Private International Institute of Management and Technology

The Impact of Risk Management on The Project Unfold

A Thesis presented for the Master of Project management degree

By

Anas Sedrati

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ACKNOLEDGMENT

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SUMMARY

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INTRODUCTION

Risk management in projects has been a serious worry for many firms in recent years. The complexity, volatility, and intense rivalry of today's economic and industrial environment, as well as the difficulties faced in project management, are the source of new challenges and developing problems. Projects frequently result in major and costly failures, as well as degradation or questioning of their main objectives (costs, deadlines, and technical performance) and, in some cases, outright abandonment.

Risk management is an unavoidable aspect of business. People normally try to make their lives as joyful and secure as their circumstances and resources allow. However, no matter how carefully these matters are managed, there is a danger because the outcome, whether good or terrible, is rarely anticipated with 100% confidence. Nearly everything we do involves risk, but this reading will concentrate on economic and financial risk, particularly as it relates to investment management.

Whether consciously or unconsciously, all organizations and investors manage risk in their decisions. Business and investment are fundamentally about allocating resources and capital to certain risks. These businesses may take steps to avoid some risks, pursue the risks that bring the highest rewards, and monitor and reduce their exposure to these risks as needed during their decision-making process in an unpredictable environment.

In an uncertain environment, risk management techniques and technologies make it easier to address tough business and financial concerns. Risk isn't just something that happens to you; it's something that businesses can actively manage through their decisions, as part of a risk management framework. Risk is a necessary component of any company or financial decision.

Investment return is intimately linked to risk in even the oldest models of modern portfolio theory, such as mean–variance portfolio optimization and the capital asset pricing model, but risk must be handled optimally. Risk identification and measurement, as well as maintaining risks aligned with the enterprise's goals, are critical components of business and investment management. A larger possibility of a favored outcome more value for the firm or portfolio, or more utility for the individual results from good risk management.

Risk management is important for portfolio managers to understand not only to improve the portfolio's risk–return outcome, but also because risk management is used in two other ways at the company level. First, they assist in the management of their own businesses, each of which has its own set of risks. Second, a large portion of a portfolio's assets are claims on risky companies. Portfolio managers must assess the risks faced by organizations and how they are being addressed.

Although often viewed as defensive, risk management is a valuable offensive weapon in the manager’s arsenal. In the quest for preferred outcomes, such as higher profit, returns, or share price, management does not usually get to choose the outcomes but does choose the risks it takes in pursuit of those outcomes. The choice of which risks undertaking through the allocation of its scarce resources is the key tool available to management. An organization with a comprehensive risk management culture in place, in which risk is integral to every key strategy and decision, should perform better in the long-term, in good times and bad, because of better decision making.

This reading provides a wide approach to risk management in businesses in general as well as portfolio risk management. The ideas that underpin portfolio risk management are also applicable to financial and non-financial institutions' risk management.

As a result, it is critical, if not mandatory, for project managers to have a better understanding of the potential risks connected with their projects and to integrate risk management into the whole project management process.

This approach is advantageous for project management because it avoids undertaking an inappropriate or poorly designed project, thus ensuring smooth project execution, setting more precise and realistic objectives, and having a broad vision of the fact that it collects the necessary information for effective decision-making and the definition of appropriate responses.

We also discuss project management interest; the approach improves project management, focuses efforts on the most sensitive points of the project, informs all project stakeholders of the risks incurred and assures them of the effectiveness of the control actions taken, and finally, it meets the requirements for increased risk management in project management. Risk management, in general, allows you to track the progression of risk during a project.

As a result, the focus of this study will be on the continuous and iterative process of risk management, which strives to identify and analyze risks, implement proper planning, monitor and control them, and eventually communicate them to all project members.

Part 1: Identifying risk through an assessment of strengths and weaknesses

- **Chapter1:** Risk identification

- **Chapter 2:** The risk analysis

Chapter 1 : Risk identification

Section 1 : Risk identification process

The identification of risks constitutes the first phase of risk analysis and aims to establish as exhaustive a list as possible of all the risks for the entity in question. It is about spotting potential problems before they turn into real problems and including that information in the project management process. This phase makes it possible to formulate the risk statements and identify their contextual information. The risk statement and the contextual information about that risk can be clarified by answering the following three questions:

-What are the conditions or symptoms that make a risk what it is, i.e. a problem awaiting the occurrence of circumstances that will allow it to materialize?

-What is the significance of a risk, in other words, what impact will it have if it occurs?

-Where does the risk come from, in other words what are the causes of the observed conditions or symptoms?

Figure 1 : Risk management Process

Source : https://www.360factors.com/blog/five-steps-of-risk-management-process/

The continuous process of identifying a risk first requires open communication to encourage all project stakeholders to communicate the potential problems they see, from a vision oriented towards the future of the project. Product or service that is the subject of the project. Individual contribution is also required in this phase, as well as exchanges fostered by teamwork allow a better understanding of the project and a more precise and exhaustive identification of the risks to which it is exposed.

Risk identification is carried out on the one hand by establishing a benchmark and on the other hand by continuously identifying risks.

Section 2: Establishment of a benchmark

Brainstorming as a method of identifying risks in a project. It is one of the oldest and most widely used techniques. The method involves a small group of interested parties, such as the project team, stakeholders, and independent experts who, in a short period of time, generate ideas.

The establishment of a benchmark makes it possible to establish a shared vision of the risks to which the project is exposed, it greatly facilitates the continuous identification of risks by each of the stakeholders throughout the project. It can be established at the beginning of the project. periodically during the project (annually, semi-annually, etc.), during formal reviews of the status of the project, following an important event in the project, or following the assignment of a new project manager.

It is also desirable that the establishment of a repository be carried out by stakeholders independent of the project, to ensure a free identification of any constraint.

Once the benchmark is established, the resulting risks will be managed when their priority justifies it, and new risks will probably be identified. The risks in question will probably be considered by several stakeholders. However, as work progresses, these Stakeholders run the risk of losing sight of obstacles the project may face. The establishment of a repository therefore makes it possible to take stock of the potential problems to which the project is exposed and to inform all stakeholders to share a common vision.

Section 3: Gathering information from different sources to identify risks

High quality information is important to identify risks. Historical information about an institution can serve as a starting point for risk identification, followed by discussions with a diverse range of stakeholders about current issues and evolving data analysis, reviewing performance indicators, economic information, loss data, scenario planning and other risk indicators can provide valuable risk insights. Also, the processes used during strategic planning such as SWOT analysis of strength, weakness, opportunity and threat, technological, economic, social, political, and legal environment.

PEST (EL) Analysis and benchmarking will have revealed significant risks and opportunities which should not be ignored, they should be included in the risk register.

Certain disciplines such as IT, strategic management, health and safety, etc. they have already established risk identification methodologies in accordance with their professional norms and standards. The risk identification process must recognize and use the results of these techniques so as not to "reinvent the wheel".

Section 4: Continuous risk identification

Continuous risk identification involves identifying issues that may hinder project completion as they are spotted by individuals or groups in the course of their day-to-day work. This identification should be incorporated into project management activities. Thus, in the progress reports, a section should be specifically dedicated to the risks to which the project is exposed.

Furthermore, using forms that allow project team members to communicate identified risks to stakeholders will quickly institutionalize an identification process. If these types of mechanisms are implemented on a regular basis, it will be possible to report anomalies detected in a system and, as a result, request desirable changes. A good place to start is the Checklist for Identifying Risks in System Development and Maintenance.

Section 5: SWOT Analysis

SWOT is an acronym for strength, weaknesses, opportunities and threats and SWOT analysis (also known as SWOT matrix) focuses on evaluating these four elements of an organization or project.

This method of identifying risk also expands the range of identified risks by including internally generated risks.

Analysis of the internal section of a project includes looking at the strengths and weaknesses and analysis of the external section includes the opportunities and threats. First, the strengths and weaknesses of a project are identified and then the opportunities and threats from those results. The method also analyses to which degree the strengths counteract the threats and identify the opportunities which may surmount the weaknesses.

In some cases, brainstorming may be used to identify possible strengths, weaknesses, opportunities, and threats. In risk identification, the weaknesses and threats are more important aspects, as they are the possible risk sources of the project which may need to be managed. SWOT analysis is not acceptable for identifying future risks, but only existing or obvious risks. There is also a challenge in categorizing accurately as strengths can become weaknesses, opportunities can turn into threats and not all combinations may be considered. Furthermore, SWOT analysis is mainly a qualitative analysis and without quantitative analysis.

Section 6: The outputs of risk identification

The "risk register" is the main output of a risk identification exercise and is the document in which the risks are recorded.

A risk register is a comprehensive record of all risks across the Institution or project depending on the purpose/context of the register. There is no single blueprint for the format of a risk register and Institutions have a great degree of flexibility regarding how they lay out their documents.

The risk register serves three main purposes

1. It is a source of information to report the key risks throughout the Institution, as well as to key stakeholders.

2. Management uses the risk register to focus their priorities risks.

3. It is to help the auditors to focus their plans on the Institution's top risks.

Here are below the risks register records:

- The risk
- Risk category
- How and why the risk can happen "cause of risk"
- How will the risk impact the institution if it materializes "impact on institution"
- The qualitative and / or quantitative cost should the risk materialize
- The likelihood and consequences of the risk to the institution
- The existing internal controls that may minimize the likelihood of the risk occurring
- A risk level rating based on pre-established criteria
- Framework, including an assessment of whether the risk is acceptable or whether it needs to be treated
- A clear prioritization of risks (risk profile)
- Accountability for risk treatment (may be part of the risk treatment plan)
- Timeframe for risk management.

Once the risks have been identified, the existing controls evaluated, and it has been determined that the controls are insufficient, an assessment of whether the risk is acceptable or whether it needs to be treated must be performed.

Chapter 2: The risk analysis

The goal of the analysis phase is to convert the information and risk data gathered during the identification phase. Once this analysis is completed, it will be possible to identify a mitigation and contingency strategy for each risk and define the appropriate measures based on the results obtained.

In risk analysis, there are two types of analytical methods: qualitative and quantitative.

Section 1: Qualitative Risk Analysis

Qualitative risk analysis is the process of prioritizing risks for subsequent action by analyzing their likelihood of affecting project development.

Risk probability and impact assessment:

At this stage, every potential risk is researched and analyzed in terms of its potential impact on the project's objectives, including both positive opportunities and negative threats (e.g. cost, schedule, quality, performance). Each risk is assigned a level based on the results of an interview, an investigation, or a meeting with all parties involved.

I. Impact risk rating matrix:

The proven risk probability results can be expressed as very high, high, neutral, low, and very low in qualitative terms.

The risk rating is created using a matrix that represents risk scales for each of the risks. The matrix displays the risk probability scale, which ranges from 0% to 100%, as well as the risk impact scale, which represents the severity of the risk's impact on the project's goal. This matrix aids in data quality improvement and makes the procedure simple to repeat throughout the project.

II. Risk categorization:

Risks are categorized by common causes in this step to discover the project's most vulnerable areas and to aid in the development of an effective risk response plan.

III. Risk urgency assessment:

To obtain a final sensitivity rating, the risk of urgency can be combined with risk ranking, a strategy for determining how meaningful risk data is for risk management.

IV. Expert judgment:

Obtaining expert advice, such as from people with recent experience on similar project issues, through interviews or risk facilitation workshops, can be beneficial in a variety of situations.

Section 2: Quantitative Risk Analysis Process

Quantitative Risk seeks to statistically examine the likelihood of each risk and its impact on project goals, as well as the overall risk level of the project. This procedure employs a variety of techniques and procedures, including data collection and representational techniques, to calculate the probability of meeting project objectives, measure risk exposure, and generate a size and cost assessment timetable.

I. Stakeholder interviews :

Interviews could be used to acquire information and create optimistic (low rating) and pessimistic (high rating) risk scenarios.

II. Sensitivity analysis:

Assists in determining which risks are the most serious for the project. In general, this study investigates how the uncertainty of each project aspect affects the examination of the goal, while other uncertain elements are kept at their baseline values and illustrated using a tornado diagram.

III. EMV (expected monetary values analysis):

It is a statistical method for calculating the average outcome when the future contains potential outcomes that may or may not occur (such as positive values-opportunities, or negative values-risks). A Decision Tree Analysis, which is a diagram that depicts a decision under consideration and

the consequences of selecting from the various alternatives, is commonly used to demonstrate these. This diagram shows the risk probabilities as well as the cost or reward of each logical path.

IV. Modeling and simulation:

It is a tool that employs a model to convert uncertainties into their potential impact on project objectives at the overall project level. To assist with this, the Monte Carlo technique could be used.

V. Cost risk analysis:

Traditional project work breakdown structures (WBS) can be used for cost estimation analysis; otherwise, cost estimates can be used as input values, chosen at random for each iteration based on the values probability distribution, to determine the overall cost.

VI. Schedule risk analysis:

The Precedence Diagramming Method can be used to conduct analysis (PDM). It is a method of creating a project network diagram that depicts the activities and their connections with arrows to emphasize interdependence. This activity-on-node diagram can be used to determine whether the project's goal will be met on time and on budget.

VII. Expert judgment:

Getting expert guidance on identifying potential cost and schedule consequences, evaluating options, interpreting data, and identifying weaknesses and strengths can be quite beneficial.

Risks are an unavoidable part of any enterprise. One of the most difficult tasks a project manager faces is avoiding becoming overwhelmed by the quantity or scale of potential hazards. Instead, a smart project manager should be able to concentrate on the critical factors that could jeopardize the project's smooth operation and design a risk response plan as a result.

The risk analysis process in project management is one of the most significant operations in project management, with the goal of reducing the project's liabilities and ensuring its successful completion.

Section 3: Risk assessment

I. Probability (or frequency) of a risk:

The likelihood of survival is the first attribute that characterizes a risk. When it comes to operational risk, which is a risk that is likely to reoccur from project to project, we can also discuss frequency. Rather than assigning a probability to the possibility of impacted parties not being notified of events that affect them during the project's execution, the occurrence can be described as chronic, infrequent, or unusual.

Qualitative	Statement of uncertainty	Ordinals	Quantitative
Very high	Almost Certainly, Very probable	5	>80%
High	Likely, Shortly, Without a doubt	4	61-80%
Average	Random More than possible	3	41-60%
Weak	Unlikely. Doubtful. Probably not	2	21-40%
Very weak	Very unlikely, Implausible	1	0-20%

Table 1 : Frequency's impactRisk

Source : :https://www.qgcio.qld.gov.au/information-on/ict-risk-management/ict-risk-matrix

This step assesses the likely impact of each risk event on the project. This evaluation frequently considers how the event may affect budget, scheduling, and technical performance goals. However, they are not the only factors that have an impact, political and economic consequences must also be considered.

Each risky event's likelihood (chance) is also evaluated. When circumstances prevent a straightforward assessment of likelihood using objective methods, subjective probability evaluation approaches are typically used.

II. Impact of a risk:

For some programs or projects, the impacts of the risk on the goals and objectives of the company or organization are more significant for the managing organization. Risks are assessed against the potential negative impact on business objectives. The use of risk management tools for the company and its components can contribute to the consistency of risk determination. Depending on the importance of a component to the success of the business (for example, the risk of using business communications to support a military operation and the business's impact on mission success, compared to the risk of using business communications to transporting military equipment in peacetime), the risks may be perceived differently at the business level, even when the solution sets are the same or similar.

One way that management plans for engineering an enterprise is to create capability portfolios of technology programs and initiatives that, when timed, will deliver time-phased capabilities that further enterprise goals and business outcomes. mission. A capabilities portfolio is a dynamic construction of the organization over time to deliver capabilities at specific times. A capability can be defined as the ability to achieve an effect on a norm under specified conditions using multiple combinations of means and ways of performing a set of tasks. With the introduction of capacity management, defining the impact of risk on functional or capacity goals can provide valuable insights into capacity at risk and which risks are likely to have a significant impact on capacity. Achieve one capability and/or affect multiple areas of capability.

The impact of a risk is the loss incurred if the risk occurs. It can be assessed for several dimensions: budget impact, impact on schedule, impact on performance, etc.

	Consequence				
Likelihood	Insignificant	Minor	Moderate	Major	Critical
Rare	LOW Accept the risk Routine management	LOW Accept the risk Routine management	LOW Accept the risk Routine management	MEDIUM Specific responsibility and treatment	HIGH Quarterly senior management review
Unlikely	LOW Accept the risk Routine management	LOW Accept the risk Routine management	MEDIUM Specific responsibility and treatment	MEDIUM Specific responsibility and treatment	HIGH Quarterly senior management review
Possible	LOW Accept the risk Routine management	MEDIUM Specific responsibility and treatment	MEDIUM Specific responsibility and treatment	HIGH Quartely senior management review	HIGH Quarterly senior management review
Likely	MEDIUM Specific responsibility and treatment	MEDIUM Specific responsibility and treatment	HIGH Quarterly senior management review	HIGH Quarterly senior management review	EXTREME Monthly senior management review
Almost certain	MEDIUM Specific responsibility and treatment	MEDIUM Specific responsibility and treatment	HIGH Quarterly senior management review	EXTREME Monthly senior management review	EXTREME Monthly senior management review

Table 2: Risk Matrix

Source : https://www.qgcio.qld.gov.au/information-on/ict-risk-management/ict-risk-matrix

As in the case of probability, a numerical value can be associated with an impact statement to facilitate the calculation of the degree of exposure to risk. If a scale of 1 (Very low) to 5 (Critical) is used to represent the impact in the previous table, a risk can be assessed as Critical in terms of cost,

Moderate in terms of timing and Moderate in terms of technical performance. If the relative importance of cost, schedule and technical performance is respectively equal to 0.5, 0.3 and 0.2 for a given project, the overall impact is obtained by the following relationship:

Overall risk impact = 0.5x5 + 0.3x3 + 0.2x3 = 4.0 (High)

Section 4: Risk Velocity

The time it takes for a risk to have an impact is called risk velocity. Consider velocity to be a prediction of the time range in which a risk might materialize.

We have more time to respond to threats when the velocity is low. We may take efforts to decrease the likelihood and impact of a threat. The risk owner has enough time to devise a contingency and backup strategy.

Threats strike swiftly if the velocity is high. As a result, these risks are more likely to become concerns, resulting in additional effort and money spent. The following are some of the causes of high-velocity risks:

• Your sponsor informs you that two key team members must be transferred to another project within two weeks

• The servers you ordered for your test region will be two to three weeks late

• Wildfires are threatening the area where your offices are located

Assume that two dangers each have a risk score of 20 out of a possible 25. Risk A, on the other hand, is more likely to happen in two to three weeks, but Risk B will take at least six months. Which threat requires your immediate attention? Look at the difference.

I. How to rate risk velocity

Rating probability and impact is a traditional method of conducting qualitative risk assessments. On a scale of 1 to 5, we might assign a 4 to the probability of a risk and a 5 to the impact. The risk score of 20 is calculated by multiplying these ratings.

Individuals can also incorporate risk velocity in their evaluations as an option.

Velocity Scale		
Rating	Description	Definition
5	Very High	Very rapid, little or no warning, instantaneous
4	High	Risk may occur in a matter of days to a few weeks
3	Medium	Risk may occur in a matter of a few months
2	Low	Risk may occur in a matter of several months
1	Very Low	Very slow, occurs over a year or more

Figure 2: Rating risk velocity

Source: https://projectriskcoach.com/how-to-evaluate-risk-velocity/

(Probability + Velocity) x Impact = Risk Score

Let's assume the velocity is rating as 4. For the previous example, the risk score would be:

(4 + 4) x 5 = 40

Consider the following risks:

Risk	Probability	Impact	Velocity	Risk Score
A	**4**	**5**	**4**	**40**
B	**2**	**2**	**3**	**10**
C	**5**	**4**	**4**	**36**
D	**4**	**5**	**1**	**25**

Table 3 : Velocity and its impact on evaluation risk

Notice how the velocity ratings play a significant role in risk assessment. Despite the fact that Risks A and D have the same chance and impact ratings, Risk A is more concerning since it is more likely to occur sooner.

For risk managers and project managers, risk management should be made as simple as possible. Increasing the velocity of an Enterprise Risk Management Program or larger, more complex projects may be beneficial. Think about the cost/benefit of incorporating risk velocity into your risk assessment.

II. Classification and consolidation of risks:

Classification and consolidation activities aim to assess a set of risks and determine how they relate to each other. The resulting classes or groups provide a different perspective when planning mitigation and contingency measures. Among other things, they facilitate the identification of recurring risks and they allow economies of scale to be achieved during planning by deriving mitigation and contingency measures that may be appropriate for the management of several risks simultaneously. Consolidation activity, in particular, allows minor risk statements to be combined in order to arrive at a new risk statement and make it easier to manage.

The risk classification can be carried out according to various axes: their source, the product, the component or the service affected, the phase at which they are likely to occur, the groups responsible for managing them, etc.

III. The scheduling of risks:

A schedule risk analysis is a planning method aimed at improving a project's predictability and performance. It assists project managers in determining the anticipated impact of uncertainty and individual risks on completion time.

When used correctly, schedule risk analysis is a powerful tool in any project manager's toolbox, providing useful and actionable data to help them make better decisions.

Here is below 5 Advantages of Schedule Risk Analysis:

a) Lower the cost of resources

"Time is money," as the phrase goes in integrated schedule risk analysis. In basic terms, if the work for which non-labor resources are being employed takes longer than expected, the cost of those resources will likely rise.

b) Reduce Labor Costs

Labor costs rise when an activity that was supposed to take 30 days takes 50 instead. If the project lasts longer, indirect costs such as project team management will rise as well.

Again, project managers can improve communication with their labor force and cut expenses by accurately estimating the project finish date.

c) Identify High-Risk Areas

The goal of schedule risk analysis used to be to identify the most significant risks of project overrun. It's now commonly utilized to prioritize risk-mitigation measures.

Project managers may target important resources where they're required most with quantitative risk analysis, making risk reduction a viable and realistic tool for effective management.

d) Accurately Determine Project End-Date

Given the inherent uncertainty of time estimates, stakeholders are frequently more comfortable with a range of durations for project activities rather than a specific calculation. Range estimation and risk assessment are difficult tasks that necessitate analytical abilities and a basic understanding of statistics.

Project managers, on the other hand, can better predict the effects of unexpected occurrences on the project outcome and more precisely determine the project end-date if they have a basic understanding of probability and distribution functions.

e) Produce Actionable Information

Schedule risk analysis is only useful if it generates data that can be used to reduce or eliminate the risks it identifies.

While techniques like Monte Carlo simulation are commonly associated with schedule risk analysis, it must also consider the impact of individual hazards rather than just a measure of the uncertainty of timetable lengths if it is to be truly useful.

A basic Monte Carlo analysis generates a list of cost items or schedule tasks, but it does not provide actionable data to help make crucial decisions.

When utilized effectively, schedule risk analysis provides significantly more actionable information and analyses the likely impact of specific risks on time-to-completion, resulting in practical results in a range of real-world circumstances.

The risk ordering is carried out first by calculating the degree of risk exposure (RE) by the relationship:

ER = (Probability associated with the risk) x (Impact of the risk)

Magnitude of impact	Impact definition	Score	Rating
High impact/ High probability	**Very high** They are the biggest risks that entrepreneurs should pay attention.	5	A
High impact / Medium probability Medium impact / High probability	**High** These risks have either a high probability of occurrence, or a significant impact	4	B
Medium impact / Medium probability	**Medium** There is a medium chance that the risks appear noticeable impact.	3	C
Medium impact / Low probability Low impact / Medium probability	**Low** These risks can occur in some situations and have a low to medium impact.	2	D
Low impact / Low probability	**Insignificant** There are risks with low probability of occurrence and low impact. Can therefore be neglected.	1	E

Table 4 : A scale of risk exposure

Source: https://www.semanticscholar.org/paper/Using-Probability-%E2%80%93-Impact-Matrix-inAnalysis-and-Dumbrav%C4%83Iacob/dfb3166dc7e812fbcf3135b46377bea551dac08f/

The degree of risk exposure is a first parameter for prioritizing risks in order todetermine which ones will be addressed first.

When two risks have the same degree of risk exposure, gravity can be used to achieve finer scheduling. Severity is determined by the relationship:

Severity = ER / Delay

Using a scale of 1 to 3 to represent a delay varying from short term to long term, the numerical value associated with severity will be greater the shorter the delay.

If two risks have the same degree of risk exposure and the same severity, additional parameters may be necessary in order to specify their ordering.

Part 2:Planning, implementation, and progress monitoring for risk mitigation

- **Chapter 1:** Risk planning and action
- **Chapter 2**: Follow-up phase

Chapter 1 : Risk planning and action

Section 1: Mitigation and contingency measures

The planning phase's goal is to plan mitigation and, if necessary, contingency measures to reduce the risks identified during the identification phase. Finally, mitigation and contingency measures will aim to reduce the likelihood (or frequency) and impact of each risk, which are two of the attributes determined during the analysis phase.

It is important to plan effectively and intelligently. The planning of mitigation and contingency measures should include as much detail as is necessary in order to be able to derive benefits.

Effective risk planning is a continuous process of developing mitigation and contingency measures as new risks emerge during the project.

This planning necessitates an integrated management process that is aligned with the project's objectives. A shared vision of the product or service that is the subject of the project, combined with a global perspective that considers the needs of the clientele as well as the objectives of the organization of which the project is a part, allows for the design of mitigation measures and contingencies that consider the interests of the clientele, the project itself, and the organization.

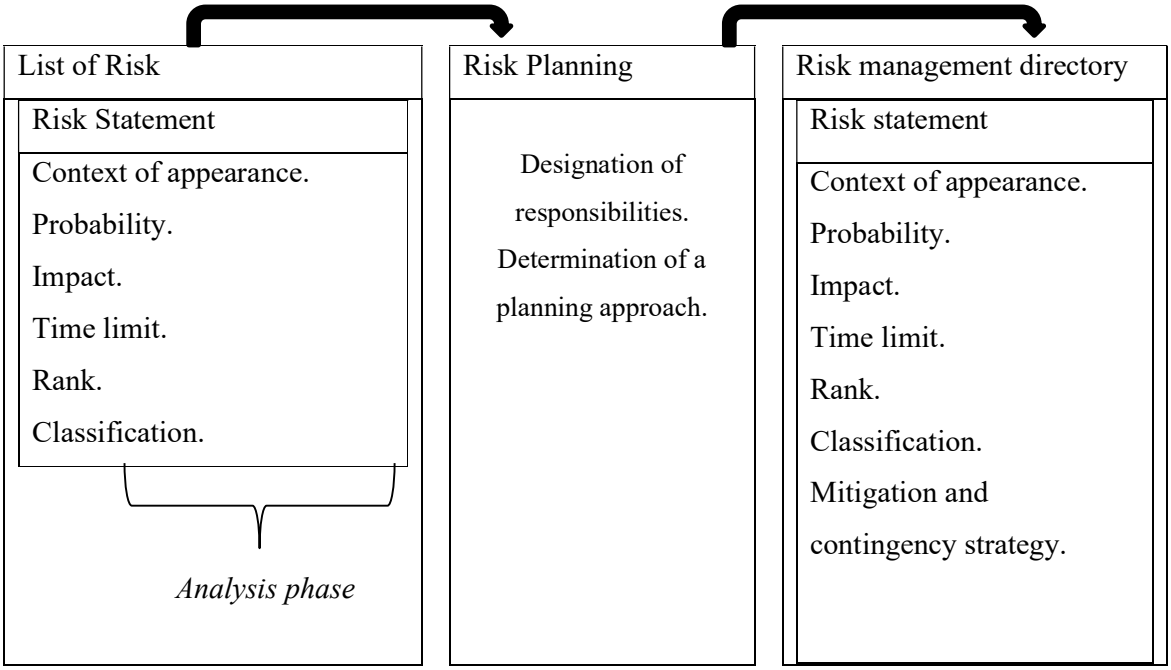

Table 5 : planning phase

The risk sheets generated during the analysis phase, ordered and classified according to the criteria defined during the analysis, are inputs to the planning phase, as are information about the resources assigned to the project, its constraints and objectives, and the risk repertoire. The latter is a useful source of information that can be used during planning, particularly if similar risks have already been the subject of mitigation and contingency measures in ongoing or completed projects.

Mitigation and contingency measures are defined and circumscribed within the framework of a coherent approach, their scope is identified, and responsibilities are assigned based on these inputs. This includes both responsibilities for the definition of the measures in question as well as those for their implementation. The planning phase yields mitigation and contingency measures that can be incorporated into the corresponding risk sheets or, if their scope warrants it, the subject of separate plans. The risk directory has been updated as well.

Section 2 : Risk Management strategy

The risk management strategy reflects the organization's vision for risk management, including policies, processes, and standards for identifying, assessing, responding to, monitoring, and governing risk—potentially in all forms, but at least within a specific category of risk. The strategy outlines the organization's strategic planning assumptions, limits, decision-making criteria, and other elements that influence risk management, such as context-specific and overall risk tolerance articulations. The risk management plan identifies senior executives and other stakeholders with significant decision-making authority, and it should clearly outline the information flows and decision-making procedures associated with risk management.

Section 3 : Strategies for mitigation and contingency measures

I. ACCEPTANCE:

This strategy corresponds to a concerted action to "live with" the consequences of a risk if it occurs. It can be considered when it is possible to bear the resulting losses. An acceptance strategy's mitigation and contingency measures consist of doing nothing to reduce the risk in question.

II. AVOIDANCE:

The goal of this strategy is to eliminate risk. This could include, for example, deciding not to develop a specific feature for a given application. It is usually taken into account when there is a good chance that the situation will lose if the risk occurs. Mitigation and contingency measures, which correspond to an avoidance strategy, entail taking steps to avoid the situation that generates the risk.

III. PROTECTION:

The development of redundancy or fault tolerance is at the heart of the protection strategy. It can be considered when reducing the impact of a risk is critical and the associated mitigation and contingency measures are financially feasible. The mitigation approach resulting from a protection strategy is to design measures that will result in redundancy and tolerance for expected failures.

IV. REDUCTION:

This strategy is most associated with the concept of risk management. It consists of taking measures to reduce the likelihood of the risks occurring, their frequency (if they are recurring

risks), as well as their impact if they do occur. This strategy is adopted when the cost-benefit analysis warrants it. The reduction strategy differs from the protection strategy by the nature of the mitigation and contingency measures.

V. RESERVE:

This strategy consists of planning supplements in terms of time, budget, IT resources, human resources, etc. It can be considered in the event that there are uncertainties as to the actual consumption of such resources. The corresponding mitigation and contingency measures consist of evaluating the size and nature of the reserves to be planned and the period during which they must be available.

A. TRANSFER (OR DELEGATION):

This strategy consists of transferring the risk to a stakeholder who is better able to assume it. It is used when such a stakeholder is available and in the event that an acceptance strategy would prove more costly than if the risk were assumed by the stakeholder in question. The mitigation and contingency measures corresponding to a transfer strategy consist in planning the activities related to the choice of the stakeholder and the negotiation of the clauses governing the mitigation and contingency measures taken by the latter.

B. RESEARCH:

The search strategy is to seek additional information. It is adopted when knowledge of the risk in question is not sufficient to choose one or the other of the preceding strategies. The mitigation and contingency measures corresponding to a research strategy take the form of actions aimed at collecting the information that will make it possible to adopt one of the other six strategies

Chapter 2 :Follow-up phase

Section 1 : Assessment based on information collection

This phase aims to collect all of the information needed to update the risk sheets and present the results to the people who will be using this information; the goal is to make decisions about each risk.

It should include the following activities:

- ✓ Collection of information
- ✓ Complication of information
- ✓ Communication of results

The phase is an ongoing, periodic process communicated at regular intervals to stakeholders. And open communication ensures a real presentation of risks without hiding the consequences of a situation. The phase uses an integrated management process, so it seeks to ensure harmony between the approach and the supervision of the project. This allows stakeholders to interpret information and identify trends and identify new risks through a Perspective comprehensive and forward-looking vision.

Section 2: Detail on the phase

Monitoring phase entries and exits:

Entries made up of risk sheets resulting from the planning phase which includes the risk management plan, information on the resources assigned to the project, data collected during its implementation, as well as information relating to the project. evolution of risks. These entries are reviewed, then the relevant information is compiled, and reports summarizing the risk statements are prepared. The phase then results in risk sheets, which is an update of the risk management plan, and which includes a progress report on the state of risks.

The phase involves the use of metrics thus allowing risk assessment; there are two types of metrics

I. Indicators:

They are data representations that provide insight into the risk management process's activities and outcomes. For example, the degree of exposure to the risk and the severity of the risk allow

you to assess the effectiveness of risk mitigation and contingency planning throughout the project. Effective indicators are simple to calculate, make data collection easier, and are relevant to the topic they represent

II. Triggers:

They are used in conjunction with indicators to determine where action is required. As in the case of putting in place a contingency plan. A good trigger is one that gives you a heads-up when something is about to happen.

Section 3: The activities that are carried out as part of the collection of information

- Examine project data that is likely to have an impact on the risks being tracked.

- Data on the status of mitigation efforts or data on contingency plans are examined.

- Before adopting mitigation or contingency actions, update each risk's qualities, probability, impact, and time available.

- Gathering any additional information that may shed new light on the risks, their features, or the effectiveness of mitigation or contingency actions that have been adopted thus far, as well as the relevance of those that are planned.

- The indicators are being updated, particularly the degree of risk exposure and the severity of each danger.

Analyzing the acquired information and assessing the state of each risk, the status of mitigation or contingency measures, and the total risk are all part of the compilation processes. The compilation's findings were disseminated to interested parties. The risk assessment sheets are being used.

Section 4:Advice

The monitoring phase is concerned with tracking the progression of risks as well as the mitigation and contingency plans in place to lessen their impact, frequency, and possibility. These two tracks are mutually exclusive.

The monitoring phase is guided by the following principles:

- At each project monitoring meeting, follow up on risks in order. Risk monitoring will be assigned in this manner, and risk sheets (related to the monitoring of mitigation and contingency measures) will be updated on a regular basis.
- Incorporate risk management into the quality assurance process. Follow-up activities will be taken out as a result of this.
- All project participants must have access to the risk sheets' information in a clear and concise format.
- Select metrics, values, or events that serve as triggers, allowing stakeholders to react and take relevant actions at the appropriate moment.
- At the very least, risk evolution should be monitored, even if the risk mitigation strategies in the risk sheets have not yet been implemented or developed.
- It should be remembered that after compiling the data, it may be required to review the mitigation and contingency actions. Updating a risk's properties may also necessitate re-triggering the analysis step.

Part 3 : Communication's role in implementing risk-control measures

- **Chapter 1:** Risk control
- **Chapter 2:** Risk communication
- **Chapter 3:** Case study: Risk assessment and prevention in chemical laboratories

Chapter 1 : Risk control

Section 1: Risk control process

As the project unfolds, the portfolio of potential risks should be readjusted based on the new information gathered. Since certain risks may disappear, others appear or still others, initially considered as low, which may quickly become unacceptable for the company if they have not been able to be controlled; the level of exposure to the risks of the project is brought to change. This is why it is important to periodically monitor and control the risks incurred.

The purpose of this step is to monitor the application of control actions, to assess the effectiveness of the actions taken, and to monitor the triggering of feared events and their consequences.

The following measures are commonly used to control risk:

- Elimination/Substitution
    - Use a different method or material if possible
- Engineering Controls
    - Guards and shields for moving parts and electrical connections
    - Placing the material or process in an enclosed system
    - Isolating the hazards
    - Chemical fume hoods
    - Biosafety cabinets
- Administrative control:
    - Working alone policies
    - Standard Operating Procedures
    - Additional training
    - Warning signs
    - Hygiene practices (proper glove removal, washing hands, etc.)

- Housekeeping

- Personal Protective Equipment
  - Eye/face protection (safety glasses, goggles, face shield)
  - Protective clothing (gloves, lab coat)
  - Respirator
  - Hearing protection

Follow the hierarchy of controls and use the most effective control that is technically feasible and reasonable for the situation.

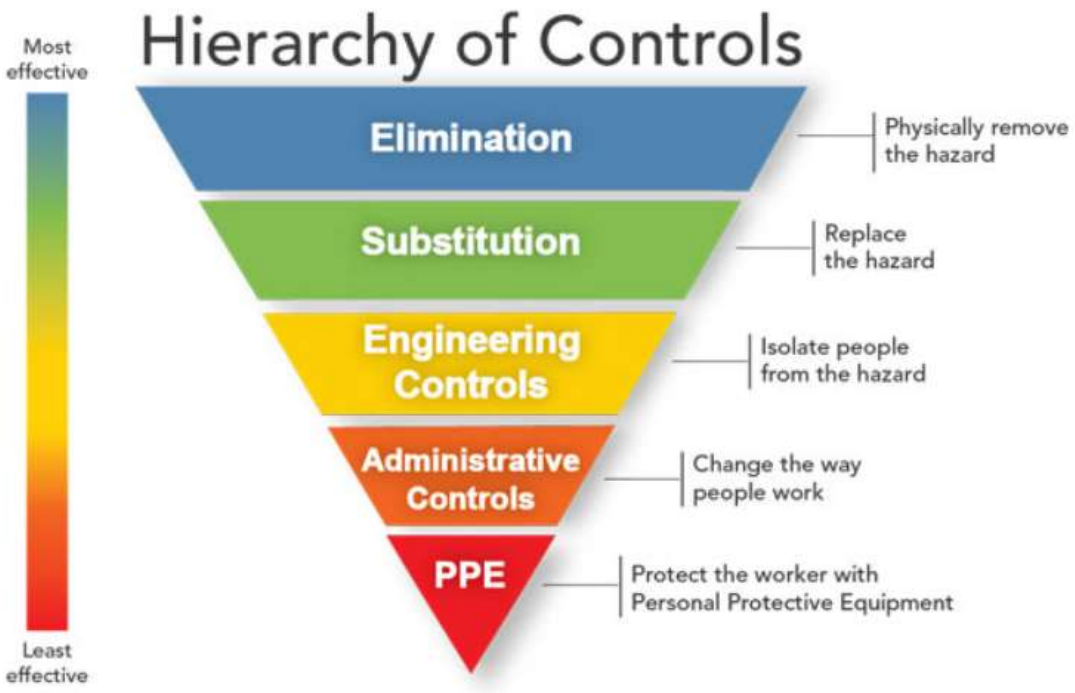

Figure 3: Hierarchy of controls

Source :http://www.cdc.gov/niosh/topics/hierarchy

Section 2 : The control phase activities

I. Analysis the outcomes of monitoring activities.

In this first phase, it is necessary to collect information which comes from the other phases (Progress report, project data, risk directory, risk management plan, etc.).

II. The choice of a mode of action in relation to these risks

The first phase's information processing results in decision making: there are six standard decisions:

A. NEW PLANNING:

When the evolution of risks requires that mitigation or contingency measures be modified to take into account new developments.

B. RISK CLOSING:

When the level of risk exposure has decreased to an acceptable level, the risk is no longer a concern, or the risk is no longer relevant because it referred to a phase of the project that has now ended.

C. DEVELOPMENT OF A CONTINGENCY PLAN:

When it appears that the mitigation measures may not prove to be conclusive and that it would be prudent to plan contingency measures that would not have been developed during the planning phase. Preparing a contingency plan can be expensive.

D. IMPLEMENTATION OF THE CONTINGENCY PLAN:

When it appears probable that the mitigation measures are inconclusive and that the mitigation measures must be supported by contingency measures or interrupted and replaced by the implementation of the contingency plan .

E. PERFORMING MORE IN-DEPTH ANALYZES:

When there is a need to postpone decision making until more information on the state of risk or the state of mitigation or contingency measures is available.

F. CONTINUED MONITORING:

When no specific action is required other than to keep risk monitoring activities going.

Section 3: The implementation of decisions made in response to each risk

In this section, we will provide some tips for proper decision implementation and highlight the points that require special attention:

Monitoring is essential during the control phase and should be addressed at each project supervision meeting.

In most cases, it is preferable to conduct extensive analysis and research rather than to wait for an event and then react. It is preferable to prevent rather than cure.

Decisions must be made with all relevant information from all stakeholders at hand.

A closed risk file can be reactivated in the event of an event; however, consulting the documents associated with the risk closure is strongly advised.

It is mandatory to establish a risk benchmark at the end of the project or if the number of risks is high. The risk repository must be kept up to date and easily accessible.

The risk directory is a source of critical information that will allow you to save time and avoid making the same mistakes, as well as a very useful source of information for those who will take on project responsibility in the future.

Chapter 2:Risk communication

The communication phase's goal is to ensure that the risks associated with the project and the available options are well understood, allowing for fair choices that consider the requirements that the project must meet.

however, It should be noted that the role of communication is more than just the transmission of information or the exchange of data on feared events and their consequences. It is also a gathering of people gathered around a topic on which everyone can and should have a say. On the one hand, it promotes the pooling of knowledge, the sharing of knowledge and experiences, and thus contributes to an increase in discussions and the confrontation of ideas and points of view. On the other hand, it enables, through the numerous exchanges required for its implementation and use, to obtain from all project participants a shared awareness of the risks involved, as well as an in-depth dialogue on their causes and consequences.

Finally, it enables you to learn to work in a team, to establish effective relationships among the various professionals involved, and to increase their interactivity with mutual enrichment, allowing you to create the conditions for fruitful collaboration and a good understanding of the situation, as well as to obtain a degree of consensus on the project's level of risk exposure. To

be effective, the communication phase must adhere to the principle of free communication, which means an exchange of information free of constraints between stakeholders at the same and different hierarchical levels. It should also value individual opinions while encouraging teamwork, which promotes the exchange of ideas and thus contributes to the improvement of information quality and relevance.

Section 1: Information transfer

The transfer of risk information according to the risk management phases and the stakeholders most likely to be concerned is illustrated in the following diagram

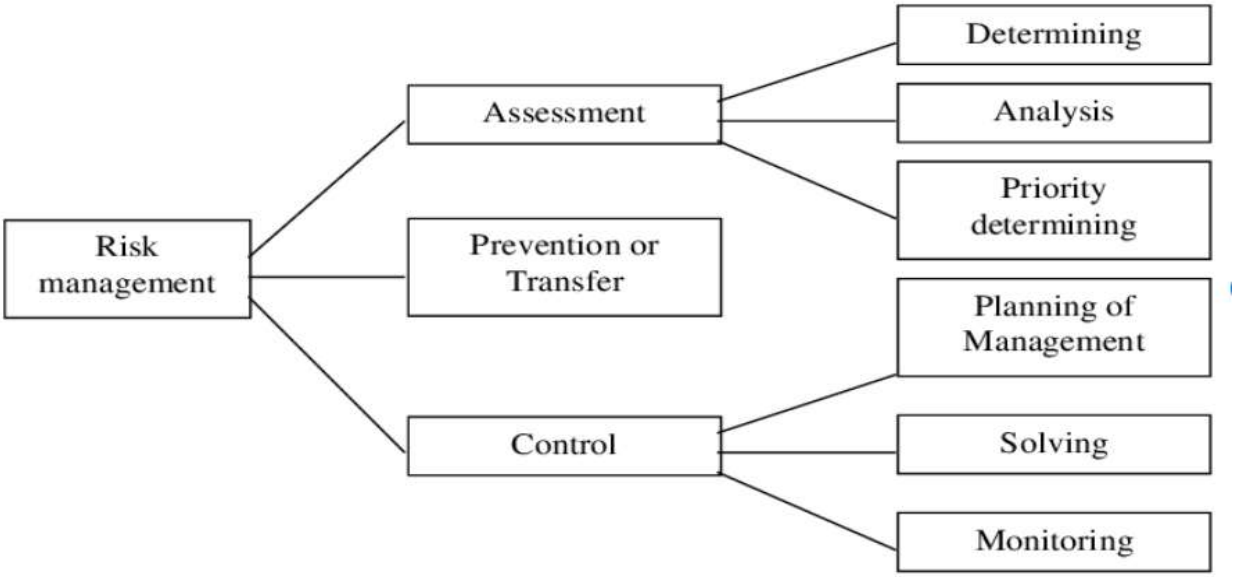

Figure 4 : Risk management action

Source : https://www.researchgate.net/figure/Risk-management-actions_fig1_327932936

Note that the information available following the application of the analysis phase can also be transferred to the control phase before being transmitted to the planning phase, because it is possible that a decision could be made. taken at this time. The information resulting from the application of the control phase is then used as part of the application of the planning phase and transferred to the monitoring phase. The information associated with the latter will be processed by the control phase and the trends that can be identified will likely influence the identification phase.

Three main categories of factors must be taken into consideration in establishing the communication phase, namely the individual attitude towards risk, the nature of the groups and the organizational culture.

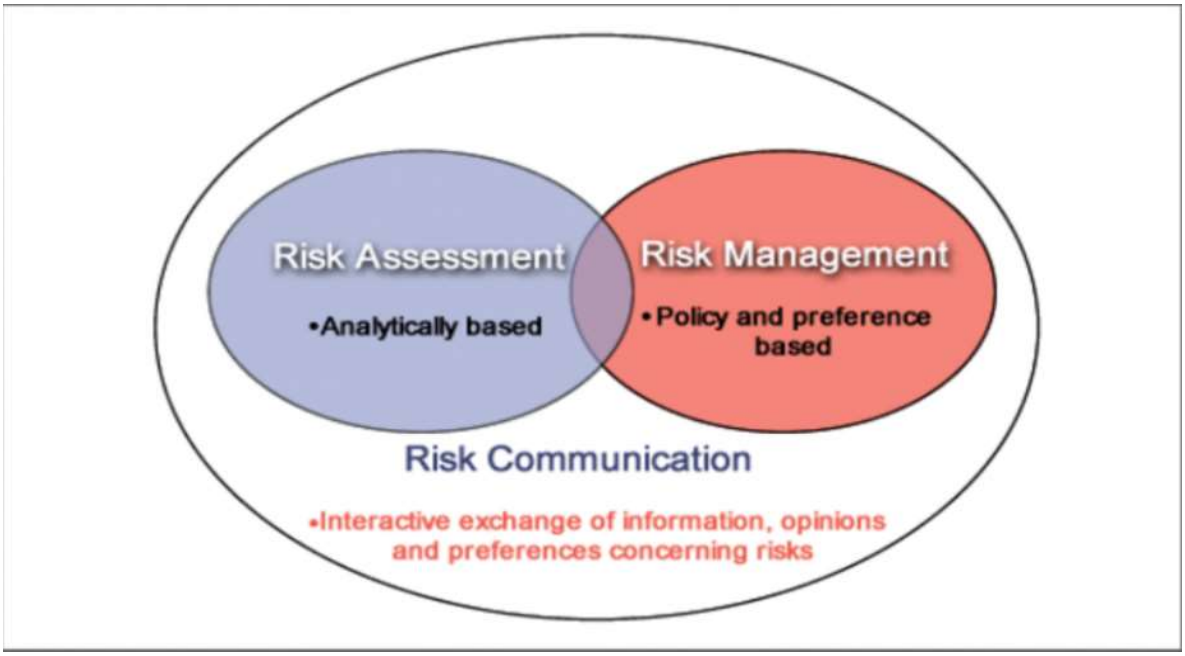

Figure 5 : Risk Communication

Source:https://healthcomm.onair.cc/health-risk-communication-overview/

Section 2: Individual attitude to risks

People are divided into three groups: those who avoid risks, those who take them, and those who are risk averse. The dominant characteristic of the group of people asked to comment on risks will invariably have a significant impact on the nature and content of the information communicated as part of the risk management process implementation. As a result, it is preferable to ensure that the composition of the sample of individuals consulted is balanced throughout the process's implementation.

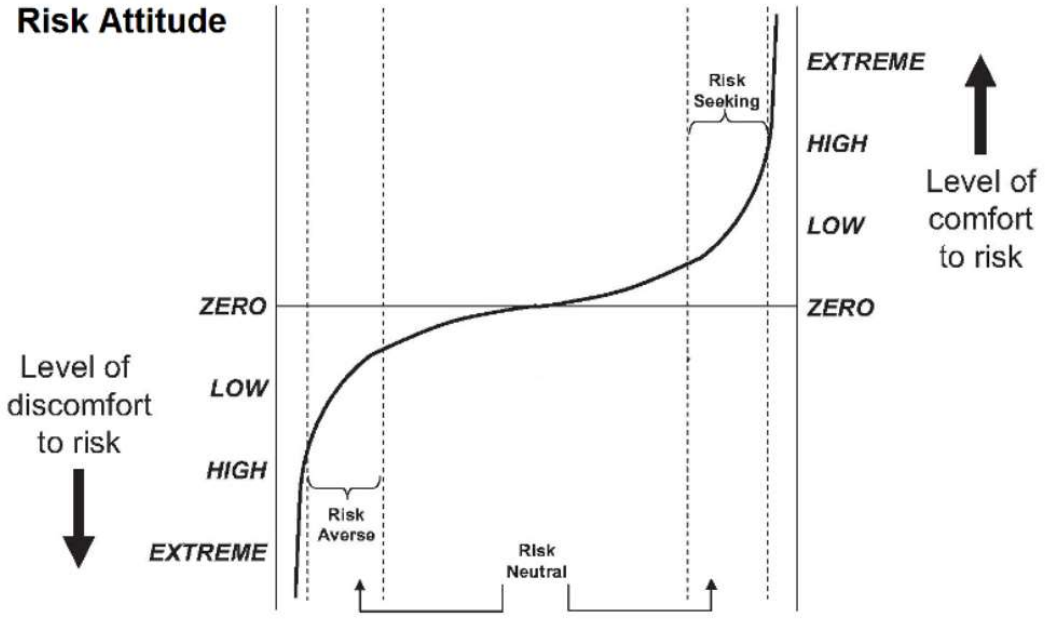

Figure 6 : Risk attitude

Source :https://pmwares.com/risk-attitude/

Section 3 : Nature of groups

The size and location of the groups involved in the project's realization, as well as the project itself, will have an impact on the implementation of the communication phase. The dynamics of a small team differ significantly from those of a large team, and communication is much easier to establish in the first.the second. Communication within a team sharing the same room is also easier than in a team spread over several rooms, especially if they are far from each other.

Section 4: Organizational culture

The organizational culture that characterizes the entity in which the project fits will also have an important influence on how the communication phase is established.
Four dominant cultures have thus been identified by Larry Constantine in the context of his work on this subject ["Work Organization: Paradigms for Project Management and organization", Communications of the ACM, Oct. 93, Vol. 36, No. 10], in particular:

- the so-called closed organizational culture (resistant to risk), represented by the rigid traditional hierarchy where the group is valued in relation to the individual

- the so-called random organizational culture, which characterizes start-up companies, where the individual is valued and where risk-taking is encouraged

- the so-called open organizational culture (characterized by a neutral attitude to risk), often observed in standards bodies where consensus building is of great value and where discussions are encouraged.

- the so-called synchronous organizational culture (rather resistant to risk), characterizing an organization where everyone has a common vision and understanding of how it operates.

Chapter 3: Case study, Risk assessment and prevention in chemical laboratories

I. Case study:

Risk assessment and prevention in chemistry laboratories

Biological analysis laboratories are, by definition, a sector where professionals are particularly vulnerable to infectious disease.

Given the variety of procedures performed, the equipment and instruments used, and the chemicals used, the possibility of an accident is high.

II. Risk association:

- Materials, such as:
    - Glassware: Breakage due to the fragility of the material, mechanical and thermal shocks or internal pressure can cause injury
    - Refrigerant: Risk of vapor emissions
    - Hot baths:
    - Steam room:
    - Ray generator: Risk of irradiation

- Chemical products, the danger may be linked to:
    - The physical properties of the substance or preparation: risk of flammability or explosion.
    - Chemical properties: actions harmful to the body characterized by:
        - ✓ Corrosive effect: Sudden destruction of tissue
        - ✓ Irritant effect: inflammatory reaction without destruction of the tissue

III. Risk Identification Methodology

a) List of generic risks based on types:

N°	Risk Type		Risk Type
1	Risks of falling on the same level	10	Risk associated with collapses and falling objects
2	Risks of falling from height	11	Risk and nuisance related to noise
3	Risks related to internal circulation	12	Risk related to thermal environments
4	Road risk	13	Risk of fire, explosion
5	Risks associated with physical activity	14	Risks related to electricity
6	Risks associated with mechanical handling	15	Lighting Hazards
7	Risks related to products, emissions and waste	16	Radiation Hazards
8	Risks related to biological agents	17	Other risks
9	Risks related to work equipment		

Table 6:list of generic risks

Activity	Risks	Dangerous situation	Damages	**Damage caused in the event**
Mineral chemistry lab	Product Risks	Handling acid-base chemicals	Skin contact burn Eye irritation	Product spillage screenings during the restlessness
		Handling of toxic product	Inhalation poisoning	Toxic vapor emissions

b) Determine the damage caused in the event of a dangerous situation

Table 7 : Types of damages in a dangerous situation

IV. Risk analysis:

The handling of contaminated biological samples poses the greatest risk in the laboratory.

For humans, this infectious risk will depend on:

- The pathogenicity of the infectious agent

- The extent of contamination (infectious load X volume of inoculums)

- The state of the manipulator's immune defenses

Risk assessment process:

• Identify the danger

• Analyze or assess the risks associated with the hazard

• Determine the appropriate means to eliminate or control these risks

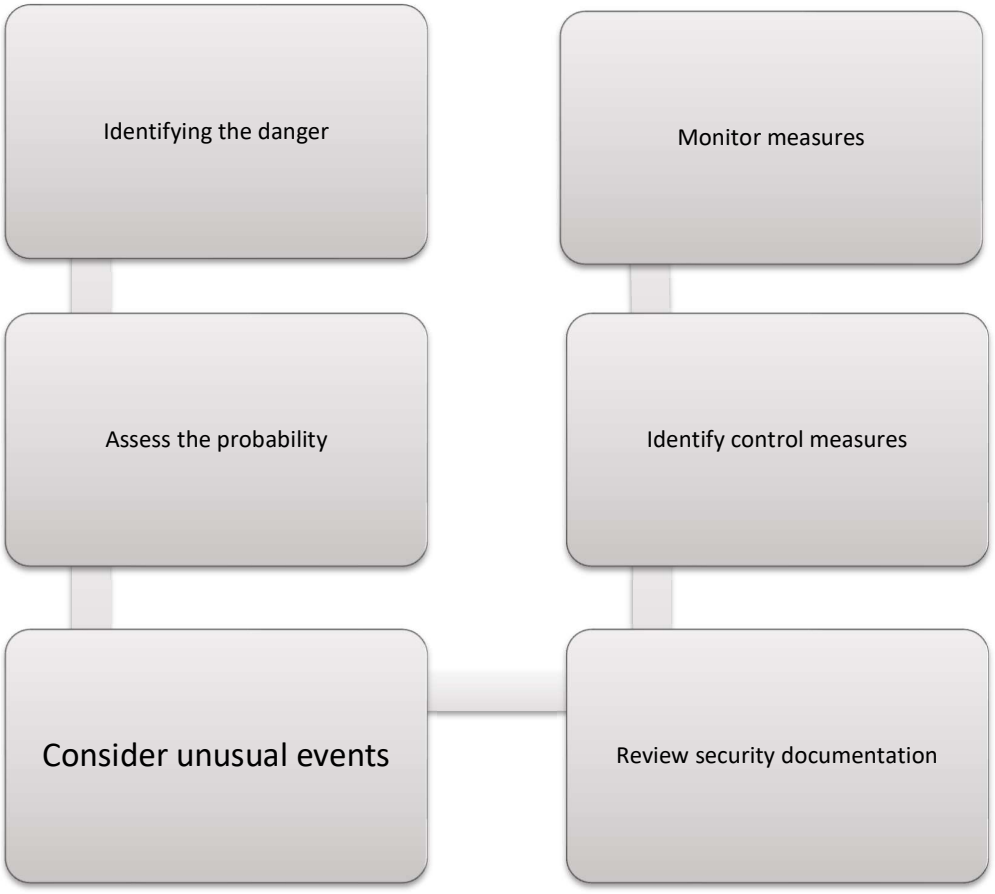

Figure 7 :Risk management process

Severity / Probability	1 no effect	4 minor	9 light injuries	16 severe injuries	25 critical	49 catastrophic
1: extremely unlikely	1	4	9	16	25*	49
3: remote	3	12	27	48	75	
5: occasional	5	20	45	80	125	
7: reasonably possible	7	28	63	112		
9: frequent	9*	36	81			

Table 8 : Safety matrix (chemistry lab):

Probability	Severity
1= Extremely Unlikely	1= No effect on personal safety
3= Remote (few failures)	4= Minor effects, no injuries but maintenance action required
5= Occasional failures	9= Light injuries (first aid type), equipment damage
7=Reasonably possible (repeated failures)	16= Heavy injuries (medical attention required)
9= Frequent failures, failure inevitable	25= Critical. Medical attention and severe lost time injuries. Heavy equipment damage
	49= Catastrophic. Fatality, equipment destruction

Table 9 : Rating risk velocity

V. Risk planning in chemical laboratories:

A. Order and cleanliness:

- Cleanliness and sanitation
- Avoid cluttering corridors, benches and fume cupboards
- The emergency exits in the free state
- Daily washing of floors and benches

B. Hygiene:

- The labor code prohibits taking meals in premises assigned to work.
- The public health code prohibits putting toxic or dangerous products in containers usually reserved for food use, or putting food products in containers reserved for chemical work ...

C. Implementation of appropriate prevention:

Risk prevention in a chemical laboratory result from the risk assessment. It is based on:

- suitable infrastructure (premises, worktops, ventilation, and pollutant capture devices), favoring closed circuit work and the use of fume cupboards or glove boxes,
- an adapted work organization,
- limitation of exposure to products (substitution by less dangerous products, when possible, limitation of handling outside of containment),
- good knowledge of the dangers associated with the products and materials used, which requires training and information for personnel.

In order to limit the consequences of an accident, the installation and maintenance of safety showers and eye washers in chemical laboratories is imperative.

Collective and individual protection

In all cases, collective protection measures should be favored over individual protection measures.

There are several common collective protection devices that can be used in the laboratory regardless of the operations performed:

D. The glove box

provides good protection for operators but makes it difficult to handle products and equipment.

• Gloves, gowns, protective goggles and closed shoes must be worn in the laboratory. The choice of gloves, clothing and eye or face protection will be made according to the products handled. For specific operations, other personal protective equipment is necessary (mask, suit, etc.).

VI. Monitoring and control phase:

Concerning these 2 phases, they consist in measuring a posteriori the actions implemented previously and adjusting them as and when. (Example make changes in the security matrix concerning tps etc ...)

VII. Communication phase:

The employer (or the person responsible for the laboratory) must set up a prevention and safety organization:

• management of laboratory activity, equipment and products that are used (including their storage),

• order, cleanliness, hygiene,

• emergency procedures.

He must also ensure its application, by making it known to each person working in the laboratory, through appropriate information and training (procedure, signage, labeling, waste management, etc.).

VIII. Concerned public

• Laboratory managers or specialists in the fields of industry, research, or practical teaching

• Security managers

• Any professional with knowledge of chemistry or wishing to refresh itChallenges

Laboratory activities often involve the presence and significant use of chemicals. From the storage of products to the layout of workplaces, including the choice of equipment, the entire laboratory must be organized by integrating the concept of risks linked to the hazardous properties of the products used.

IX. Communication objectives

• Learn to better manage chemical risks and dangers in the laboratory

• Present prevention and protection measures in the presence of chemicals

• Present the legislation on hazardous chemicals

• Understand how to implement legal requirements in the laborator

GENERAL CONCLUSION

Effective risk management is seen as a source of cost reduction and, in the long term, as a guarantee of better controlled development of the company.

The benefits that the Directorates-General derive from this are numerous:

- Detailed information on threats to their business that were not clearly identified.

- A formalized and shared risk inventory making it possible to launch targeted actions or projects to control them.

- An assessment of the sensitivity and accountability of their main managers to business risks.

- An improvement in the performance of activities

Nevertheless, one of the most frequent difficulties encountered by risk managers remains the allocation of resources: if the risks are not correctly assessed and prioritized, the company may take time to manage risks and claims that have little impact. likely to occur.

Resources are then unnecessarily wasted when they could have been exploited in more profitable activities. The manager's skill lies in minimizing the negative effect of risks with a minimum budget and staff! … In addition, the time taken to process a risk also puts a strain on the company's overall activity, even if the method adopted is legitimate, in particular when development projects are blocked while awaiting management risk control measures. .

It appears today that the implementation of good risk management is not a problem of costs, or of resources, but really of the ability of the entire company to implement tools and processes while creating a real risk culture anchored at all levels of the organization.

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