*	.290*	.240*	

TABLE XV
THE VALUE OF CORRELATION, R SQUARE AND ADJUSTED R SQUARE (MODEL SUMMARY)

Model	R	R Square	Adjusted R Square	Durbin-Watson
1	.365ª	.133	.121	1.877

a. Predictors: (Constant), c7

TABLE XVI
AN ANALYSIS OF VARIANCE (ANOVAᵇ)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	6.261	1	6.261	11.344	.001ª
	Residual	40.844	74	.552		
	Total	47.105	75			

a. Predictors: (Constant), c7 b. Dependent Variable: r3

TABLE XVII
THE COEFFICIENTS AND DISTRIBUTED T (COEFFICIENTSª)

Model		Unstandardized Coefficients B	Standardized Coefficients Beta	T	Sig.
1	(Constant)	2.878		5.378	.000
	c7	.354	.365	3.368	.001

a Dependent Variable: r3

R4: Risk of 'Too Little Attention to Breaking Development and Implementation into Manageable Steps' Compared to Controls:

Tables XVIII to XXI show that the significant value is less than the assumed value at the α = 0.05 level of significance, so there is a positive relation among controls 1, 2, 3, 4, 5, 6, 7, 8, 9, 19, 23, 27, 28, 29, 30 and risk 4.

Also controls 3 and 29 have an impact on the risk 4. In addition, the results show that controls 3, and 29 have a positive impact value of 0.430 and 0.397 respectively, also multiple correlation value is 0.504, and the value of R^2 is 0.254.

This interprets as a percentage of 25.4 % from the dependent variable of risk 4.

Also the Durbin–Watson statistic (D) is 1.942 and (d_u=1.680, d_L=1.571) based on K=2, N=76, at α=0.05; there is evidence of no autocorrelation (d_U < D < 2+d_L: No autocorrelation).

TABLE XVIII
THE VALUE OF CORRELATION

C1	C2	C3	C4	C5	C6	C7
.359**	.348**	.430**	.267*	.426**	.277*	.323**
C8	C9	C19	C23	C27	C28	C29
.336**	.425**	.229*	.354**	.302**	.281*	.397**

TABLE XIX
THE VALUE OF CORRELATION, R SQUARE AND ADJUSTED R SQUARE (MODEL SUMMARY)

Model	R	R Square	Adjusted R Square	Durbin-Watson
1	.430ᵃ	.185	.174	
2	.504ᵇ	.254	.233	1.942

a. Predictors: (Constant), c3 b. Predictors: (Constant), c3, c29

TABLE XX
AN ANALYSIS OF VARIANCE (ANOVAᶜ)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7.944	1	7.944	16.77	.000ᵃ
	Residual	35.042	74	.474		
	Total	42.987	75			
2	Regression	10.906	2	5.453	12.40	.000ᵇ
	Residual	32.081	73	.439		
	Total	42.987	75			

a. Predictors: (Constant), c3 b. Predictors: (Constant), c3, c29 c. Dependent Variable: r4

TABLE XXI
THE COEFFICIENTS AND DISTRIBUTED T (COEFFICIENTSᴬ)

Model		Unstandardized Coefficients	Standardized Coefficients	T	Sig.
		B	Beta		
1	(Constant)	2.646		5.720	.000
	c3	.377	.430	4.096	.000
2	(Constant)	1.810		3.292	.002
	c3	.291	.331	3.067	.003
	c29	.228	.280	2.596	.011

Dependent Variable: r4

R5: Risk of 'Inadequate Training Team Members' Compared to Controls:

Tables XXII to XXV show that the significant value is less than the assumed value at the α = 0.05 level of significance, so there is a positive relation among controls 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 21, 23, 24, 27, 28, 29, 30 and risk 5.

Also controls 3 and 29 have an impact on the risk 5. In addition, the results show that controls 3, and 29 have a positive impact value of 0.441 and 0.381 respectively, also multiple correlation value is 0.502, and the value of R^2 is 0.252.

TABLE XXII
THE VALUE OF CORRELATION

C1	C2	C3	C4	C5
.365**	.381**	.441**	.231*	.244*
C6	C7	C8	C9	C10
.296**	.227*	.282*	.341**	.247*
C11	C12	C30	C13	C14
.374**	.237*	.354**	.335**	.368**
C21	C23	C24	C27	C28
.290*	.297**	.257*	.297**	.333**
C29				
.381**				

TABLE XXIII
THE VALUE OF CORRELATION, R SQUARE AND ADJUSTED R SQUARE (MODEL SUMMARY)

Model	R	R Square	Adjusted R Square	Durbin-Watson
1	.441ᵃ	.194	.184	
2	.502ᵇ	.252	.232	1.611

a. Predictors: (Constant), c3 b. Predictors: (Constant), c3, c29

TABLE XXIV
AN ANALYSIS OF VARIANCE (ANOVAᶜ)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	11.062	1	11.062	17.865	.000ᵃ
	Residual	45.820	74	.619		
	Total	56.882	75			
2	Regression	14.361	2	7.181	12.328	.000ᵇ
	Residual	42.520	73	.582		
	Total	56.882	75			

a . Predictors: (Constant), c3 b. Predictors: (Constant), c3, c29c. Dependent Variable: r5

TABLE XXV
THE COEFFICIENTS AND DISTRIBUTED T (COEFFICIENTSᴬ)

Model		Unstandardized Coefficients	Standardized Coefficients	T	Sig.
		B	Beta		
1	(Constant)	2.258		4.268	.000
	c3	.445	.441	4.227	.000
2	(Constant)	1.375		2.172	.033
	c3	.354	.351	3.243	.002
	c29	.241	.257	2.380	.020

a. Dependent Variable: r5

This interprets as a percentage of 25.2 % from the dependent variable of risk 5. Also the Durbin–Watson statistic (D) is 1.611 and (d_u=1.680, d_L=1.571) based on K=2, N=76, at α=0.05; there is evidence of inconclusive (d_L < D < d_U: Inconclusive).

R6: Risk of 'Inadequacy of Source Code Comments' Compared to Controls:

Tables XXVI to XXIX show that the significant value is less than the assumed value at the α = 0.05 level of significance, so there is a positive relation between control 4 and risk 6. Also the control 4 has an impact on the risk 6. In addition, the results show that the control 4 has a positive impact value of 0.237, and the value of R^2 is 0.056. This interprets as a percentage of 5.6 % from the dependent variable of risk 6. Also the Durbin–Watson statistic (D) is 1.908 and (d_u=1.652, d_L=1.598) based on K=1, N=76, at α=0.05; there is evidence of no autocorrelation because this rule (d_u < D < 2+d_L: No autocorrelation).

TABLE XXVI
THE VALUE OF CORRELATION

r	C4
R6	.237*

TABLE XXVII
THE VALUE OF CORRELATION, R SQUARE AND ADJUSTED R SQUARE (MODEL SUMMARY)

Model	R	R Square	Adjusted R Square	Durbin-Watson
1	.237ᵃ	.056	.043	1.908

a Predictors: (Constant), c4

TABLE XXVIII
AN ANALYSIS OF VARIANCE (ANOVAᵇ)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.834	1	1.834		
	Residual	30.942	74	.418	4.387	.040ᵃ
	Total	32.776	75			

a. Predictors: (Constant), c4 b. Dependent Variable: r6

TABLE XXIX
THE COEFFICIENTS AND DISTRIBUTED T (COEFFICIENTS^A)

Model		Unstandardized Coefficients B	Standardized Coefficients Beta	T	Sig.
1	(Constant)	3.725		8.140	.000
	c4	.190	.237	2.095	.040

Dependent Variable: r6

R7: Risk of 'Inadequate Test Cases and Generate Test Data' Compared to Controls:

Tables XXX to XXXIII show that the significant value is less than the assumed value at the α = 0.05 level of significance, so there is a positive relation among controls 1, 2, 3, 7, 11, 14, 16, 30 and risk 7.

Also the control 3 has an impact on the risk 7.

In addition, the results show that the control 3 has a positive impact value is 0.323 and the value of R^2 is 0.105.

This interprets as a percentage of 10.5 % from the dependent variable of risk 7.

Also the Durbin–Watson statistic (D) is 2.025 and (d_u=1.652, d_L=1.598) based on K=1, N=76, at α=0.05; there is evidence of no autocorrelation because this rule (d_U < D < 2+d_L: No autocorrelation).

TABLE XXX
THE VALUE OF CORRELATION

C1	C2	C3	C7
.307**	.300**	.323**	.264*
C11	C4	C16	C30
.288*	.233*	.262*	.249*

TABLE XXXI
THE VALUE OF CORRELATION, R SQUARE AND ADJUSTED R SQUARE (MODEL SUMMARY)

Model	R	R Square	Adjusted R Square	Durbin-Watson
1	.323^a	.105	.092	2.025

a. Predictors: (Constant), c3

TABLE XXXII
AN ANALYSIS OF VARIANCE (ANOVA^B)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5.116	1	5.116	8.638	.004^a
	Residual	43.831	74	.592		
	Total	48.947	75			

a. Predictors: (Constant), c3 b. Dependent Variable: r7

TABLE XXXIII
THE COEFFICIENTS AND DISTRIBUTED T (COEFFICIENTS^A)

Model		Unstandardized Coefficients B	Standardized Coefficients Beta	T	Sig.
1	(Constant)	2.975		5.751	.000
	c3	.303	.323	2.939	.004

a. Dependent Variable: r7

R8: Risk of 'Real-Time Performance Shortfalls' Compared to Controls:

Tables below show that the significant value is less than the assumed value at the *α* = 0.05 level of significance, so there is a positive relation among controls 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 14, 16, 18, 19, 20, 21, 23, 27, 28, 29, 30 and risk 8.

In addition, the results show that controls 3, and 29 have a positive impact value of 0.437 and 0.464 respectively, also multiple correlation value is 0.549, and the value of R^2 is 0.301.

This interprets as a percentage of 30.1 % from the dependent variable of risk 8.

Also the Durbin–Watson statistic (D) is 1.982 and (d_u=1.680, d_L=1.571) based on K=2, N=76, at α=0.05; there is evidence of no autocorrelation (d_U< D < 2+d_L: No autocorrelation).

TABLE XXXIV
THE VALUE OF CORRELATION

C1	C2	C3	C4	C5	C6
.350**	.433**	.437**	.390**	.386**	.300**
C10	C7	C8	C9	C10	C11
.307**	.346**	.304**	.350**	.307**	.307**
C14	C16	C18	C19	C20	C21
.234*	.262*	.237*	.284*	.291*	.249*
C23	C27	C28	C29	C30	
.277*	.358**	.359**	.464**	.240*	

TABLE XXXV
THE VALUE OF CORRELATION, R SQUARE AND ADJUSTED R SQUARE (MODEL SUMMARY)

Model	R	R Square	Adjusted R Square	Durbin-Watson
1	.464^a	.215	.204	
2	.549^b	.301	.282	1.982

a . Predictors: (Constant), c29 b. Predictors: (Constant), c29, c3

TABLE XXXVI
AN ANALYSIS OF VARIANCE (ANOVA^C)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	10.514	1	10.514	20.279	.000^a
	Residual	38.367	74	.518		
	Total	48.882	75			
2	Regression	14.711	2	7.356	15.714	.000^b
	Residual	34.170	73	.468		
	Total	48.882	75			

a . Predictors: (Constant), c29
b. Predictors: (Constant), c29, c3
c. Dependent Variable: r8

TABLE XXXVII
THE COEFFICIENTS AND DISTRIBUTED T (COEFFICIENTS^A)

Model		Unstandardized Coefficients B	Standardized Coefficients Beta	t	Sig.
1	(Constant)	2.231		4.443	.000
	c29	.403	.464	4.503	.000
2	(Constant)	1.310		2.309	.024
	c29	.307	.354	3.384	.001
	c3	.293	.313	2.994	.004

a. Dependent Variable: r8

R9: Risk of 'Test Case Design and Unit-Level Testing Turns out Very Difficult' Compared to Controls:

Tables below show that the significant value is less than the assumed value at the α = 0.05 level of significance, so there is a positive relation among controls 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 16, 18, 24, 25, 27, 28, 29 and risk 9.

Also controls 2 and 28 have an impact on the risk 9.

TABLE XXXVIII
THE VALUE OF CORRELATION

C1	C2	C3	C4	C5	C6
.388**	.486**	.424**	.343**	.242*	.295*
C7	C8	C9	C10	C11	C12
.320**	.314**	.307**	.302**	.355**	.237*
C13	C14	C16	C18	C24	C25
.240*	.367**	.331**	.238*	.301**	.266*
C27	C28	C29			
.346**	.402**	.240*			

TABLE XXXIX
THE VALUE OF CORRELATION, R SQUARE AND ADJUSTED R SQUARE (MODEL SUMMARY)

Model	R	R Square	Adjusted R Square	Durbin-Watson
1	.486ª	.236	.225	
2	.530ᵇ	.281	.261	2.020

a. Predictors: (Constant), c2 b. Predictors: (Constant), c2, c28

TABLE XL
AN ANALYSIS OF VARIANCE (ANOVA^c^)

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	13.427	1	13.427	22.830	.000ª
	Residual	43.521	74	.588		
	Total	56.947	75			
2	Regression	15.994	2	7.997	14.255	.000ᵇ
	Residual	40.953	73	.561		
	Total	56.947	75			

a. Predictors: (Constant), c2 b. Predictors: (Constant), c2, c28
c. Dependent Variable: r9

TABLE XLI
THE COEFFICIENTS AND DISTRIBUTED T (COEFFICIENTS^A^)

Model		Unstandardized Coefficients	Standardized Coefficients	T	Sig.
		B	Beta		
1	(Constant)	1.639		2.732	.008
	c2	.575	.486	4.778	.000
2	(Constant)	.955		1.431	.157
	c2	.453	.383	3.477	.001
	c28	.247	.236	2.139	.036

a. Dependent Variable: r9

In addition, the results show that controls 2, and 28 have appositive impact value is 0.486 and 0.402 respectively, also multiple correlation value of 0.530, and the value of R^2 is 0.281.

This interprets as a percentage of 28.1 % from the dependent variable of risk 9. Also the Durbin–Watson statistic (D) is 2.020 and (d_u=1.680, d_L=1.571) based on K=2, N=76, at α=0.05; there is evidence of no autocorrelation (d_U < D < 2+d_L: No autocorrelation).

R10: Risk of 'Lack of Adherence to Programming Standards' Compared to Controls:

Tables below show that the significant value is less than the assumed value at the α = 0.05 level of significance, so there is a positive relation among controls 1, 2, 3, 4, 5, 6, 7, 8, 9, 19, 21, 23, 24, 25, 26, 27, 28, 29 and risk 10. Also controls 1, 7 and 29 have an impact on the risk 10. In addition, the results show that controls 1, 7, and 29 have a positive impact value of 0.451, 0.457 and 0.258 respectively, also multiple correlation value is 0.572, and the value of R^2 is 0.327. This interprets as a percentage of 29.9 % from the dependent variable of risk 10. Also the Durbin–Watson statistic (D) is 2.034 and (d_u=1.709, d_L=1.543) based on K=3, N=76, at α=0.05; there is evidence of no autocorrelation (d_U < D < 2+d_L: No autocorrelation).

TABLE XLII
THE VALUE OF CORRELATION

C1	C2	C3	C5	C6	C7
.451**	.334**	.293*	.255*	.409**	.457**
C8	C9	C10	C11	C18	C21
.327**	.256*	.302**	.395**	.314**	.266*
C23	C27	C28	C29	C30	
.306**	.309**	.275*	.391**	.258*	

TABLE XLIII
THE VALUE OF CORRELATION, R SQUARE AND ADJUSTED R SQUARE (MODEL SUMMARY)

Model	R	R Square	Adjusted R Square	Durbin-Watson
1	.457ª	.209	.198	
2	.530ᵇ	.280	.261	
3	.572ᶜ	.327	.299	2.034

a. Predictors: (Constant), c7 b. Predictors: (Constant), c7, c29
c. Predictors: (Constant), c7, c29, c1

TABLE XLIV
AN ANALYSIS OF VARIANCE (ANOVA^d^)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	11.431	1	11.431	19.510	.000ª
	Residual	43.358	74	.586		
	Total	54.789	75			
2	Regression	15.362	2	7.681	14.221	.000ᵇ
	Residual	39.428	73	.540		
	Total	54.789	75			
3	Regression	17.914	3	5.971	11.659	.000ᶜ
	Residual	36.876	72	.512		
	Total	54.789	75			

a. Predictors: (Constant), c7 b. Predictors: (Constant), c7, c29
c. Predictors: (Constant), c7, c29, c1 d. Dependent Variable: r10

TABLE XLV
THE COEFFICIENTS AND DISTRIBUTED T (COEFFICIENTS^A^)

Model		Unstandardized Coefficients	Standardized Coefficients	T	Sig.
		B	Beta		
1	(Constant)	2.148		3.895	.000
	c7	.478	.457	4.417	.000
2	(Constant)	1.159		1.800	.076
	c7	.391	.373	3.591	.001
	c29	.258	.281	2.698	.009
3	(Constant)	.533		.777	.440
	c7	.275	.262	2.327	.023
	c29	.220	.239	2.320	.023
	c1	.290	.252	2.232	.029

a. Dependent Variable: r10

Software Risk factors identification checklists and control factors (risk management techniques):

Table XLVI show risk factors identification checklist with risk software projects based on a questionnaire of experienced software project managers. He can use the checklist on software projects to identify and mitigate risk factors on lifecycle software projects by risk management techniques.

TABLE XLVI
SOFTWARE RISK FACTORS MITIGATED BY RISK MANAGEMENT TECHNIQUES

No	Software Risk Factors	Risk Management Techniques
1	Failure to gain user commitment.	C3: Assessing cost and scheduling the impact of each change to requirements and specifications.
2	Personnel shortfalls.	C3: Assessing cost and scheduling the impact of each change to requirements and specifications.
3	Failure to utilize a phased delivery approach.	C7: Developing contingency plans to cope with staffing problems.
4	Too little attention to breaking development and implementation into manageable steps.	C3: Assessing cost and scheduling the impact of each change to requirements and specifications, C29: Provide training in the new technology and organize domain knowledge training.
5	Inadequate training team members.	C3: Assessing cost and scheduling the impact of each change to requirements and specifications, C29: Provide training in the new technology and organize domain knowledge training.
6	Inadequacy of source code comments.	C4: Develop prototyping and have the requirements reviewed by the client.
7	Inadequate test cases and generate test data.	C3:Assessing cost and scheduling the impact of each change to requirements and specifications
8	Real-time performance shortfalls.	C29: Provide training in the new technology and organize domain knowledge training, C3: Assessing cost and scheduling the impact of each change to requirements and specifications.
9	Test case design and Unit-level testing turns out very difficult.	C2: Stabilizing requirements and specifications as early as possible, C28: Maintain proper documentation of each individual's work.
10	Lack of adherence to programming standards.	C7: Developing contingency plans to cope with staffing problems, C29: Provide training in the new technology and organize domain knowledge training, C1: Using of requirements scrubbing.

VI. Conclusion

The concern of our paper is the managing risks of software projects in Implementation phase.

The results show that all risks in software projects were important in software project manager perspective, whereas all controls are used most of time, and often.

Therefore, the software risk factors in Implementation phase from risk number 6, 3, 2, 10, 1, 4, 9, 5, 7, 8 were identified as important, aggregating the responses resulted in the following ranking of the importance of the listed risks (in order of importance): Risk 6, Risk 3, Risk2, Risk 10, Risk 1, Risk 4, Risk 9, Risk 5, Risk 7, and Risk 8.

The results of this paper show also that most of the top ten controls are used most of the time. However, "provide training in the new technology and organize domain knowledge training" is the highest; aggregating the responses resulted in the following ranking of the importance of the listed controls (in order of importance): C29, C30, C20, C27, C21, C19, C28, C25, C26, and C23.

These tests were performed using regression analysis (stepwise regression), to compare the controls to each of the risk factors to determine if they are effective in mitigating the occurrence of each risk factor and selecting best model. Relationships between risks and risk management techniques, which were significant and insignificant, any control is no significant, we are not reported. However, we determined the positive correlation between risk factors and risk management techniques, then measure impact risk in software project lifecycle.

We used correlation analysis, regression analysis models based on stepwise selection method (add and remove), and then Durbin–Watson Statistic techniques proposed. However, we referred the control factors were mitigated on risk factors in Table XLVII.

Through the results, we found out that some control haven't impact, so the important controls should be considered by the software development companies in Palestinian.

In addition, we cannot obtain historical data form database until using some techniques. As future work, we will intend to apply these study results on a real-world software project to verify the effectiveness of the new techniques and approach on software project. We can use more techniques useful to manage software project risks such as neural network, genetic algorithm, and Bayesian statistics and so on.

References

[1] S. Masticola, "A Simple Estimate of the Cost of Software Project Failures and the Breakeven Effectiveness of Project Risk Management," *2007 First International Workshop on the Economics of Software and Computation*, May 2007.

[2] K. Schwalbe, *Information Technology Project Management*, Sixth. course technology,cengage learning, 2010, p. 490.

[3] D. McNair, "Controlling risk," *Magazine Ubiquity*, vol. 2001, no. January, ACM New York, NY, USA, 01-Jan-2001.

[4] J. Miler, "P H D T HESIS A Method of Software Project Risk Identification and Analysis Jakub Miler," GDAŃSK UNIVERSITY OF TECHNOLOGY, 2005.

[5] J. Miler and J. Górski, "Supporting Team Risk Management in Software Procurement and Development Projects," in *4th National Conference on Software Engineering*, 2002.

[6] C. R. Pandian, *Applied software risk management : a guide for software project managers*. Auerbach Publications is an imprint of the Taylor & Francis Group, an informa business, 2007, p. 246.

[7] M. Keil, P. Cule, K. Lyytinen, and R. Schmidt, "Aframework for Identifying Software Project Risks," *Communications of the ACM*, vol. 41, no. 11, 1998.

[8] J. Hoffer, J. George, and J. Valacich, *Modern Systems Analysis*

and Design, 6th ed. Prentice Hall, 2011, p. 575.
[9] J. Taylor, *Managing Information Technology Projects: Applying Project Management Strategies to Software, Hardware, and Integration Initiatives*. AMACOM © 2004, 2004, p. 274.
[10] J. Sodhi and P. Sodhi, *IT Project Management Handbook*. Management Concepts, 2001, p. 264.
[11] B. Boehm, "Value-based software engineering," *ACM SIGSOFT Software Engineering Notes*, vol. 28, no. 2, p. 3, Mar. 2003.
[12] H. Taylor, "The move to outsourced IT projects: key risks from the provider perspective," in *SIGMIS CPR '05 Proceedings of the 2005 ACM SIGMIS CPR conference on Computer personnel research*, 2005, pp. 149–154.
[13] T. Addison and S. Vallabh, "Controlling Software Project Risks – an Empirical Study of Methods used by Experienced Project Managers.," in *Proceedings of SAICSIT*, 2002, pp. 128 – 140.
[14] L. Wallace and M. Keil, "Software project risks and their effect on outcomes," *Communications of the ACM*, vol. 47, no. 4, pp. 68–73, Apr. 2004.
[15] D. Liu, Q. Wang, and J. Xiao, "The role of software process simulation modeling in software risk management: A systematic review," *2009 3rd International Symposium on Empirical Software Engineering and Measurement*, pp. 302–311, Oct. 2009.
[16] E. Odzaly, D. Greer, and P. Sage, "Software risk management barriers: An empirical study," in *3rd International Symposium on Empirical Software Engineering and Measurement*, 2009, pp. 418–421.
[17] P. Bannerman, "Managing Structure-Related Software Project Risk: A New Role for Project Governance," *2010 21st Australian Software Engineering Conference*, pp. 129–138, 2010.
[18] N. Zazworka and C. Ackermann, "CodeVizard : A Tool to Aid the Analysis of Software Evolution," *Proceedings of the 2010 ACMIEEE International Symposium on Empirical Software Engineering and Measurement*, vol. 2, no. 4, pp. 4503–4503, 2010.
[19] S. Islam, "Software Development Risk Management Model- a goal-driven approach Shareeful Islam," Technische Universitat Munchen, 2009.
[20] A. Elzamly and B. Hussin, "Estimating Quality-Affecting Risks in Software Projects," *International Management Review , American Scholars Press*, vol. 7, no. 2, pp. 66–83, 2011.
[21] J. Dhlamini, I. Nhamu, and A. Kachepa, "Intelligent Risk Management Tools for Software Development," *Risk Management*, pp. 33–40, 2009.
[22] A. De Melo and A. Sanchez, "Software maintenance project delays prediction using Bayesian Networks," *Expert Systems with Applications*, vol. 34, no. 2, pp. 908–919, Feb. 2008.
[23] K. Khanfar, A. Elzamly, W. Al-Ahmad, E. El-Qawasmeh, K. Alsamara, and S. Abuleil, "Managing Software Project Risks with the Chi-Square Technique," *Management Review*, vol. 4, no. 2, pp. 18–29, 2008.
[24] A. Elzamly and B. Hussin, Managing Software Project Risks with Proposed Regression Model Techniques and Effect Size Technique, (2011) *International Review on Computers and Software (IRECOS.)*, 6 (2), pp. 250–263.
[25] R. Dash and R. Dash, "Risk Assessment Techniques for Software Development," *European Journal of Scientific Research*, vol. 42, no. 4, pp. 629–636, 2010.
[26] Oracle, "A Standardized Approach to Risk Improves Project Outcomes and Profitability," 2010.
[27] B. Boehm, "Software Risk Management: Principles and Practices," *Management*, no. January, 1991.
[28] T. S. G. 1995 CHAOS, "THE STANDISH GROUP REPORT The Standish Group 1995. Reprinted here for sole academic purposes with written permission from The Standish Group. CHAOS," *29/2/2012*, 1995. .
[29] T. Addison, "E-commerce project development risks: evidence from a Delphi survey 1," *International Journal of Information Management*, vol. 23, no. June 2001, pp. 25–40, 2003.
[30] D. Aloini, R. Dulmin, and V. Mininno, "Risk management in ERP project introduction: Review of the literature," *Information & Management*, vol. 44, no. 6, pp. 547–567, Sep. 2007.
[31] W.-M. Han and S.-J. Huang, "An empirical analysis of risk components and performance on software projects," *Journal of Systems and Software*, vol. 80, no. 1, pp. 42–50, Jan. 2007.
[32] S.-J. Huang and W.-M. Han, "Exploring the relationship between software project duration and risk exposure: A cluster analysis," *Information & Management*, vol. 45, no. 3, pp. 175–182, Apr. 2008.
[33] B. Aritua, N. J. Smith, and D. Bower, "What risks are common to or amplified in programmes: Evidence from UK public sector infrastructure schemes," *International Journal of Project Management*, vol. 29, no. 3, pp. 303–312, Jun. 2010.
[34] R. O. Y. Schmidt, K. Lyytinen, M. Keil, and P. Cule, "Identifying Software Project Risks : An International Delphi Study," *Journal tjf Managemenl Information Systems /Spring*, vol. 17, no. 4, pp. 5–36, 2001.
[35] R. Nakatsu and C. Iacovou, "A comparative study of important risk factors involved in offshore and domestic outsourcing of software development projects: A two-panel Delphi study," *Information & Management*, vol. 46, no. 1, pp. 57–68, Jan. 2009.
[36] J.-C. Chen and S.-J. Huang, "An empirical analysis of the impact of software development problem factors on software maintainability," *Journal of Systems and Software*, vol. 82, no. 6, pp. 981–992, Jun. 2009.
[37] M. Keil, A. Tiwana, and A. Bush, "Reconciling user and project manager perceptions of IT project risk: a Delphi study 1," *Information Systems Journal*, no. April 1999, pp. 103–119, 2002.
[38] L. Wallace, M. Keil, and A. Rai, "How Software Project Risk Affects Project Performance : An Investigation of the Dimensions of Risk and an Exploratory Model," *Decision Sciences*, vol. 35, no. 2, 2004.
[39] M. Sumner, "Risk factors in enterprise-wide/ERP projects," *Journal of Information Technology*, vol. 15, no. 4, pp. 317–327, Dec. 2000.
[40] B. Boehm and R. Ross, "Theory-W Software Project Management: Princioles and Examples," vol. 15, no. 7, pp. 902–916, 1989.
[41] Kweku Ewusi-Mensah, *Software Development Failures: Anatomy of Abandoned Projects*. The MIT Press, 2003, p. 276.
[42] G. Paré, C. Sicotte, M. Jaana, and D. Girouard, "Prioritizing Clinical Information System Project Risk Factors : A Delphi Study," in *Proceedings of the 41st Hawaii International Conference on System Sciences -*, 2008, pp. 1–10.
[43] D. Houston, G. Mackulak, and J. Collofello, "Stochastic simulation of risk factor potential effects for software development risk management," *Journal of Systems and Software*, vol. 59, no. 3, pp. 247–257, Dec. 2001.
[44] B. Lawrence, K. Wiegers, and C. Ebert, "The Top Risks of Requirements Engineering," 2001.
[45] D. Shafer and C. Officer, "Software Risk : Why must we keep learning from experience ? Where does Risk Occur in DP Software Development ?," in *DYNAMIC POSITIONING CONFERENCE*, 2004, pp. 1–19.
[46] H. Hoodat and H. Rashidi, "Classification and Analysis of Risks in Software Engineering," *Engineering and Technology*, vol. 56, pp. 446–452, 2009.
[47] C. Jones, G. Glen, G. Anna, and D. Miller, "Strategies for improving systems development project success," *Issues in Information Systems (IIS)*, vol. XI, no. 1, pp. 164–173, 2010.
[48] C. Jones, *Applied Software Measurement Global Analysis of Productivity and Quality*, Third Edit., no. Third Edition. McGraw-Hill Companies., 2008, p. 662.
[49] A. Taimour, "Why IT Projects Fail," 2005.
[50] L. Rui-ge and W. Bing-rong, "The Correlation Influence Factors Analysis in the Initial dosage of Insulin Therapy of Diabetes," pp. 774–777, 2011.
[51] V. Marza and M. A. Seyyedi, "Fuzzy Multiple Regression Model for Estimating Software Development Time," vol. 1, no. 2, pp. 31–34, 2009.
[52] C. Martín, J. Pasquier, C. Y. M., and A. G. T., "Software Development Effort Estimation Using Fuzzy Logic : A Case Study," in *Proceedings of the Sixth Mexican International Conference on Computer Science (ENC'05)*, 2005.
[53] X. Jin and X. Xu, "Rmote sensing of leaf water content for winter wheat using grey relational analysis (GRA), stepwise regression method (SRM) and partial least squares (PLS)," in *2012 First International Conference on Agro- Geoinformatics (Agro-Geoinformatics)*, 2012, pp. 1–5.

[54] Y. Lan and S. Guo, "Multiple Stepwise Regression Analysis on Knowledge Evaluation," in *2008 International Conference on Management of e-Commerce and e-Government*, 2008, pp. 297–302.
[55] N. Zhou, S. Member, J. W. Pierre, and D. Trudnowski, "A Stepwise Regression Method for Estimating Dominant Electromechanical Modes," *IEEE TRANSACTIONS ON POWER SYSTEMS*, vol. 27, no. 2, pp. 1051–1059, 2012.

Authors' information

[1]Department of Computer Science
Faculty of Applied Sciences
Al-Aqsa University Gaza, Palestine
P.O.BOX: 4051
Tel.:+ 9708/2130044
Mobile No.: +970599855174
E-mail: abd_elzamly@yahoo.com

[2]Fakulti Teknologi Maklumat & Komunikasi,
Universiti Teknikal Malaysia Melaka
Locked Bag 1752, Durian Tunggal
Post Office 76109 Durian Tunggal, Melaka Malaysia.
Phone: +606 331 6675
E-mail: burairah@utem.edu.my

Abdelrafe Elzamly is currently studying a Ph.D. in Software and Information Systems Engineering from Faculty of Information and Communication Technology at Technical University Malaysia Malaka (UTeM), Born in November 30, 1976, Gaza, Palestine. He received his B.Sc. degree computer in 1999 from Al-Aqsa University, Gaza, his Master's degree computer information system in 2006 from The University of Banking and Financial Sciences. He is working as lecturer in Computer Science at Al-Aqsa University from 1999 to 2013 as a full time and worked as lecturer in Islamic University in Gaza from 1999 to 2007 as part time. Also He worked as a manager in The Mustafa Center for Studies and Scientific Research-Gaza from 2010 to 2012. His research of interest is risk management, quality software, software engineering, and data mining.

Burairah Hussin got a Ph.D. in Management Science –Condition Monitoring Modelling from University of Salford, UK in 2007. He received his M.Sc. Degree in Numerical Analysis and Programming from University of Dundee, UK in 1998. He received his B.Sc. Degree in Computer Science from University Technology Malaysia in 1996. He is currently working as associate professor in University Technical Malaysia Malaka (UTeM), he is the Coordinator for Centre for Advanced Computing Technologies (C-ACT) in Faculty of Information Technology and Communication, FTMK and he worked as Deputy Dean (Research and Post Graduate), Faculty of Information and Communication Technology at Technical University Malaysia Malaka (UTeM). His research interests are in data analysis, data mining, maintenance modelling, artificial intelligent, risk management, numerical analysis, and computer network advisor and development.

Praise Worthy Prize

2281-2954(201309)1:5;1-K