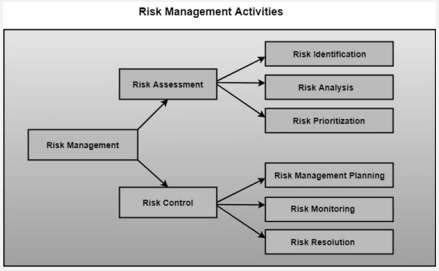
RISK ANALYSIS



Qualitative Risk Analysis

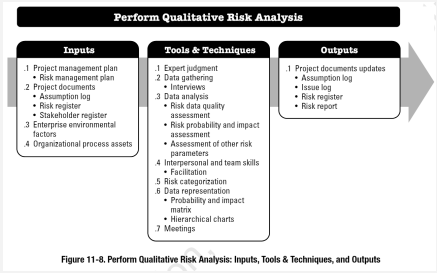


Figure 11-8. Perform Qualitative Risk Analysis: Inputs, Tools & Techniques, and Outputs

RISK ANALYSIS

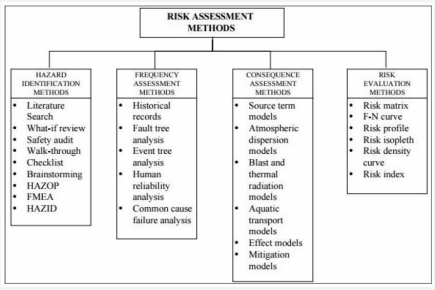
Risk Analysis - Involves examining identified risks; Deciding on risk treatment options; and Evaluating the effectiveness of existing risk control measures.

Quantitative Analysis - Uses numerical data and calculations. Assigns values to consequences & their probabilities to calculate a numeric indication of the level of risk.

Qualitative Analysis - Measures risk based on the significance of its consequences.
Subjective and uses ratings such as high, medium, low.
Should include a clear explanation of the bases for each rating.

Traditional Accident Analysis - Help risk mgrs identify the causes of accidents and choose the best risk control techniques.
Basic causes of most accidents incl. Poor Management, Safety Policy, and Personal or Environment factors.

Risk Assessment Methods



MONTE CARLO SIMULATION

Used to model the probability of different outcomes in a process that cannot easily be predicted due to the intervention of random variables; It is a technique used to understand the impact of risk and uncertainty in prediction & forecasting models.

A computerized statistical model that simulates the effects of various types of uncertainty.

Model focuses on specific variables in a project, such as revenues, interest rates, gross margins, and costs

Results are compiled into probability distributions representing possible outcomes

RISK IDENTIFICATION: Team Approaches:

Facilitated Workshops: Group discussions facilitated by risk mgmt professionals who meet with the firm's leaders, key employees, and other stakeholders.
Facilitator encourages brainstorming and follow up discussions.
A neutral party administers a risk workshop & propels group to achieve its goal.

Delphi Technique: Group of experts make independent projections through anonymous questionnaires that should move towards consensus - group members do not meet face-to-face.
adv (+): cheaper, anonymous responses avoid group bias and encourage honest answers
disadv (-): experts' opinion are limited to their own thinking and may not produce forward thinking.

RISK IDENTIFICATION: Team Approaches: (cont)

Scenario Analysis: Identifies risks & predicts the potential consequences of those specific risks.
adv (+): identifies a range of potential consequences and helps risks mangers prioritize risk
disadv (-): analysis could miss key risks, results are limited by members' imaginations

HAZOP (Hazard & Operability Study): Comprehensive review of a system or process.
Team of experts and stakeholders meets in a facilitated workshop to identify the risks associated with a process and to recommend possible solutions.
Ideal for when all risks need to be eliminated

SWOT Analysis: Assesses the firm's internal strengths & weaknesses and the firm's external opportunities & threats.
Team approach used for analyzing specific new projects/products; Should conclude with a go or no go recommendation.

ACCIDENT ANALYSIS TECHNIQUES

Change Analysis - Projects the effects of a proposed change or combination of changes on the safety and reliability of an existing system.
Appropriate for EXISTING systems, not proposed systems.
ex) Before changing a trucking fleet from gas to diesel engines, project new safety hazards for drivers, mechanics, service suppliers, and general public.

Job Safety Analysis (JSA) - Dissects a repetitive task into steps & identifies potential hazards for each step, focusing on human error.
Appropriate for repetitive human tasks performed in a stable environment or where a person must act safely to avoid accidents, not appropriate for to entirely mechanical tasks.

Sequence of Events (Domino Theory) - Holds that accidents result from human failings.

ACCIDENT ANALYSIS TECHNIQUES (cont)

Domino Accident: Chain of Events
1. Ancestry & Social environment - Person's genetic background &/or environment cause undesirable character traits (recklessness, stubbornness).
2. Fault of Person - Person's undesirable character traits cause him to commit unsafe acts or to create physical or mechanical hazards.
3. Unsafe act or physical/mechanical hazard - The unsafe act (horseplay, ignoring safety requirements) or hazard (open flames near flammable substances, lack of proper lighting) causes an accident.
4. Accident - The accidental event (falling persons, uncontrolled fire) causes injury.
5. Injury - The undesirable final event (fractures, lacerations, burns).

Technique & Operations Review approach (TOR) - An approach to accident causation that views the cause of accidents to be a result of mgmt's shortcomings.
Holds that accidents result from management failures.

TOR approach: (7) categories of Management faults:
1. Inadequate coaching;
2. Failure to take responsibility;
3. Unclear authority;
4. Inadequate supervision;
5. Workplace disorder;
6. Inadequate planning/organization;
7. Personal deficiencies.

Energy Transfer Theory - An approach to accident causation that views accidents as energy that is released and that affects objects, including living things, in amounts or at rates that the objects cannot tolerate.

RISK CONTROL

Risk Control: A conscious act or decision not to act that reduces the frequency and/or severity of losses or makes losses more predictable.

(5) Basic Principles:
- Accidents & unsafe acts/conditions reveal management system failures;
- Certain controllable circumstances produce severe injuries;
- Mgmt should manage safety like any other function, by setting and achieving goals;
- Mgmt procedures for accountability produce effective line safety;
- Safety's function is to locate and define accident causing operational errors by tracing accidents to their root causes & controlling them.

RISK CONTROL GOALS

Pre-Loss Goals: Aims to reduce the amount or extent of damages or injuries incurred in a single event. *Applied before a loss occurs.*
- Economy of Operations
- Tolerable Uncertainty
- Legality
- Social Responsibility

Post-Loss Goals: Focuses on emergency procedures, salvage ops, rehabilitation, public relations, and legal defenses. *Applied after a loss occurs.*
- Survival
- Continuity of Operations
- Profitability
- Earnings Stability
- Social Responsibility
- Growth

Techniques used to support these goals:
- Ensure Business Continuity
- Implement Effective & Efficient risk control measures
- Comply with Legal Requirements
- Promote Life Safety

Root Cause Analysis (RCA)

Root Cause: Basic Characteristics: Specify; Identify; Control; and Recommend.
1. **Specify** - Root cause is expressed as a specific underlying cause, not as a generalization.
ex) operator removed safety guard, NOT operator error.
2. **Identify** - Root cause can be reasonably identified by understanding the reason why it happened.
3. **Control** - Root cause must be expressed as something that can be modified.
ex) Failure to maintain a backup generator, NOT lightning that caused power failure.
4. **Recommend** - Root cause must produce at least 1 effective recommendation for preventing future reoccurrence of the event.

(RCA) Weaknesses (-):
- Only looks backwards (doesn't consider future causal factors)
- Can fail to identify all root causes
- Can only be done or reviewed periodically (not continuous)

Root Cause Analysis (RCA) (cont)

Root Cause Analysis (RCA) - Used in proactive management to identify predominant cause of loss.
Uses a step by step evaluation to identify the underlying cause of an unwanted outcome.
A 'factor' is considered the root cause of a problem if removing it prevents the problem from recurring.
A 'causal factor', conversely, is one that affects an event's outcome, but is not the root cause.
*Typically used after an event has occurred, but it can be used to predict events and to solve problems proactively, rather than only retroactively.

Root Cause Analysis Process - (4) steps:
1. **Collect Data** - Risk Mgr must obtain complete info about the circumstances, the facts, and causes of the event.
2. **Chart Casual Factors** - The agent that directly results in one event causing another event.
3. **Identify root cause/causes** - Once all the casual factors are identified, the risk Mgr uses mapping or flow charting to determine the underlying reasons for each casual factor.
4. **Implement recommendations** - Risk Mgr identifies & implements achievable recommendations for preventing recurrence of the event.
Final product is a root cause summary table that incl. recommendations for each root cause identified for each casual factor.

Root Cause Analysis: (5) Approaches:
1. **Safety-based RCA**: Arose from accident analysis & occupational safety and health.
2. **Production-based RCA**: Arose from quality control procedures for industrial manufacturing.
3. **Process-based RCA**: Similar to production based RCA, but also includes business processes.
4. **Failure-based RCA**: Arose from failure analysis and is used mainly in engineering and maintenace.
5. **Systems-based RCA**: Combines the other 4 approaches w/ concepts from change mgmt, risk mgmt, and systems analysis concepts.

LOSS CAUSE: Physical, Human, and Organizational

Physical Cause - The failure of a tangible or material item, such as a defective part.

Human Cause - Occurs when human error or inaction is the root cause of an accident, such as operator error or improper maintenance.

Organizational Cause - Results from faulty systems, processes, or policies.

CH.3 VOCAB

Energy Transfer Control: approach to accident causation that views accidents as energy that is released and that affects objects, including living things, in amounts or at rates that objects cannot tolerate.

Technique of Operations Review (TOR): approach to accident causation that views cause of accidents to be a result of management's short-comings

Change Analysis: analysis that projects the effects of a given system change is likely to have on an existing system

Job Safety Analysis (JSA): analysis that dissects a repetitive task, whether performed by a person or a machine, to determine the potential hazards if each action is not performed

Monte Carlo Simulation: model that stimulates the effects of various types of uncertainty may have on a process. Another approach to solving complex problems and predicting outcomes.

Delphi Technique: decision-making technique in which group members do not meet face to face but respond in writing to questions posed by the group leader

Scenario Analysis: identifies risks and predicts the potential consequences of those specific risks

Causal Factors: agents that directly result in 1 event causing another

Facilitated Workshops: a risk workshop administered by a neutral party and propels group to achieve its goals

HAZOP (Hazards and Operability Study): team of subject matter experts and stakeholders identifies the risks associated with a given process and recommends a solution (*ideal for when all risks need to be eliminated*)