A Holistic Approach to Risk Assessment and Decision Analysis to Improve Project Performance

Md. Irfath Ali[1], K. Kalpana [2], A.Pathanjali Sastri[3] B.Lakshmi[4]

[1]M.Tech(CSE), M.V.R.College of Engg. & Technology, paritala, india
[2]Asst.Professor, Dept. of CSE, M.V.R.College of Engg. & Technology, paritala, india
[3]Asst.Professor, Dept.of Computer Applications, V.R.Sidhhartha Engg. College, Vijayawada
[4] Asst.Professor, Dept.of Computer Applications, V.R.Sidhhartha Engg. College, Vijayawada

Abstract: *A risk is an event or condition that, if it occurs, has a positive or negative effect on a project's objectives. Corrective actions will probably reduce risk for a project. A risk is the precursor to a problem; the probability that, at any given point in the software life cycle, the predicted goals cannot be achieved within available resources. Risk cannot be eliminated from a software project, but it can be managed. Risk management is critical to the success of any software effort and is a strategic aspect of all software projects.*

Software risk management is a software engineering practice with processes, methods, and tools for managing risks in a project. It provides a disciplined environment for proactive decision-making to assess continuously what can go wrong; determine what risks are important to deal with; and implement actions to deal with those risks. Risk management planning addresses the strategy for risk management, the risk management process, and the techniques, methods, and tools to be used to support the risk management process.

The process of risk management embodies the identification, analysis, planning, tracking, controlling, and communication of risk. The main aim of the paper is to promote the importance and relevance of risk management and the identified risks are analyzed to determine their potential impact and likelihood of occurrence. Risk Management Plans are developed to document the project's approach to risk management, risks, and decisions made about what should be done with each risk. Risks and risk actions are then tracked to closure.

Keywords: *Risk, Risk Assessment, Risk Analysis, and Mitigation Plan*

1. INTRODUCTION

According to PMBOK, a risk is an uncertain event or condition that, if it occurs, has a positive or negative effect on a project's objectives [1]. It is quite legitimate and acceptable to state that the project should prepare a risk assessment document at the inception of a project and at the end of each product development lifecycle phase or every quarterly for large and high-risk projects. This will to help the projects to discover what might impact the success of the project. But the projects normally do not practice each risk assessment to be included as a project activity in the project schedule like other activities like Project Management Review, Internal Audits, etc.

2. PAGE LAYOUT IMPORTANCE OF PROJECT RISK ASSESSMENT PROCESS

Keep in mind that the constraints that the project will have to deal with, the Project Manager along with the Risk Manager/Controller need to consider the all the risk factors well ahead at the inception phase itself. Thinking about the risks of the project will be helpful in planning how the project can avoid, or lessen the risks to avoid project failures. This initial Project Risk Assessment (PRA) is carried out to help to discover what might impact the success of the project and the organizations should not forget that the risk management runs the entire life cycle of the project.

3. RISK ASSESSMENT

Risk Management is a critical part of Project management and is dealt with in the Project itself which is considered as a Risk Mitigation process. Every Project has risks. We should not judge the projects based on the number of risks, but rather on how the risks are identified and managed effectively. The Risk Assessment Process (RAP) should start with developing awareness among the project team

members of what the project needs to cope with as it progresses through its life cycle, i.e. provide information as to how and when the particular risk will be dealt with. The project manager along with the Independent Verification and .Validation (IV&V) team target those areas of greatest risk to the project and tracked using Risk and Issue Log tool [2]. Both Risk and Issue management processes may involve making changes to the project. According to PMBOK [1], a Risk is an uncertain event or condition that, if it occurs, has a positive or negative effect on a project's objectives and an Issue is a point or matter in question or dispute, or a point or matter that is not settled and is under discussion or over which there are opposing views or disagreements. Both Risks and Issues can significant impact a project's success should be handled in similar ways and both may involve making changes to the project.

4. RISK ANALYSIS

The risk management is not only the systematic process of understanding, evaluating and addressing the possible risks, but also requires an informed understanding of relevant risks to be effective and also allowing the projects to be aware of new possibilities [3][4][5][6]. Thus an effective risk management goes through an assessment of their relative high priority risks and also a rigorous approach to monitoring and controlling them. The Risk Management sets out the technical risk management knowledge, general business knowledge, skills and behaviours expected of an effective risk analysis at each stage of the project development life cycle.

There could be various risks associated with the software development projects, the key to identify and manage those risks is to identify the possible risks using following cycle.

Step 1: Brainstorm possible risks.

Step 2: For each risk, assign a High/Medium/Low value for both likelihood of occurrence and potential impact on the project.

Step 3: Develop a mitigation strategy for each High/High, High/Medium and Medium/High risk.

Consider developing mitigation strategies for the Medium/Medium risks.

It is a normal practice in software companies to share status reports with the quality department and senior management every month. But the projects should prepare a written risk assessment report at the inception of a project and at the end of each product development lifecycle phase or more frequently for large and high-risk projects and share with the quality department atleast quarterly [7][8][9]. Moreover risk assessment shall be included as a project activity in the project schedule. The risk assessment should focus on the five key areas, Impact, Project Organization (budget, scope, stakeholders, etc), Requirements, Technical Risks and Planning Risks.

All potential risks associated with the proposed software development projects should be defined and weighed, and impacts to project cost should be determined based upon their own experiences and priorities[10][11]. This information should always be included in the Risk Management Matrix (Table 1) to monitor and control the risks. The risk management process can be broken down into two interrelated phases, risk assessment and risk control. Risk assessment involves risk identification and risk analysis to prioritize risks. Risk control involves risk planning, risk mitigation, and risk monitoring.

Table 1. *Risk Management Matrix*

ID	Risk Descri ption	Probability	Impact	Detectability	Importance	Catego ry	Trigger Event/Indica tor	Mitigati on Plan	Conting ency Plan	Owner	Status	Date Enter ed	Date to Revie w

Where:

Probability = likelihood of that the risk will occur.

Impact = Impact should be measured in terms of deviations from the schedule, effort, or costs from the schedule if risks occur.

Mitigation Plan = Identify what actions can be taken in order to reduce the probability of the risk, or to reduce its impact on the project.

Contingency Plan = Identify what actions will be taken when the risk materializes and threatens the scope, budget, or the schedule of the project.

The following tables Table 2, Table 3, and Table 4 explain how to indicate weightage based on the criticality of the parameters such as probability, impact and detectabilty respectively.

4.1 Probability

Table 2. *Probability weightage table*

Weightage	Description	Probability
4	Highly likely/probable	(76%-100%)
3	Likely	(51%-75%)
2	Somewhat likely	(26%-50%)
1	Unlikely/improbable	(0%-25%)

4.2 Impact

Table 3. *Impact weightage table*

Weightage	Description	Impact
4	Threatens the viability of the business or represents failure of the project	Critical
3	Threatens the achievement of business vision or severely reduces project benefits	Severe
2	May delay achievement of the vision or reduce project benefits	Moderate
1	No impact on business vision but may increase project costs and timescales	Minimal/minor

4.3 Detectability

Table 4. *Detectability weightage table*

Weightage	Detectability
4	Determined after impact has been realized
3	Realized upon trigger event
2	Immediately prior to trigger event; can be mitigated prior to trigger if monitored
1	Determined well in advance of occurrence or trigger event

Importance is calculated using the formula (I)= Probability *2*(Impact)* Detectability

5. RISK EVALUATION FOR THE PROJECT

There are several ways to look at the kinds of software project risks, as shown in Table 5. Table 5 shows some common risks and their potential impact for software development and implementation projects.

Table 5. *Common risks and their potential impact for software development and implementation projects*

Risk Factors	Potential Impact on Project Success L/M/H	Likelihood of Occurrence L/M/H	Mitigation Plan
Project Size (Duration or Effort)			
< 4 Months or < 1000 Hours	L	L	Nil
4-6 Months or 1000 to 3000 Hrs	M	M	Phased implementation
> 6 Months or > 3000 Hours	H	H	Decomposition into smaller phases and Phased implementation
Project Scope			
Defined and Not Large or Complex	L	L	Nil
Somewhat Defined/ Large/ Complex	H	H	• Decomposition • Add another analysis phase • Detailed specifications • Add more time to the project schedule • Prototype/review of functionality
Not Defined	H	H	• Early prototype/review of functionality • Add more time to the project schedule
Project Decision-Making			
One decision- maker	L	L	Nil
Decision making committee	M	M	• Specify decision-makers' role in project documentation
No Clear Decision-maker	H	H	• Add tasks to the Project Plan for involving decision-makers and managing relationship with them

6. CONCLUSION

The software projects have to try to determine and accept the risks including possible ones and all potential risks associated with the proposed software development project should be defined and weighed, and impacts to project parameters should be determined. This paper emphasis on the identifying and classification of risks based upon their own experiences and priorities and see how to solve them but should not try to brush them aside. The risk analysis should be done at each phase and stage and needs to be analyzed. It makes good business sense for all software development projects to incorporate risk management as part of project management. In ideal risk management, a prioritization process is followed whereby the risks with the greatest loss (or impact) and the greatest probability of occurring are handled first, and risks with lower probability of occurrence and lower loss are handled in descending order.

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AUTHORS' BIOGRAPHY

Md. Irfath Ali, persuing M.Tech(CSE) at M.V.R.College of Engineering and Technology, paritala. He is interested in various topics like Operating System, RDBMS, and Computer Organization.

Mrs. K. Kalpana has 8 years experience in teaching and working as Assistant professor in MVR College of Engineering. Her areas of interest are operating sytems, distributed systems, Database management systems. She has attended various national seminars and conferences.

Mr.A.Pathanjali Sastri is currently pursuing Ph.D Computer Science from Raylaseema University, Kurnool. He is woking as a Lecturer in Velagapudi Ramakrishna Siddhartha Engineering college since 2008 and has 10 years of Industrial experience. He has published papers in reputed journals/International conferences recently. His area of interest includes Software Engineering, Quality Assurance, Artificial Intelligence and RDBMS.

Mrs.B.Lakshmi is currently working as an Asst. Professor, Department of Computer Applications, VRSEC (Autonomous), Vijayawada, Andhra Pradesh. She has 8 years of teaching experience. Her areas of interest include Database Management Systems, Operating Systems. She had completed the OCA certification.