University Kasdi Merbah Ouargla

3rd year engineering

Module: PROJECT MANAGEMENT

LESSON_03: RISK MANAGEMENT

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Hazard vs. Risk – Understanding the Difference

HAZARD

A hazard is an element or situation that has the potential to cause harm or injury.

Example 1: A shark in the ocean is a hazard.

Example 2: A bottle of bleach sitting in a locked cabinet is a hazard.

Example 3 (IT Context): A software system processing sensitive data is a hazard.

EXPOSURE

RISK

Risk is the probability of that harm actually occurring when someone or something is exposed to the hazard.

choosing to swim with it creates a risk.

but drinking it is a risk.

but a hacker actively targeting an unpatched vulnerability is a risk.

HAZARD
(Intrinsic Source of Threat)

RISK
(Realization of Threat)

Potential to Cause Harm
(e.g., chemical, electricity, unstable ground).
Exists by **nature.**

EXPOSURE + PROBABILITY

Probability (Likelihood) x
Severity of Consequences
(e.g., exposure without protection).
Depends on human actions.

HAZARD vs. RISK: The Fundamental Difference

HAZARD: Intrinsic Source of Threat

RISK: Realization of Threat (Exposure + Probability)

Transition requires
EXPOSURE & PROBABILITY

RISK IDENTIFICATION METHODS

1. INSPECTIONS OR SITE VISITS

Physically observing workplace, activities, and conditions to identify potential hazards.

2. ANALYSIS OF HISTORICAL RECORDS & ACCIDENT REPORTS

Reviewing past logs, reports, and historical data to learn from materialized risks.

3. BRAINSTORMING & PARTICIPATION

Organizing sessions with assessment team and workers to solicit input on potential problems.

4. EXPERT CONSULTATION & INTERVIEWS

Gathering opinions of field experts and experienced individuals to anticipate less obvious risks.

Risk Identification Core

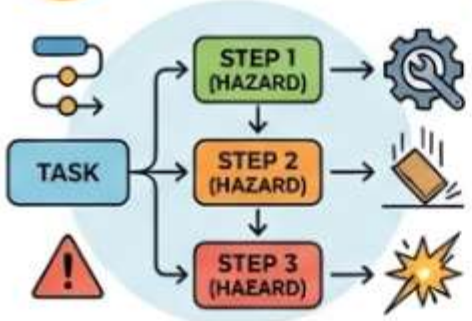
5. REVIEW OF TECHNICAL DOCUMENTATION & SUPPLIERS

Reading manufacturer manuals and analyzing SDS to understand inherent hazards of equipment and materials.

6. USE OF CHECKLISTS

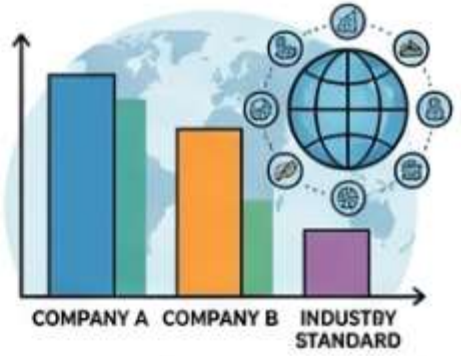
Using lists for a systematic review of common potential hazards to ensure none are overlooked.

7. JOB HAZARD ANALYSIS (JHA)



Breaking down specific tasks into steps to precisely analyze hazards associated with each.

8. INDUSTRY BENCHMARKS

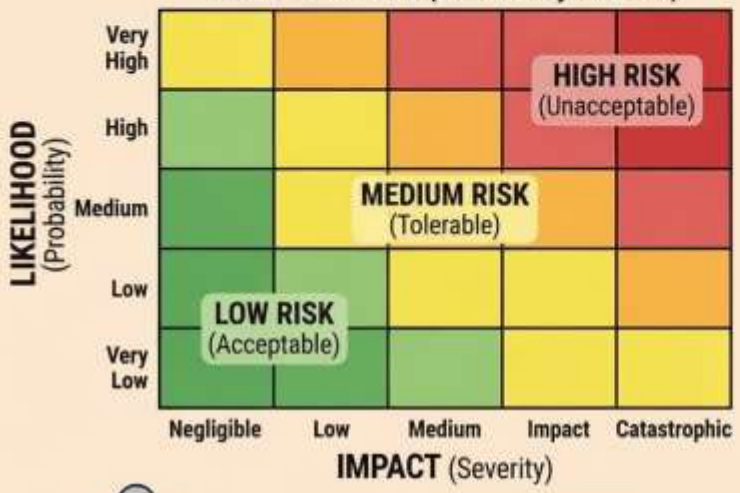


Leveraging industry standards and general data to identify recognized risks on a broader scale.

RISK ASSESSMENT AND MANAGEMENT TOOLS: QUALITATIVE, QUANTITATIVE, & TECHNOLOGICAL APPROACHES

1. QUALITATIVE TOOLS
(Judgment & Experience)

RISK MATRIX (Criticality Matrix)

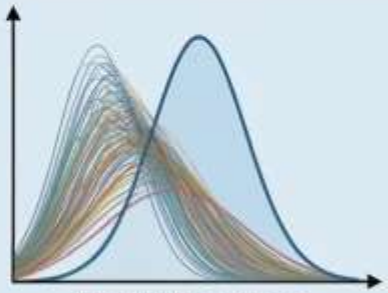


RISK REGISTERS

Risk Category	Description	
Description	Potential Causes	Mitigation Strategy

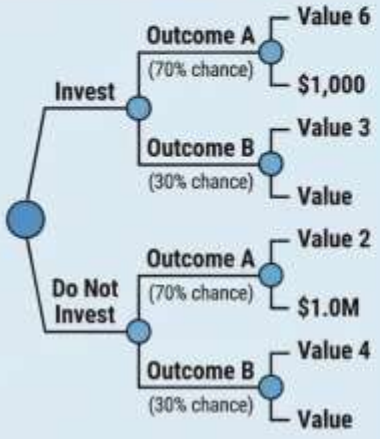
EVALUATION TEMPLATES

2. QUANTITATIVE TOOLS
(Data & Mathematics)



MONTE CARLO SIMULATION

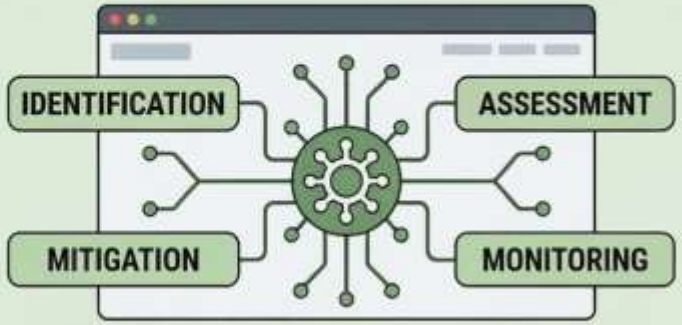
Runs thousands of scenarios; Calculates precise probabilities & confidence levels (e.g., 90% chance of completion by date)



DECISION TREES

STATISTICAL ANALYSIS SOFTWARE

3. TECHNOLOGICAL TOOLS
(Comprehensive Management)



RISK MANAGEMENT INFORMATION SYSTEMS (RMIS)

RISK MAPPING SOFTWARE

REAL-TIME MONITORING TOOLS

Risk Criticality Matrix: A Visual & Mathematical Tool

Assessing Risk Level = Probability x Severity (Impact)

Probability (Likelihood) / Frequency of Occurrence

	1 - Negligible (No Impact)	2 - Minor	3 - Moderate	4 - Major	5 - Catastrophic
5 - Very Likely (Almost Certain / Frequent)	5	10	20	15	20	25
4 - Likely	4	8	12	15	14	16
3 - Possible	3	6	9	12	12	15
2 - Unlikely	2	4	6	7	8	10
1 - Very Unlikely (Rare)	1	2	3	4	4	5

Severity (Impact) / Consequences

Calculation Example

Probability (5 - Very Likely) **x** **Severity** (3 - Moderate) **=** **Risk Score** (15)

Result: High Risk (Red Zone)

High Risk (Red Zone)

Score: 15 to 25.
Action: Critical and Unacceptable. STOP work immediately. Plan control and mitigation measures before resuming.

Moderate Risk (Yellow Zone)

Score: 8 to 14.
Action: Medium level. Work permitted with close monitoring; requires additional precautions.

Low Risk (Green Zone)

Score: 1 to 6
Action: Minimal and Acceptable. Continue activity; review regularly (e.g., annually).

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High Risk (Red Zone)

Score: 15 to 25
Action: Critical and Unacceptable. STOP work immediately. Plan control and mitigation measures before resuming.

RISK MANAGEMENT STRATEGIES

1. AVOIDANCE (or ELIMINATION)

Strategy: Completely eliminate activities exposing the organization to danger.

Example: Deciding not to enter a market deemed too risky.

2. REDUCTION (or MITIGATION)

Strategy: Implement actions to minimize probability or impact of risk.

Example: Improving security measures or using preventative technologies to control risk.

3. TRANSFER

Strategy: Shift consequences (financial) to a third party.

Example: Taking out insurance; paying premiums to reimburse losses.

4. RISK SHARING

Strategy: Distribute risk among multiple entities.

Example: Creating joint ventures, partnerships, or outsourcing to distribute risk.

5. RETENTION (or ACCEPTANCE)

Strategy: Maintain current risk level and accept potential losses.

Example: Cost of mitigation > potential impact. Accept situation, prepare contingency

RISK IDENTIFIED

ORGANIZATIONAL RESILIENCE & PREPAREDNESS

RISK ASSESSMENT REGISTER (PROJECT: OMEGA EXPANSION - PHASE 2)

1. CONTEXT AND TRACEABILITY INFORMATION

Date of Assessment: October 26, 2023	**Project Name:** Omega Expansion - Phase 2	**Location:** Site B, Manufacturing Facility	**Assessment ID:** RA-2023-1026-001

RISK ASSESSMENT OF INFORMATION	
DESCRIPTION OF ACTIVITY	Installation of new automated assembly line components in Zone 4, involving heavy lifting, electrical connections, and system integration. Work steps broken down into preparation, lifting, connection, and testing.
ASSESSMENT TEAM	**Prepared By:** A. Chen (Production Lead), B. Patel (Engineering), C. Davis (Maintenance Supervisor), D. Kim (Safety Officer)

RISK CLASSIFICATION FRAMEWORK (ORIGIN & NATURE)

RISK ORIGIN (SOURCE)

INTERNAL (Endogenous Causes)
- Technical Failures
- Human Error
- Organizational/Managerial Shortcomings

EXTERNAL (Exogenous Causes)
- Stakeholder Pressure
- Market Factors
- Societal & Environmental Issues
- Political & Economic Imbalances

RISK NATURE (IMPACT)

STRATEGIC RISKS
- Linked to Long-term Objectives
- Affects Company Survival
- Stems from Poor Decisions, Evolving Competitors, Tech Changes, Market Trends

2. DETAILED RISK IDENTIFICATION, ASSESSMENT & MITIGATION

RISK ID	ACTIVITY STEP	RISK DECLARATION (Event, Cause, Consequence)	EXPOSED ELEMENTS	INITIAL RISK ASSESSMENT (Raw Score: P x S = R)	MITIGATION PLANS AND REQUIREMENTS (Control Measures)	RESIDUAL RISK ASSESSMENT (Residual Score: P x S = R)
R-001	Heavy Lifting of Robotic Arm	Dropped load due to crane failure (Internal/Technical). **Consequence:** Severe injury/fatality, equipment damage.	Workers, Equipment	P(4) x S(5) = 20 (HIGH - RED ZONE)	**Existing:** Certified crane operator. **Future:** Implement pre-lift inspection checklist, use secondary safety straps, establish exclusion zone. **Permits:** Lifting Plan, Work Permit. **Emergency:** First Aid Kit.	P(2) x S(5) = 10 (MEDIUM - YELLOW ZONE)
R-002	Electrical Connections	Electric shock from exposed wires (Internal/Human Error). **Consequence:** Electrocution, burns.	Electricians, Maintenance Staff	P(3) x S(4) = 12 (MEDIUM - YELLOW ZONE)	**Existing:** Lockout/Tagout procedures. **Future:** Mandatory refresher training, use insulated tools, verify zero energy before work. **Permits:** Electrical Work Permit. **Emergency:** Automated External Defibrillator (AED).	P(1) x S(4) = 4 (LOW - GREEN ZONE)
R-003	System Integration Testing	Data breach from cyberattack during network connection (External/Market Factor - Cyber Threat). **Consequence:** Loss of sensitive data, production downtime.	IT Infrastructure, Company Data	P(4) x S(4) = 16 (HIGH - RED ZONE)	**Existing:** Firewall in place. **Future:** Enhance network segmentation, implement multi-factor authentication, conduct penetration testing. **Permits:** IT Security Clearance. **Emergency:** Cyber Incident Response Plan.	P(2) x S(4) = 8 (MEDIUM - YELLOW ZONE)
R-004	Project Planning Phase	Failure to adapt to new market trends and competitor technology (Strategic/Poor Decision). **Consequence:** Loss of market share, reduced long-term viability.	Company Objectives, Shareholders	P(3) x S(5) = 16 (HIGH - RED ZONE)	**Existing:** Quarterly market analysis. **Future:** Establish dedicated innovation team, invest in R&D, diversify product offerings. **Permits:** Strategic Review Board Approval.	P(2) x S(5) = 10 (MEDIUM - YELLOW ZONE)

LIMITATIONS OF RISK MANAGEMENT

- **Exercise 1: Risk Identification (6 points)**
- Project: Development of an E-learning Platform for a University.

  The platform includes the following features:
  - Student and teacher registration
  - Uploading learning materials
  - Online exams
  - Evaluation system
  - Live lecture streaming

  Project team:
  - Project Manager
  - 4 Developers
  - 1 UX Designer
  - 2 Testers

  Project duration: 7 months

  Questions:
  1. Identify six possible risks in this project.
  2. Classify the risks into the following categories:
     - Technical risks
     - Organizational risks
     - External risks

- **Exercise 2: Risk Analysis**

- Consider the following risks:

  1. Development delay (Probability: 4, Impact: 4)
  2. Cyberattack (Probability: 3, Impact: 5)
  3. Requirement changes (Probability: 5, Impact: 3)
  4. Server failure (Probability: 2, Impact: 5)

  Questions:
  1. Calculate the Risk Score for each risk using the formula:
     Risk Score = Probability × Impact
  2. Rank the risks from the most critical to the least critical.
  3. Draw a Risk Matrix and place the risks in the matrix.

- **Exercise 3: Risk Response Planning**

- Propose an appropriate strategy for each of the following risks:

  Risks:
  - Cyberattack
  - Development delay
  - Requirement changes
  - Server failure

  Possible strategies:
  - Avoid
  - Mitigate
  - Transfer
  - Accept

- Case Study: Smart City Parking System

- A city wants to develop a Smart Parking System to help drivers find available parking spaces.
  The system includes:
  Mobile Application:
  - Search for parking spaces
  - Reserve a parking spot
  - Online payment

  Backend System:
  - Parking database
  - User management
  - Payment processing

  IoT Sensors:
  - Sensors to detect whether a parking space is occupied

  Project team:
  - Project Manager
  - 5 Software Engineers
  - 1 Data Engineer
  - 2 Mobile Developers
  - 2 Testers

  Project duration: 10 months
  Student tasks:
  1. Identify eight potential risks in the project.
  2. Create a Risk Register with the following columns:
     Risk ID | Risk Description | Probability | Impact | Score | Strategy
  3. Draw a Risk Matrix.
  4. Propose mitigation plans for the three most critical risks.