



RISK MANAGEMENT

- INTRODUCTION

- RISK IDENTIFICATION

- RISK PROJECTION (ESTIMATION)

- RISK MITIGATION, MONITORING, AND MANAGEMENT

The background is a solid dark purple. It features several abstract, light-colored circular and semi-circular patterns. On the left side, there is a large, curved scale with numerical markings ranging from 150 to 260 in increments of 10. The numbers are oriented along the curve of the scale. There are also several concentric circles and arcs, some with small arrows indicating a direction of movement or rotation. The overall design is clean and modern, with a focus on geometric shapes and a monochromatic color palette.

INTRODUCTION

DEFINITION OF RISK

- A risk is a potential problem – it might happen and it might not
- Risk Management: Series of steps that help a software team to understand and manage uncertainty.
- Conceptual definition of risk
 - Risk concerns future happenings
 - Risk involves change in mind, opinion, actions, places, etc.
 - Risk involves choice and the uncertainty that choice entails
- Two characteristics of risk
 - Uncertainty – the risk may or may not happen, that is, there are no 100% risks (those, instead, are called constraints)
 - Loss – the risk becomes a reality and unwanted consequences or losses occur

RISK CATEGORIZATION – APPROACH #1

- Project risks
 - They threaten the project plan
 - If they become real, it is likely that the project schedule will slip and that costs will increase
- Technical risks
 - They threaten the quality and timeliness of the software to be produced
 - If they become real, implementation may become difficult or impossible
- Business risks
 - They threaten the viability of the software to be built
 - If they become real, they jeopardize the project or the product

RISK CATEGORIZATION – APPROACH #1

(CONTINUED)

- Sub-categories of Business risks
 - **Market risk** – building an excellent product or system that no one really wants
 - **Strategic risk** – building a product that no longer fits into the overall business strategy for the company
 - **Sales risk** – building a product that the sales force doesn't understand how to sell
 - **Management risk** – losing the support of senior management due to a change in focus or a change in people
 - **Budget risk** – losing budgetary or personnel commitment

RISK CATEGORIZATION – APPROACH #2

- Known risks

- Those risks that can be uncovered after careful evaluation of the project plan, the business and technical environment in which the project is being developed, and other reliable information sources (e.g., unrealistic delivery date)

- Predictable risks

- Those risks that are extrapolated from past project experience (e.g., past turnover)

- Unpredictable risks

- Those risks that can and do occur, but are extremely difficult to identify in advance

REACTIVE VS. PROACTIVE RISK STRATEGIES

- Reactive risk strategies
 - "Don't worry, I'll think of something"
 - The majority of software teams and managers rely on this approach
 - Nothing is done about risks until something goes wrong
 - The team then flies into action in an attempt to correct the problem rapidly (fire fighting)
 - Crisis management is the choice of management techniques
- Proactive risk strategies
 - Steps for risk management are followed
 - Primary objective is to avoid risk and to have a contingency plan⁷ in place to handle unavoidable risks in a controlled and effective manner

STEPS FOR RISK MANAGEMENT

- 1) Identify possible risks; recognize what can go wrong
- 2) Analyze each risk to estimate the probability that it will occur and the impact (i.e., damage) that it will do if it does occur
- 3) Rank the risks by probability and impact
 - Impact may be negligible, marginal, critical, and catastrophic
- 4) Develop a contingency plan to manage those risks having high probability and high impact

The background is a dark blue field featuring several abstract, light blue geometric patterns. These include concentric circles, radial lines, and circular arcs, some of which are dotted. The patterns are distributed across the frame, with a prominent one on the left side and another on the right. The overall effect is technical and modern.

RISK IDENTIFICATION

BACKGROUND

- Risk identification is a systematic attempt to specify threats to the project plan
- By identifying known and predictable risks, the project manager takes a first step toward avoiding them when possible and controlling them when necessary
- Generic risks
 - Risks that are a potential threat to every software project
- Product-specific risks
 - Risks that can be identified only by those with a clear understanding of the technology, the people, and the environment that is specific to the software that is to be built
 - This requires examination of the project plan and the statement of scope
 - "What special characteristics of this product may threaten our project plan?"

RISK ITEM CHECKLIST

- Used as one way to identify risks
- Focuses on known and predictable risks in specific subcategories (see next slide)
- Can be organized in several ways
 - A list of characteristics relevant to each risk subcategory
 - Questionnaire that leads to an estimate on the impact of each risk
 - A list containing a set of risk component and drivers and their probability of occurrence

KNOWN AND PREDICTABLE RISK CATEGORIES

- **Product size** – risks associated with overall size of the software to be built
- **Business impact** – risks associated with constraints imposed by management or the marketplace
- **Customer characteristics** – risks associated with sophistication of the customer and the developer's ability to communicate with the customer in a timely manner
- **Process definition** – risks associated with the degree to which the software process has been defined and is followed
- **Development environment** – risks associated with availability and quality of the tools to be used to build the project
- **Technology to be built** – risks associated with complexity of the system to be built and the "newness" of the technology in the system
- **Staff size and experience** – risks associated with overall technical and project experience of the software engineers who will do the work

QUESTIONNAIRE ON PROJECT RISK

(Questions are ordered by their relative importance to project success)

- 1) Have top software and customer managers formally committed to support the project?
- 2) Are end-users enthusiastically committed to the project and the system/product to be built?
- 3) Are requirements fully understood by the software engineering team and its customers?
- 4) Have customers been involved fully in the definition of requirements?
- 5) Do end-users have realistic expectations?
- 6) Is the project scope stable?

QUESTIONNAIRE ON PROJECT RISK

(CONTINUED)

- 7) Does the software engineering team have the right mix of skills?
- 8) Are project requirements stable?
- 9) Does the project team have experience with the technology to be implemented?
- 10) Is the number of people on the project team adequate to do the job?
- 11) Do all customer/user constituencies agree on the importance of the project and on the requirements for the system/product to be built?

RISK COMPONENTS AND DRIVERS

- The project manager identifies the risk drivers that affect the following risk components
 - **Performance risk** - the degree of uncertainty that the product will meet its requirements and be fit for its intended use
 - **Cost risk** - the degree of uncertainty that the project budget will be maintained
 - **Support risk** - the degree of uncertainty that the resultant software will be easy to correct, adapt, and enhance
 - **Schedule risk** - the degree of uncertainty that the project schedule will be maintained and that the product will be delivered on time
- The impact of each risk driver on the risk component is divided into one of four impact levels
 - Negligible, marginal, critical, and catastrophic
- Risk drivers can be assessed as impossible, improbable, probable, and frequent



RISK PROJECTION **(ESTIMATION)**

BACKGROUND

- Risk projection (or estimation) attempts to rate each risk in two ways
 - The probability that the risk is real
 - The consequence of the problems associated with the risk, should it occur
- The project planner, managers, and technical staff perform four risk projection steps (see next slide)
- The intent of these steps is to consider risks in a manner that leads to prioritization
- Be prioritizing risks, the software team can allocate limited resources where they will have the most impact

RISK PROJECTION/ESTIMATION STEPS

- 1) Establish a scale that reflects the perceived likelihood of a risk (e.g., 1-low, 10-high)
- 2) Delineate the consequences of the risk
- 3) Estimate the impact of the risk on the project and product
- 4) Note the overall accuracy of the risk projection so that there will be no misunderstandings

CONTENTS OF A RISK TABLE

- A risk table provides a project manager with a simple technique for risk projection
- It consists of five columns
 - Risk Summary – short description of the risk
 - Risk Category – one of seven risk categories (slide 12)
 - Probability – estimation of risk occurrence based on group input
 - Impact – (1) catastrophic (2) critical (3) marginal (4) negligible
 - RMMM – Pointer to a paragraph in the Risk Mitigation, Monitoring, and

Risk Summary	Risk Category	Probability	Impact (1-4)	RMMM

DEVELOPING A RISK TABLE

- List all risks in the first column (by way of the help of the risk item checklists)
- Mark the category of each risk
- Estimate the probability of each risk occurring
- Assess the impact of each risk based on an averaging of the four risk components to determine an overall impact value (See next slide)
- Sort the rows by probability and impact in descending order
- Draw a horizontal cutoff line in the table that indicates the risks that will be given further attention

<u>Risks</u>	<u>Category</u>	<u>Probability</u>	<u>Impact</u>	<u>RMMM</u>
<u>Estimated size of project in LOC or FP</u>	<u>PS</u>	<u>80%</u>	<u>2</u>	<u>**</u>
<u>Lack of needed specialization increases defects and reworks</u>	<u>ST</u>	<u>50%</u>	<u>2</u>	<u>**</u>
<u>Unfamiliar areas of the product take more time than expected to design and implement</u>	<u>DE</u>	<u>50%</u>	<u>2</u>	<u>**</u>
<u>Does the environment make use of a database</u>	<u>DE</u>	<u>35%</u>	<u>3</u>	<u>-</u>
<u>Components developed separately cannot be integrated easily, requiring redesign</u>	<u>DE</u>	<u>25%</u>	<u>3</u>	<u>-</u>
<u>Development of the wrong software functions requires redesign and implementation</u>	<u>DE</u>	<u>25%</u>	<u>3</u>	<u>-</u>
<u>Development of extra software functions that are not needed</u>	<u>DE</u>	<u>20%</u>	<u>3</u>	<u>-</u>
<u>Strict requirements for compatibility with existing system require more testing, design, and implementation than expected</u>	<u>DE</u>	<u>20%</u>	<u>3</u>	<u>-</u>
<u>Operation in unfamiliar software environment causes unforeseen problems</u>	<u>EV</u>	<u>25%</u>	<u>4</u>	<u>-</u>
<u>Team members do not work well together</u>	<u>ST</u>	<u>20%</u>	<u>4</u>	<u>21</u> -
<u>Key personnel are available only part-time</u>	<u>ST</u>	<u>20%</u>	<u>4</u>	<u>-</u>

ASSESSING RISK IMPACT

- Three factors affect the consequences that are likely if a risk does occur
 - **Its nature** – This indicates the problems that are likely if the risk occurs
 - **Its scope** – This combines the severity of the risk (how serious was it) with its overall distribution (how much was affected)
 - **Its timing** – This considers when and for how long the impact will be felt
- The overall risk exposure formula is $RE = P \times C$
 - P = the probability of occurrence for a risk
 - C = the cost to the project should the risk actually occur
- Example
 - P = 80% probability that 18 of 60 software components will have to be developed
 - C = Total cost of developing 18 components is \$25,000
 - $RE = .80 \times \$25,000 = \$20,000$



RISK MITIGATION, MONITORING, AND MANAGEMENT

BACKGROUND

- An effective strategy for dealing with risk must consider three issues

(Note: these are not mutually exclusive)

- Risk mitigation (i.e., avoidance)
 - Risk monitoring
 - Risk management and contingency planning
- Risk mitigation (avoidance) is the primary strategy and is achieved through a plan
 - Example: Risk of high staff turnover

BACKGROUND (CONTINUED)

Strategy for Reducing Staff Turnover

- ☐ Meet with current staff to determine causes for turnover (e.g., poor working conditions, low pay, competitive job market)
- ☐ Mitigate those causes that are under our control before the project starts
- ☐ Once the project commences, assume turnover will occur and develop techniques to ensure continuity when people leave
- ☐ Organize project teams so that information about each development activity is widely dispersed
- ☐ Define documentation standards and establish mechanisms to ensure that documents are developed in a timely manner
- ☐ Conduct peer reviews of all work (so that more than one person is "up to speed")
- ☐ Assign a backup staff member for every critical technologist

BACKGROUND (CONTINUED)

- During risk monitoring, the project manager monitors factors that may provide an indication of whether a risk is becoming more or less likely
- Risk management and contingency planning assume that mitigation efforts have failed and that the risk has become a reality
- RMMM steps incur additional project cost
 - Large projects may have identified 30 – 40 risks
- Risk is not limited to the software project itself
 - Risks can occur after the software has been delivered to the user

SOFTWARE SAFETY AND HAZARD ANALYSIS

- Risks are also associated with software failures that occur in the field after the development project has ended.
- Computers control many mission critical applications today (weapons systems, flight control, industrial processes, etc.).
- These are software quality assurance activities that focus on the identification and assessment of potential hazards that may affect software negatively and cause an entire system to fail
- If hazards can be identified early in the software process, software design features can be specified that will either eliminate or control potential hazards

THE RMMM PLAN

- The RMMM plan may be a part of the software development plan or may be a separate document
- Once RMMM has been documented and the project has begun, the risk mitigation, and monitoring steps begin
 - Risk mitigation is a problem avoidance activity
 - Risk monitoring is a project tracking activity
- Risk monitoring has three objectives
 - To assess whether predicted risks do, in fact, occur
 - To ensure that risk aversion steps defined for the risk are being properly applied
 - To collect information that can be used for future risk analysis
- The findings from risk monitoring may allow the project manager to ascertain what risks caused which problems throughout the project²⁸

Risk information sheet			
Risk ID: P02-4-32	Date: 5/9/02	Prob: 80%	Impact: high
Description: Only 70 percent of the software components scheduled for reuse will, in fact, be integrated into the application. The remaining functionality will have to be custom developed.			
Refinement/context: Subcondition 1: Certain reusable components were developed by a third party with no knowledge of internal design standards. Subcondition 2: The design standard for component interfaces has not been solidified and may not conform to certain existing reusable components. Subcondition 3: Certain reusable components have been implemented in a language that is not supported on the target environment.			
Mitigation/monitoring: 1. Contact third party to determine conformance with design standards. 2. Press for interface standards completion; consider component structure when deciding on interface protocol. 3. Check to determine number of components in subcondition 3 category; check to determine if language support can be acquired.			
Management/contingency plan/trigger: RE computed to be \$20,200. Allocate this amount within project contingency cost. Develop revised schedule assuming that 18 additional components will have to be custom built; allocate staff accordingly. Trigger: Mitigation steps unproductive as of 7/1/02			
Current status: 5/12/02: Mitigation steps initiated.			
Originator: D. Gagne		Assigned: B. Laster	

RISK MANAGEMENT

Risk for our project is: planned budget Increase
For risk management using RMMM plan.

Risk Information Sheet			
Project Name: Library Management System			
Risk ID: 007	Date: 13/03/2015	Probability: 67%	Impact: Medium
Origin: Viraj Kelkar		Assigned to: Sanket Kudalkar	
Description: More bugs are arising in the system. System is unstable. Need to be updated as the technique gets modern.			
Refinement/ Context: System is unstable due to the unexpected developer. Because of such problem the solution to the critical problem is harder to find.			
Mitigation / Monitoring Bugs must be found and simultaneously solutions to those bugs should also be found. Testing of each module should be done.			
Contingency plan and trigger Experts should be hire in case of emergency or in case of issue. As computed the risk exposure to be Rs.45,000. Allocate this amount within the project management cost. Develop revised schedule and allocate more skilled staff accordingly.			
Status / date Mitigation step initiated.			
Approval Tejas Kondhalkar		Closing date 13/3/2015	

SEVEN PRINCIPLES OF RISK MANAGEMENT

- Maintain a global perspective

- View software risks within the context of a system and the business problem that is intended to solve

- Take a forward-looking view

- Think about risks that may arise in the future; establish contingency plans

- Encourage open communication

- Encourage all stakeholders and users to point out risks at any time

- Integrate risk management

- Integrate the consideration of risk into the software process

- Emphasize a continuous process of risk management

- Modify identified risks as more becomes known and add new risks as better insight is achieved

- Develop a shared product vision

- A shared vision by all stakeholders facilitates better risk identification and assessment

- Encourage teamwork when managing risk

- Pool the skills and experience of all stakeholders when conducting risk management activities

SUMMARY

- Whenever much is riding on a software project, common sense dictates risk analysis
 - Yet, most project managers do it informally and superficially, if at all
- However, the time spent in risk management results in
 - Less upheaval during the project
 - A greater ability to track and control a project
 - The confidence that comes with planning for problems before they occur
- Risk management can absorb a significant amount of the project planning effort...but the effort is worth it