Risk Management

Lecture # 41, 42, 43,44
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Today's Outline

- **Risk Definition**
- **Risk Management**
- **Risk identification**
- **Risk projection (estimation)**
- **Risk mitigation, monitoring, and management**

What is Risk?

- **Risk is an uncertainty.**
- **We don't know whether a particular event will occur or no but if it does has a negative impact on a project.**
- **An example would be that team is working on a project and the developer walks out of project and other person is recruited in his place and he doesn't work on the same platform and converts it into the platform he is comfortable with. Now the project has to yield the same result in the same time span. Whether they will be able to complete the project on time. That is the risk of schedule .**

Understand Risk

- **Term risk is used universally, but often people attach different meanings to it.**
- **The details about risk and how it supports decision making depend upon the *context in which it is applied*.**

- **Example:**
  - **Safety professionals - view risk management in terms of reducing the number of hazard (accidents & injuries).**
  - **Traffic Police - will define risk possibilities of accidents due to not taking precautions.**
  - **SW Engg says – it is risky to have inexperience development team**

Understand Risk

- **Risk is the possibility that you may NOT achieve your planned targets because something unexpected occurs or something planned does not occur.**
- **All projects have some degree of risk because predicting the future with certainty is impossible.**
- **However, project *risk is greater* . . .**
  - **The longer your project lasts**
  - **The less experience you, your organization, or your team members have with similar projects**
  - **The newer your project's technology is**
- **Risks are events that are usually beyond the planner's control.**

Conceptual Definition of Risk

- **A risk is a potential problem – it might happen and it might not**
- **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**
- **Risk provides an opportunity to develop the project better.**

- **Risk exposure= Size (loss)* probability of (loss)**

- **There is a difference between a Problem and Risk**
  - **Problem is some event which has already occurred but risk is something that is unpredictable.**

- **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

- **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 – (continued)

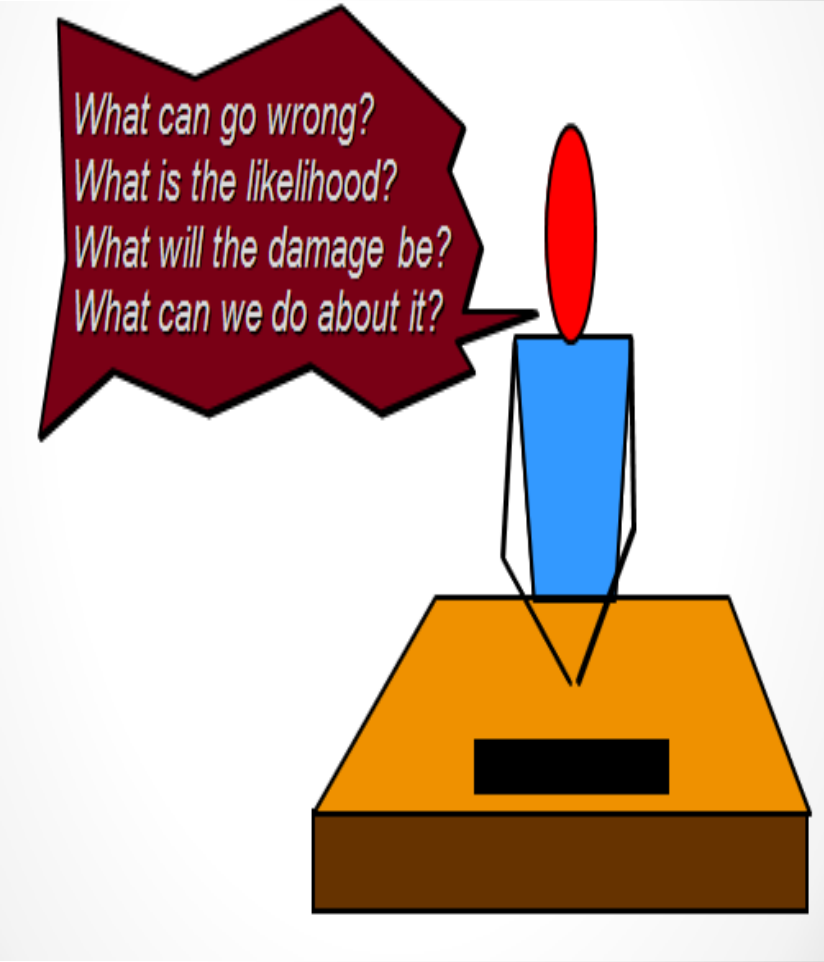
- Sub-categories of Business risks
  - **Market risk** – building an excellent product or system that no one really wants
  - **Strategic risk** – building a product that no longer fits into the overall business strategy for the company
  - **Sales risk** – building a product that the sales force doesn't 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

Sub Categories Of Risk

- **Following risk types can occur in each risk category.**
- **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**

Risk Management

- **The Risks we encounter in a project should be resolved so that we are able to deliver the desired project to the customer.**
- **The project should be managed in such a way that the risks don't affect the project in a big way.**
- **The art of managing of the risks effectively so that the WIN-WIN situation and friendly relationship is established between the team and the customer is called Risk Management.**
- **By using various paradigms, principles we can manage the risks.**



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

Reactive vs. Proactive Risk Management 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**
  - **project team reacts to risks when they occur**
  - **fix on failure—resource are found and applied when the risk strikes**
  - **Crisis management is the choice of management techniques**

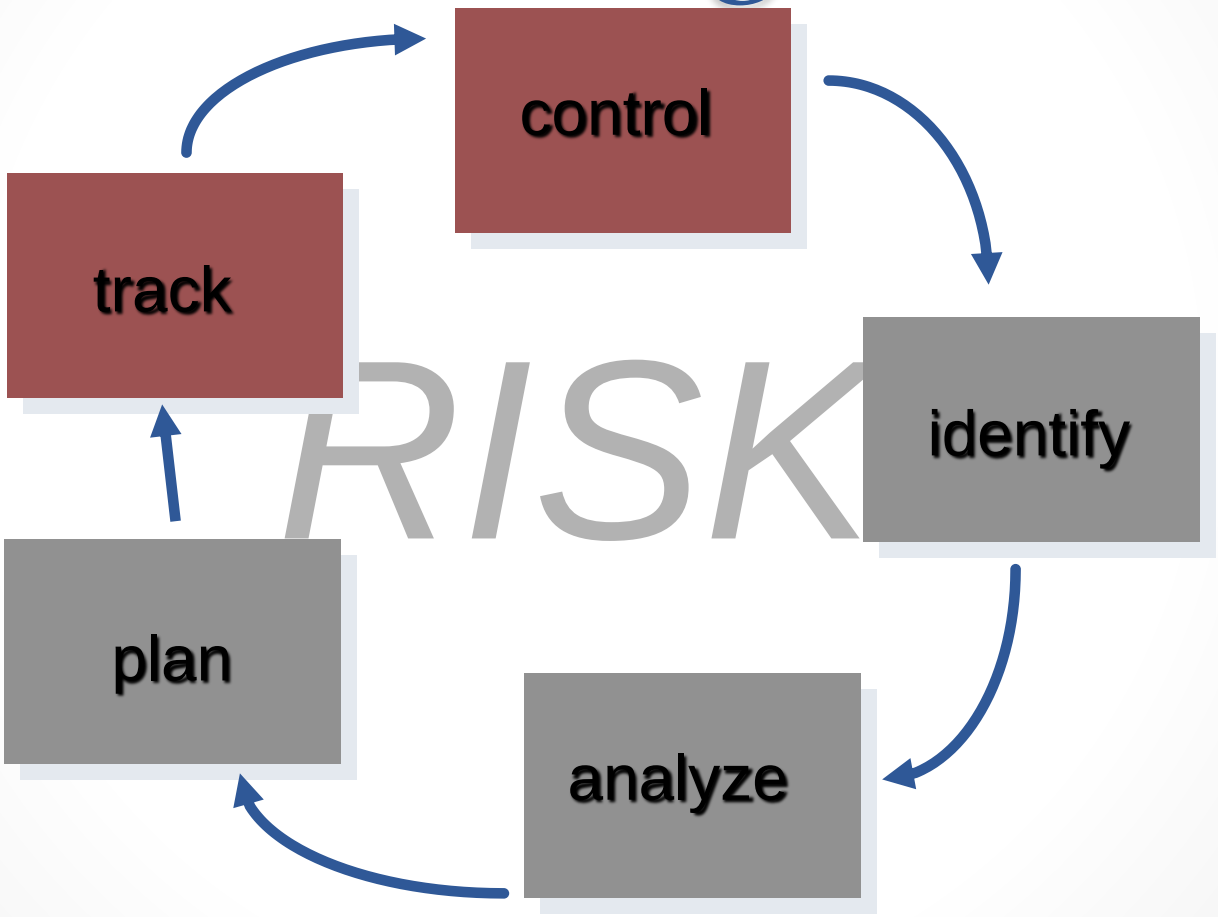
Reactive vs. Proactive Risk Management Strategies

- **Proactive risk strategies**
- **formal risk analysis is performed**
- **organization corrects the root causes of risk**
  - **Steps for risk management are followed**
  - **Primary objective is to avoid risk and to have a contingency plan in place to handle unavoidable risks in a controlled and effective manner**

Steps for Proactive 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 an impact
   - Impact may be negligible, marginal, critical, and catastrophic
4) **Develop** a contingency plan to manage those risks having high probability and high impact

Risk Management Paradigm



Risk Identification

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 a 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**
- **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

Assessing Overall Project Risk

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?

- The degree to which the project is at risk is directly proportional to the number of negative responses to these questions.

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**

Impact Assessment

Components / Category		Performance	Support	Cost	Schedule
Catastrophic	1	Failure to meet the requirement would result in mission failure		Failure results in increased costs and schedule delays with expected values in excess of $500K	
	2	Significant degradation to nonachievement of technical performance	Nonresponsive or unsupportable software	Significant financial shortages, budget overrun likely	Unachievable
Critical	1	Failure to meet the requirement would degrade system performance to a point where mission success is questionable		Failure results in operational delays and/or increased costs with expected value of $100K to $500K	
	2	Some reduction in technical performance	Minor delays in software modifications	Some shortage of financial resources, possible overruns	Possible slippage
Marginal	1	Failure to meet the requirement would result in degradation of secondary mission		Costs, impacts, and/or recoverable schedule slips with expected value of $1K to $100K	
	2	Minimal to small reduction in technical performance	Responsive software support	Sufficient financial resources	Realistic, achievable schedule
Negligible	1	Failure to meet the requirement would create inconvenience or nonoperational impact		Error results in minor cost and/or schedule impact with expected value of less than $1K	
	2	No reduction in technical performance	Easily supportable software	Possible budget underrun	Early achievable

Note: (1) The potential consequence of undetected software errors or faults.
(2) The potential consequence if the desired outcome is not achieved.

Risk Projection (Estimation) Background

- **Risk projection (or estimation) attempts to rate each risk in two ways**
  - **The probability that the risk is real (likelihood)**
  - **The consequence of the problems associated with the risk, should it occur (Severity)**
- **The project planner, managers, and technical staff perform four risk projection steps**
- **The intent of these steps is to consider risks in a manner that leads to prioritization**
- **By 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 Management Plan**

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
- 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

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 x 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 x $25,000 = $20,000

Example: Risk Impact Assessment

- **Risk identification. 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.**
- **Risk probability. 80 percent (likely).**
- **Risk impact. Sixty reusable software components were planned. If only 70 percent can be used, 18 components would have to be developed from scratch (in addition to other custom software that has been scheduled for development). Since the average component is 100 LOC and local data indicate that the software engineering cost for each LOC is $14.00, the overall cost (impact) to develop the components would be 18 * 100 * 14 = $25,200.**
- **Risk exposure. RE = 0.80 * 25,200 _ $20,200.**

Compare RE for all risks to the cost estimate for the project. If RE is greater than 50 percent of the project cost, the viability of the project must be evaluated.

Risk Mitigation, Monitoring, and Management Background

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

If RE for a specific risk is less than the cost of risk mitigation, don't try to mitigate the risk but continue to monitor it.

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

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 project

Risk information sheet

Risk ID: P02-4-32	Date: 5/9/09	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 7/1/09.

Current status:
5/12/09: Mitigation steps initiated.

Originator: D. Gagne	Assigned: B. Laster

That is all