www.arpnjournals.com

PREDICTION OF RISK FACTORS OF SOFTWARE DEVELOPMENT PROJECT BY USING MULTIPLE LOGISTIC REGRESSION

Thitima Christiansen[1], Pongpisit Wuttidittachotti[1], Somchai Prakancharoen[2] and Sakda Arj-ong Vallipakorn[3]
[1]Faculty of Information Technology, King Mongkut's University of Technology North Bangkok, Thailand
[2]Faculty of Applied Science, King Mongkut's University of Technology North Bangkok, Thailand
[3]Faculty of Medicine, Ramathibodi Hospital, Mahidol University, Bangkok, Thailand
E-mail: thitima.chris@gmail.com

ABSTRACT

This research aimed to predict the risks in software development projects by applying multiple logistic regression. The logistic regression was used as a tool to control the software development process. These consisted of the risk stratification and causal risk factors analyses. This statistical integration was intended to establish the risk factors, anticipated and minimized the risk, which can occur during processes of software development. The factor analysis incorporated with logistic regression was used to predict the risk classification probability of failure or success of software development. The logistic regression analyses can grade and help to point out the risk factors, which were important problems in development processes. These analytical results can lead to create and development of strategies and highlighted problems, which are important issues to manage, control and reduce the risks of error. The result from classification of questionnaires of software development risk analyses by SPSS program had overall prediction accuracy at 90%.

Keywords: software development, risk management, multiple logistics regression.

INTRODUCTION

Current technology and modern software development is progressing along with the increase in speed, memory and supporting technology. The developing software continuously and efficiently remains a necessity. For this reason, high quality software development usually needs certain surrounding factors such as the standard of software project management especially complied with strict rules which effect the developer and software project. According to the completion, accuracy, possibility, need, priority, and clarity, should all be checked and inspected at each step. For the improvement of risk management procedures, the following process need to be followed such as identify, analyze and prioritize of works, planning and scheduling task, problem solving to prompt management. The project control in each process, monitoring of the effects and changes, all aid development and help achieve completion timelines (Tharwon, 2011).

The risk management classification helps to analyses the risk factors by problem analysis. The questionnaires of software development were used to look for hidden risks along development processes. Next steps, the factors from the questionnaires were analyzed to predict the factor, which causes the risk of the software development (John, 2012).

Software development projects always have more risks than other management projects because it has more technical uncertainty and complexity. Most developers look for methodology to minimize the important risks to improve their management, because the risk factor affects the success or failure of any project. Thus, should be eliminated to gain customer satisfaction and reach the goal based on their timeline (Rabia, 2013).

Therefore, the author of this paper proposes the idea to control risk of projects by searching the factors that causes risks and the delays in software development project by multiple logistic regression analysis. These statistical models will help project managers to simplify the start of a project, anticipate and avoid problems before they occur (Ying, 2012).

This research highlights the problems of software development, covers risk management, and looks at helping developers to prevent problems and processes that control timeframes according to the project plan.

RESEARCH SIGNIFICANCE

Risk management in software development project was the comprehensive methods that consisted of project planning, clarify of their objectives, reacting, recheck and included the risks control and management which can happen and needed to solve through the development phases. The goal of the risk management intended to add the possibilities of positive impact and reduced the possibilities of negative impact on the project (Hooman, 2013). The reason was why we compared between the project efficacy and the successful factors. The factors which were determined from this comparison was potential risks to the success of the project. Because these differences will effect to the success of the project (Tim, 2009).

Risk was a situation or any actions which will happen during unforeseen circumstances and effect or damage (cost or non-cost) or failure or reduce the chance of the success of the organization in terms of monitory strategy (Tim, 2014). Financial and service costs would be the good represent of unmanaged risk side effects by measuring from the impact and chance of the happening.

www.arpnjournals.com

Risk management manages the risk in the method of the measurement (Larson, 2012), inspect and control the risks, which link together with the activities and working process to reduce the risk and possibility of loss and damaged that organization have previously faced. The risk might happen from many factors from the process. In the software development projects, they are prone to have more chances of failure (Venkatesh, 2012), from many factors such as manpower problems, mistakes when selecting the best decision of management among the participants or collaborative who worked together (Muhammad, 2014). In the developing process, there might be conflict or misunderstanding leading to risk of the project failure. The other factors such as changes and advanced development of information and technology should also be of concern, see details in Figure-1.

Figure-1. Risk management.

Risk assessment was the method to specify the risk, analysis the risk and prioritize the risk by measuring from the chance and impacts. After the measurement, we will know the degree of risk which were classified as maximum risk, high risk, medium risk or low risk based on chance and effect of each risk that occurred (Dana, 2012).

Risk control was a policy or steps series which will reduce the risk and increase the likelihood of success for the project which were controlled for prevention, inspection, advice and correction (Pontakorn, 2012).

Both risk assessment and control are usually required as the common components in the development process. These management methods essentially integrate into working processes but most developers will never know (C Verma, 2010). that there was any risk management, see Table-1.

Table-1. Software development project.

Risk assessment	
Risk Identification	Developer realized that the new programmer lacks of knowdedge of the program language.
Risk Analysis	Analyses the important problems that could effect to the project management and might causes to the project failure.
Risk Prioritization	Prioritise and compare the problems or the risks and find the way to solve the problems.
Risk control	
Risk Management Plan. Risk Resolution	Management planning by solving the risks or problems in many methods. To choose the interesting way to solve the problem such as making of the pair programming
Risk Monitoring	Follow up and close monitoring

PROCESS RISK MANAGERMENT

Software risk management is similar to the other management projects which means develop projects handle many risks which can lead to the project failure and problems such as budget estimation, constraint of time and resources, lack of the measurement or commitment from high executive management (Abdullahi, 2014). Risk is very important to the management of software development projects because organizations are serious about managing the risks to find out the causes, measure the effect which could impact the business, controlled and minimize risks.

Thus, it is important to identify or specify the risk concerns referring to the safety of the property in the organization, managing causes of risk before it affects the project, and causes problems (Venkatesh, 2012). see Figure-2.
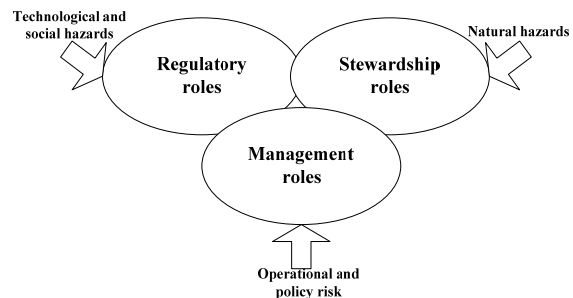

Figure-2. Risk and the role of government (OECD).

www.arpnjournals.com

Risk definitions

Uncertainty about the outcome that it will be occurred as expected or not.

Actions or events that may undermine the abilities of the organization to achieve the objectives.

Actions or events that may change or threaten or any other negative occurrences.

Trends or chances that may take the risks and effects in case that the event actually happens.

Risk analysis was the method to bring the specific risks to analyze and grouping and search for more information which causes risks, effect of the risk, failure level and defined the direction and control to reduce the risks (Mead, 2009). Risk management must be understood and weighted between the control of the expenses and how to management follow the timeline of project planning. In depth of risk management consists of the control planning, tracking, risk controlling those were methods of specify and analysis and coping to the new risk.

Classifying software risks will affect the timeline, expense and quality of business. It depends on expertise of the project management to make the survey and checking from the developed questionnaire which made from the experience from the developer. The analysis started to discriminate risks from low to high. After the questionnaire survey, the results found that the project categorized to low risk but developer should be aware and concerned if low risk was complex as same as the big project (Koolmanojwong, 2010). Planning and controlling organization strategy with clearly risk, define and analysis risk will enhance to success and reduce the chance of the failure. The risk of the software development was the main factor and condition which needed to highlighted, controlled, and managed to make the project successful (Betz, 2010).

Factor Analysis

Factor analysis was the technique to group related factors to one another. The same factor will relate together. The relation may be in a positive direction or negative direction or contra direction, and also the factor which is not related or less relevant. Factor analysis was a statistical technic which was used to analyze of measurement. Analysis will help to point out that the tools or technics measures the factor positive or negative.

Multiple logistic regression

Factor analysis will help to group the analysis to the technique group while multiple logistic regression analysis will use the possibility from the grouping and predicting from the independent factor which the factor might combine with the continuous factor or continuous factor or dichotomous of the value factors such as the YES and No, success and failure factor. The objective of the same factor analysis but multiple logistic regression has the dependent factor as the separated factor. However, It shown different from the risk management perspective. The multiple logistic regression analysis was used the statistic to separate all of factor into risk and non-risk

groups. This statistic technique can predict the possibility of the risk and increased the part which already classified as normal distribution, despite size of the groups were different but still can analysis and predict the risks to proper with development project. This analyses will compare the result of predicted risks which were analyzed in to coefficients or Odds that mean we can graded the interesting risk and compared among them. For the final regression, the result will should only the rest of maximum risk related with success and failure that might be concerned to manage during project development process.

Multiple regression was the correlation between the associated factors or classified problems and at least dichotomous independent factors such as dependent factor was Y, Independent factors were X1 to X30. All factors will be measured by parametric method as range or proportional or ratio.

PRELIMINARY INVESTIGATIONS

Method and process for risk prediction for the software development project by using multiple logistic regresses were separated in to many parts, see Figure-3.
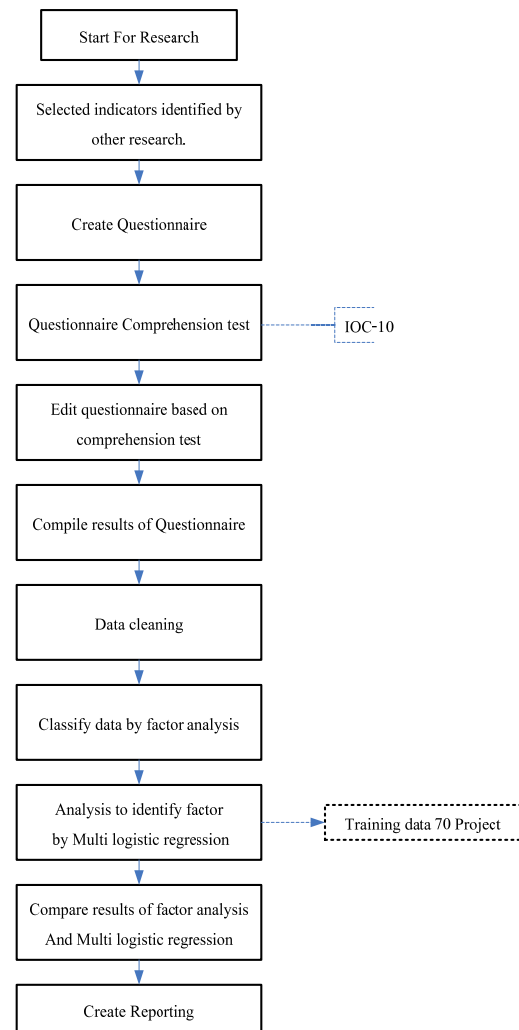

Figure-3. Process and method for prediction.

www.arpnjournals.com

Collecting the indicators

To classifying software risks, in this research, the author reviewed and selected many researches related to software developing projects which were studied, analyzed and categorized into low, intermediate and high risk factors. This prototype of risk factors used for risk estimation in this research. The related factor which caused the risk, level of the risk in the project and impact from the risk which used for identifying the risk factor, and to point out the risk which showed significant effect to the successful of project.

The summarization of the factors selected from classifying software risk were selected. The factors which related and grouped as domain group before questioning from the related factor and making the questionnaire as shown in Table-2.

Table-2. Classifying risk category.

Rank	Risk Category
1	User
2	Requirement
3	Cost
4	Schedule
5	Quality
6	Business
7	People
8	Project complexity
9	Planning & Control
10	Team
11	Organizational Environment
12	Scope change
13	Communication
14	Overdrawn Budget
15	Unrealistic Requirements
16	Change Management
17	Estimation
18	Project Management Activities
19	Design
20	Developer
21	Development
22	Process
23	Stakeholder
24	Software
25	Culture
26	Time Dimension
27	Resource availability

Summary of indicators

A summary of the indicators have been selected from a software risk taxonomies (Classifying Software Risks). The indicators of selection, main domain group of risk categorization were groped and prioritized as follows, the information is displayed in the Table-3.

Table-3. Main Group for risk category for software development.

Rank	Risk Category
1	User
2	Software Requirement
3	Estimations
4	Cost
5	Schedule
6	Planning and Control
7	Team
8	Software

Standardization of questionnaire from experts

The experts who have knowledge of software development or software development management will help to determine the optimized questionnaires. The authors specified and selection 5 experts from 5 organizations qualified with at least 9 years of experiences in software development projects to help determine if the questionnaires matched, understood and were relevant to the objectives. The final questionnaires were selected from their expertise, related risk factors and co-operation, which ensured that results from the questionnaires were reliable.

Data collection and validation

The data collection came from the 5 experts that have the same opinion and direction, agree or probably agree and disagree. In another way, if one of answer from these experts answered not-agree and disagree answered from people who did the questionnaire from their own experience. So that the factor caused the risk for software developing project came from the same direction (agree, probably agree vs. disagree) of the questionnaires.

Factor extraction and results

Factor extractions is the method to separate and grouped of all factors in terms of quality analysis and develop the questionnaire which has objective to select the factor which causes the risks and analysis from the risk factors for predicting the risk in the project. The results of questionnaire answered from the involved personnel was important. Because of these answers or perspectives would provide the information which can be trusted and covered all the factors. In additions, the questionnaire also was the tools to improve of gaps and mistakes and revised again to maximized efficiency of developed questionnaires.

ARPN Journal of Engineering and Applied Sciences

Analysis by multiple logistic regression from the questionnaire of 70 projects were relevant and enrolled to summarize the factor which causes the risk of projects see Table-4.

Table-4. Risk factor.

No.	Risk factors that cause software development projects.	Risk Level				
		5	4	3	2	1
User						
1	The user has opposition to change to a new system.					
2	Conflict between the system users (User) on matters related to the project.					
3	System user (User) have a negative attitude towards the project					
4	System user (User) does not make pledges to the project.					
5	Lack of cooperation from the user (User)					
Software Requirement						
1	Requirements of the system (Requirement) Changes often do not stop.					
2	Users are not able to explain the requirement that adequate or unclear description.					
3	Developer misunderstanding about the customer's needs.					
4	Lack of customers and developers. The interaction between customer requirements and the developer, advanced scenarios.					
Estimations						
1	Contains a list of the missing or dropped from the list, as well as evaluation has been included in the requirement clear.					
2	Do not give importance to the project evaluation and characterizations are not good enough.					
3	Pressure that is not relevant to the technical evaluation of the expenses or schedule doesn't match the reality.					
Cost						
1	The budget is too small.					
2	Delayed disbursements budget.					
Schedule						
1	The time limit for completion of the project does not make sense, such as too little.					
2	Project time estimation error.					
Planning and Control						
1	Assigning responsibility is unclear, and the responsible authority.					
2	There are no project management experiences.					
3	Estimating the resources needed is not fully covered.					
4	Project planning is not effective.					
Team						
1	Invalid human resources (lack of skills, lack of practice)					
2	The allocation of resources such that the allocation is too small for the individual. Not match the capabilities of the next					
3	Team members do not receive sufficient training in the required subject.					
4	The personnel shortage.					
Software						
1	The complexity of the software architecture to develop.					
2	The size of the software development project, such as small, medium large.					
3	Technological change in the software development.					
4	The software uses sophisticated learning incomprehensible.					
5	Lack of software development processes such as Agile.					
6	Lack of tools (Tool) to assist in the development of software.					

APPLICATION MODULES

The results were analyzed using multiple logistic regression of the respondents to the software development projects which were the subject of the 40 questions and a summary of all the factors were analyzed by the program. Multiple logistic regression analysis from questionnaire, the personnel will answer the respondents. Almost of them had experiences from other companies in software project. Multiple logistic regression analysis of how the guidelines were finalized at the Table-5.

Table-5. Results of multiple logistic regression analysis.

Original value	Internal value
No risk	0
Study risk	1

Table-6. The results from classification.

Observed			Predicted		
			Factor		**Percentage of Correct Prediction**
			Risk	**Non Risk**	
Step 0	Factor	Risk	37	0	100
		Non risk	33	0	0
	Overall percentage				52.9

The variables in the Equation showed the intercept-only model is ln(odds) = -0.114 (Table-7). If we exponential both sides of this expression, we found that our predicted odds [Exp. (B)] = 0.892. That was the predicted odds of deciding to no risk the research is 0.892. Since 33 Project of our subjects decided to no risk the research and 37 decided to have the risk in research, our observed odds was 33/37 = 0.892.

Table-7. The result of variables in the equation.

		B	S.E.	Wald	diff	Sig	Exp. (B)
	Constant	-0.114	0.239	0.228	1	.633	0.892

This Block 1 output, this SPSS has added the risk factor variable as a predictor. Omnibus Tests of Model Coefficients gives us a Chi-Square of 43.903 on 30 diff, significant beyond .001. This was a test of the null hypothesis that added the risk factor variable to the model has not significantly increased our ability to predict the decisions made by our subjects (rejected of null hypothesis with p-value < 0.05).

Table -8. Omnibus tests of model coefficients.

		Chi-square	Diff	Sig.
Step 1	Step	43.903	30	0.049
	Block	43.903	30	0.049
	Model	43.903	30	0.049

www.arpnjournals.com

Table-9. Result from data (Questionnaire).

Unweighted Cases		N	Percent
Selected Cases	Included in analysis	70	100
	Missing cases	0	0
	Total	70	100
Total		70	100

Table-10. Result from classification.

Observed			Predicted		
			Factor		Percentage of Correct Prediction
			Risk	Non Risk	
Step1	Factor	Risk	34	3	91.90%
		Non risk	4	29	87.90%
	Overall percentage				90.00%

From Table-10, there were the actual data of the expectations (factor risk) 34 questionnaires and (factor non risk) 3 questionnaires. When using predictive equations, 37 questionnaires can be predicted. Therefore, the corrected prediction is around 91.9%. Next, there were the actual data of the expectations (factor risk) 4 questionnaires and (factor non risk) 29 questionnaires. When using predictive equations, 33 questionnaires can be predicted. Therefore, the corrected prediction is around 87.9%. Then, the overall prediction accuracy was 90.0%.

These results were found using SPSS to analyze the data from the questionnaire.

CONCLUSIONS

The main aim of the software development process was the acquisition of profit. It was an impulsion causing the importance to find out the risk factors which comes with software development projects of each organization.

Preliminary risk classification, focuses on the risks that are frequently happen in software development projects, common problems of improve processes for greater efficiency in the software development projects. The decision to select appropriate project was an important issues that must be emphasized and it necessary to have the answer about prediction of risks.

The reason why the prediction of risk from software development process was necessary and must be obtained because it will help project manager to manage and estimate mistakes and delayed in each step of processes all the time. Moreover, it supports to making decision to carry out a software development project properly. Thus the classification, prediction of risk factors, estimation of risk factors in software development process

is really importance and useful because it will promise to enhance the successful of the software development project.

REFERENCES

Tharwon, A. (2011). Top Ten Lists of Software Project Risks :Evidence from the Literature Survey. Proceedings of the International MultiConference of Engineers and Computer Scientists.

Rabia, H. and Muhammad, A. (2013). Critical success factors assessment in Software Projects. Science and Information Conference.

Hooman, H. and Hassan, R. (2009). Classification and Analysis of Risks in Software Engineering.World Academy of Science, Engineering and Technology.

Tim, M., Osamu, M., Yasunari, T., and Tohru, K. (2009). Explanation vs Performance in Data Mining: A Case Study with Predicting Runaway Projects. J. Software Engineering & Applications.

Abdullahi, M. and Shuib, B. (2014). Risk Assessment Factors for SME Software Development Companies in Malaysia. Universiti Teknologi PETRONAS (UTP) Sri Iskandar, Malaysia.

Gray, C.F. and Larson, E.W. (2008). Project Management: The Managerial Process, 4th ed. McGraw-Hill Irwin.

Venkatesh, S.,K. and Kumar, P.V. (2012). An Efficient Risk Analysis in Requirement Engineering. Research scholar,Professor in Osmania University,JNTU Kakinada.

Muhammad, Z. F., Muhammad, A., and Madiha, W. (2014). Risk Management System for ERP Software Project. Technology, Islamabad, Pakistan.

Dana, S. K., Mark, S., Liming, Z., He, Z., and Ross J., (2012). Risks of Off-The-Shelf-based Software Acquisition and Development: A Systematic Mapping Study and A Survey. Proceedings of the EASE 2012 - Published by the IET.

Pontakorn, S. and Sakgasit, R. (2014). Top Twenty Risks in Software Projects:A Content Analysis and Delphi Study. Department of Computer Engineering Faculty of Engineering, Chiang Mai University Chiang Mai, Thailand.

Verma, C. and Amin, A. (2010). Significance of Healthy Organizational Culture for Superior Risk Management. Developments in E-Systems Engineering.

Betz, S., Hickl, S., and Oberweis, A. (2011). Risk Management in Global Software Development Process

www.arpnjournals.com

Planning. EUROMICRO Conference on Software Engineering and Advance Application.

Ibrahim, S. and Ali, R.Z.R.M. (2011). Study on acceptance of Customized Software Process Improvement (SPI) Model for Malaysia's SME. Malaysian Conference in Software Engineering (MySEC).

Han, W. M. and Huang, S.J. (2007). An Empirical Analysis of Risk . Components and Performance on Software Projects. The Journal of Systems and Software.

Koopman, P. (2011). Risk Areas In Embedded Software Industry Projects. Electrical and Computer Engineering, Carnegie Mellon University, Pittsburgh, Pennsylvania, USA.

Ramli, M., Hairul, Nizam M., and Nasir. (2008). Assessing Software Risk Management practicesin a Small Scale. IEEE.
Koolmanojwong, S. (2010). The Incremental Commitment Spiral Model Process Patterns for Rapid-Fielding Projects. PhD Dissertation, Department of Computer Science, University of Southern California.

Mead, N.R., et.al. (2009). Ensuring Cost Efficient and Secure Software through Student Case Studies in Risk and Requirements Prioritization. hicss, pp.1-9, 42nd Hawaii International Conference on System Sciences.

Supannika, K., and Barry, B. (2013). A Look at Software Engineering Risks in a Team Project Course. University of Southern California (USC)

Ying, Q., Meng-Jia, Y., and Feng, L. (2012). The Risk Factor Analysis For Software Project Based on the Interpretative Structural Modelling Method. International Conference on Machine Learning and Cybernetics.

Christin, L., Jesper, P. N., and Martin, H. (2011). Software Risk Analysis in Medical Device Development. Software Engineering Research Group, Department of Computer Science, Lund University, Faculty of Engineering,Lund, Sweden.

Kusumo, D. S., Zhu, L., Staples, M., and Zhang, H. (2011). Systematic Mapping Study on Off-The-Shelf-based Software Acquisition. In ACIS 2011 Proceeding, Sydney.

Davide, A., Riccardo, D., and Valeria, M. (2011). Modelling and assessing ERP project risks: A Petri Net approach. European Journal of Operational Research.

Wu, H. (2011). The software project risk management Study. Hunan machinery.

Koutanis, D., Tsihrintzis, G.A., and Virvou, M. (2014). Identifying and Managing Risks in the Development of

Online Educational Software. Department of Informatics, University of Piraeus.

Abdullah, A. M. C., and Shamsul, A. (2011). Software Risk Management: Importance and Practices.

Reed, A. H., and Knight, L.V. (2011). Major Virtual Project Risk Factors. J. Inf.Technol.Manag.

Sharif, A. M., Basri, S. and Ali, H. O. (2013). A Study on SME Software Development Background and Risk Assessment Implementation in Malaysia.

Chen G., Sai, Y., and Zhang, J. (2009). ERP Implementation Based on Risk Management Theory: Empirical Validation. Management and Service Science‖, International Conference.

Yilmaz, A.K., and Flouris T. (2010). Managing corporate sustainability: Risk management process based perspective‖. African Journal of Business Management .

Iskanius, P. (2009). Risk Management in ERP Project in the Context of SMEs. Engineering Letters.

Basit, S., Ihsan, U., and Naveed, K. (2009). Software Risk Identification and Mitigation in Incremental Model. Department of Computer Science King Saud University Riyadh, KSA.

Shehnila, Z. (2009). Software Risk Management. Department of Computer Science & IT. NED University of Engineering and Technology, Karachi, Pakistan.

Pew, R. W., and Mavor, A. S. (2007). Human-System Integration in the System Development Process: A New Look. National Academy Press.

Swart, R.S, and Erbacher, R.F. (2007). Educating Students to Create Trustworthy Systems. IEEE Security and Privacy.

Taran, G. (2007). Using Games in Software Engineering Education to Teach Risk Management. Cseet, Conference on Software Engineering Education & Training.

Boehm, B. and Bhuta, J. (2008). Balancing Opportunities and Risks in Component-Based Software Development. IEEE Software, November-December,Volume 15, Issue 6, pp. 56-63

G. Pare, C. Sicotte, M. Jaana, and D. Girouard. (2008). Prioritizing Clinical Information System Project Risk Factors: A Delphi Study. Hawaii Conference on System Sciences.

Neil, N. M, Marsh, W., Hearty, P., Radlinski, L. and Krause, P. (2008). On the effectiveness of early life

cycle defect prediction with Bayesian Nets. Empirical Software Engineering, Published Online.

Lobato, L. L., Neto, P. A. M. S., Machado, I. C., Alemida, E. S., and Meira, S. R. L.(2012). Risk Management in Software Product Lines An Industrial Case Study. International Conference on Software and System Process.

John, E., and Amandha, G. (2012). Classification of risks and management Implications. Australian School of Business, UNSW.

Zhang, J.G. and Xu, Z.C. (2010). Method Study of Software Project Risk Management. School of Economics and management. University of Science and Technology Beijing USTB Beijing, China

Dengsheng, W., Hao, S., Minglu, L., Chen, C., and Jianping L. (2010). Modeling Risk Factors Dependence Using Copula Method for Assessing Software Schedule Risk. Shandong Economic University.

Özgür Cingiz, M., Ahmet, U. and Oya, K. (2013). Prediction of Project Problem Effects on Software Risk Factors.Computer Engineering Department Yıldız Technical University,Turkey.

Wang, W., Zhang, D. and Miao, X. (2011). Research on the Risk Management of Mining Construction Projects. School of Mechanics & Architecture and Civil Engineering China University of Mining and Technology Xuzhou, China.

Iqra, B., Tayyaba, N. and Muhammad, A. (2013) Risks factors identification and assessment in Virtual Projects of Software Industry: A Survey Study. Department of Computer Software Engineering National University of Sciences and Technology, Islamabad, Pakistan.

Rita, C. N. and Andries, B. (2007). A Generic AgentFramework to Support the Various Software Project Management Processes. Interdisciplinary Journal of Information.

Boehm, B. and Lane, J. (2007). Using the Incremental Commitment Model to Integrate Systems Acquisition. Systems Engineering, and Software Engineering.

Yudistira, A. and Paolo, G. (2007). Risk Analysis as part of the Requirements Engineering Process. University of Trento, Department of Information and Communication Technology.

OECD Reviews of Regulatory Reform, Risk and Regulatory Policy, Improving the Governance of risk, OECD Publishing.