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# Methods of analyzing and assessing economic and financial risks

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**Abstract**
The paper is structured in four sections. The first section defines the notions of risk and failure, highlighting the differences between them. The second section presents the typology of risks by classifying them into classes according to criteria relating mainly to the areas in which they occur: natural and climatic, financial, legal, professional. The third section presents the ways to analyze and evaluate risks, emphasizes the role of the critical matrix, and reviews the most commonly used risk assessment methods: Osborn Brainstorming, Delphi, Abaque de Régnier, BISF method (breakdowns, the importance of the equipment, the state of the process and its function, RCM (reliability centered maintenance), Ishikiwa. The fourth section describes the most common methods and tools currently applied in analyzing and assessing economic risks, following the main features in which events must fit to ensure dependability: reliability, maintainability; availability; safety. Among semi-empirical instruments are mentioned: Preliminary risk analysis; Global risk analysis; Fault Analysis and Effects Analysis; Hazard and Operability Studies; Functional analysis, as well as logical tools such as Markov chains and Petri networks. Methods based on system modeling are also presented: Methodology of analysis of systems dysfunction - systemic organized risk analysis method; probabilistic modeling of dynamic systems, based on Monte-Carlo simulation, Layer of Protection Analysis; the Hazard Analysis Critical Control Point method. In conclusion, the international standards and European directives on risk assessment, prevention and reporting are presented: The ISO / IEC 31010: 2009 risk assessment standard includes several tools for managing risk factors; Seveso Directive (2012/18 EU Directive of 4 July 2012) common policies on the prevention of major industrial risks; Directive 2008/1 / EC on Integrated Pollution Prevention and Control.

**Keywords:** risk, failure, modeling, criticality, assessment

## Introduction

The notions of danger and failure are not confused. Failure [Hans Günter Brauch, 2011] is defined as a potentially unhealthy injury or event for people, property or the environment. The risk involves two aspects: the first, qualitative, relates to the way in which the system is exposed to a dangerous situation which, in circumstances, can turn into an accidental situation with different consequences as nature and importance; the second aspect is of a quantitative nature and shows the probability of occurrence of the undesirable event as well as the severity of the uncertainty of the dangerous situation or of the accident.

In an accident scenario, within a system, the failure will create an undesirable situation by the action of a case that exposes the system to risk - the cause will be designated the exposure factor - and a cause involving this risk is triggered (trigger factor). The undesired event or the accident will occur by activating an aggravating factor, which will produce the negative consequences.

Risk management includes reduction and control activities on risk-defining items, prevention activity includes actions to reduce the likelihood of occurrence of risk, while protection against risks aims to reduce the severity of their consequences. Prevention aims to reduce the probability of occurrence of the causes that can trigger the dangerous situation, trigger causes, if the dangerous situation exists or the causes that create the circumstances of the unwanted event.

The risk reduction process is based on the concept of risk criticality, which is the result of a decision based on a scale of values that follows the various aspects: political, ethical, religious, economic, etc., for each risk evaluated f (R) = (G, V) is associated with a reduction or control action.

The set of pairs (G, V) corresponds to the category of criticality, divided into three classes according to the ALARA principle (As Low As Reasonably Achievable).

The activities undertaken for risk analysis have several aspects:

- issues related to the risks of the system being analyzed;
- the methodology by which the nature, value and quality of the documentation underlying the determination of their utility are examined;
- the method of achieving the system, consisting of a succession of operations to achieve the ultimate goal, it being necessary to report possible errors in each operation and to find solutions for the prevention / treatment of risks;
- tools used are the engineering or experimentation procedures used to design / implement a method;
- the term "risk analysis" means any structured approach to identifying, evaluating, controlling, processing and managing risks, in particular economic - industrial and financial risks.

## 1. Defining the notions specific to risk analysis and treatment

The risk is the occurrence of an undesirable event, the occurrence of a dangerous event or the confrontation with an environment that has become hostile.

Note that risk is known in advance, and exposure to risk is the result of a conscious process, which we know as risk-taking. In this regard, the risk is distinguished, for example, from failure or incident, which usually occurs unexpectedly.

The risk is usually banal, but harmful enough to be undesirable. In this respect, it is particularly distinguished from the notion of danger, which implies the possibility of serious harm, including, in the event of an accident, the death of one or more natural persons.

A risk is an unexpected situation, which is another difference from danger. We talk of danger when the probability of occurrence and consequences are important, while the risk exists when the probability of occurrence is not zero. For example, at the Torino scale, we are talking about the normal hazard at level 1 and the dangerous object in level 5.

The Torino Impact Hazard Scale (NASA / JPL Near-Earth Object Program Office, 13 Apr 2005. Retrieved 2011-11-05.) is a method of classifying asteroids impact risks in astronomy, or comets with Terra. The scale is graduated from 0 - which means no chance of collision - up to 10 - collision resulting in a global catastrophe. The Torino scale uses, in order to graphically present the risk, a five-color coding corresponding to the level of risk.

Assessing the criteria that classifies risks by the severity of the impact is very subjective, which may justify the fact that in the scientific and technical fields, a quantifiable and rigorous risk definition has been sought.

In the field of economic safety, risk is defined as the probability that a hazard becomes reality in one or more scenarios associated with adverse consequences on goods or persons. The risk level is calculated by quantifying the probability of occurrence of each scenario and by estimating the severity of the consequences of that scenario.

The risk is the coexistence of a dangers and an undesirable situation. When a person assumes a risk, they take an action hoping to win, but being aware that the stakes are both winning and losing:

- danger: the consequences of the action taken are not entirely foreseeable;
- stake: There is hope for winning and / or fear of loss.

This concept can be applied in many areas:

- in game theory, action has a gamble or complexity making it impossible to predict what the opponent will do; stake is the expected gain in money, material goods, recognition or only the satisfaction of the game, distraction;
- in the use of equipment, the hazard may indicate a deficiency, a malfunction, a handling error, etc. The expected benefit is the operation according to the projected parameters, but failure can result in a waste of time and, consequently, productivity, excessive consumption of energy and consumables, destruction of a good, bodily injury, pollution environment, etc. ;
- in case of a major risk - natural disaster, industrial accident - danger is the production of an extreme mature phenomenon such as earthquakes, hurricanes and tsunamis, but also industrial accidents. The challenge of setting up industrial sites is the important benefits that an income-generating activity can produce on a social, fiscal, environmental, etc. level.
- in the business sphere, the likelihood of unwanted events depends on the evolution of the markets, the pace of emergence of innovative technologies, the conjunctural trend of market demand, etc. The expected benefits relate to return on investment, market share, but there is also the danger of declining activity, with negative effects on employment.

Risk management consists of assessing and anticipating risks, as well as establishing a systematic monitoring and data collection system to trigger alerts.

Risk is the combination of four factors: a hazard, a probability of occurrence, its severity and acceptability. The notion of risk should not be confused with that of danger, which is a dreadful event, while the risk becomes serious only if it is highly probable. The criticality of a risk results from the combination of its severity and probability.

Role of the concept of risk aversion in economic and financial models

Aversion to risk is an economic behavior. Thus, each investor prefers a relatively safe gain rather than a much bigger, but uncertain and random one, but there is no standard profile of the investor, the behavior being very different from case to case.

Aversion to risk is one of the first principles found in the economy. It is evidenced by Daniel Bernoulli 300 years ago, which led to the concept of economic utility and financially to the notion of risk premium. Theories that relied on these concepts have allowed them to address the issues of price and yield balancing, including their mathematical modeling

In the field of finance, notions of risk and earnings gain new valences, becoming more complex than in the real economy. Thus, in finance, risk is considered to be a good that can be negotiated through demand and supply on an adequate market - stock and commodity exchanges.

The risk theory introduces the hypothesis of limited rationality of economic agents, so that in the agent relations one can determine the level of risk exposure for the different participants:

- shareholders, who own a share of the corporation's share capital, are satisfied if the shares they own bring a gain - dividends, and so on. - (Ego-optimal level optimal value of action);
- other stakeholders in the "stakeholders" business: employees, managers, suppliers, creditors, public authorities for taxation, etc. believes that the organization is of social or public utility if the expectations are met (acceptable level of socio-optimal risk for optimal partnership value).

## 2. Typology of risks

The risk typology makes it possible to classify the risk to better guide the analysis, so it can fit into one of the following categories: organizational, technical, financial, human, legal, environmental.

Risks also vary according to the severity of their impact on the environment where they occur, and to analyze the specific area affected. Such risks may be: technological or industrial risks, operational risks, non-compliance risks, medical risks, computer security risks, phytosanitary risks, risks of loss of competence, reputational risks, supply chain risks in the faulty lifecycle management, social risks, pyrotechnical risks, health risks, urbanization risk, insurance risks, risks from an active error, risks from a latent error, etc.

Natural risk and climate risk

Natural risk involves the spatial superposition of the expansion of a brutal natural phenomenon, which produces large amounts of human and material damage. The phenomenon of climate change has become acute over the last decades. At the Rio de Janeiro Earth Summit (1992) and then in Johannesburg (2002), sustainable development approaches were proposed, the implementation of which lies with both the public sector and the private corporation, in order to predict disastrous natural phenomena and damage prevention major.

Financial risk.

In the financial field and implicitly in the economic one - economic investments and financial placements, credit activity, insurance, etc. - the risk refers to the possibility of financial loss caused by uncertainties that can be quantified. In theory, there is a correlation between the assumed risk and the expectation of gain, the risk measure being linked, in finance, to the volatility of the exchange rate and the standard deviation. Consequently, financial risk is not considered as a negative element, as the value of a risky asset has the potential to fluctuate greatly in the future. up or down.

Legal risk

The complexity and some inconsistencies in normative acts, whether primary or secondary internal legislation, the late transposition of European directives or too frequent changes create legal uncertainty.

Professional risk

Occupational risk is the combination of the likelihood and consequences of producing a hazardous event specific to professional activity, and both aspects need to be considered to assess this type of risk. In addition, in order to minimize the possibility of such a risk, it will act in two ways: by means of measures limiting the frequency of occurrence and by actions that decrease the severity of the possible negative impact.

## 3. Risk analysis and assessment

Any economic activity involves risks that leaders of public and / or private organizational entities have to manage and, above all, evaluate them. To this end, the risks must be identified and minimized, the costs that the risk management involves, including when they produce negative outsourcing to be corrected, must be assumed. At the same time, protection against detected risks calls for appropriate insurance, as well as an analysis of the entire life cycle of products and / or services, with the complex interaction of all stakeholders.

Risk analysis is carried out in two aspects: qualitative and quantitative.

Qualitative risk assessment is typical in the project management process as well as in corporate governance and requires risk classification based on two criteria: impact and likelihood of occurrence.

Risk evaluation

Risk assessment is done by calculating their criticality, which allows the previously identified hazards to be quantified as well as the degree of acceptability.

In order to assess the risks, risk indices or risk coefficients are constructed in the form of measurable values, with which their risks and consequences can be assessed objectively.

The method is known as QRA (Quantitative Risk Assesment), and the resulting indicator is called, in terms of a specialist in risk management, criticality.

The Critical Matrix presents a set of probability / severity of the negative impact (Pk / Gk) beyond which the risk passes from the acceptable to the unacceptable range. In this respect, a Pair of Pearl Gear (Pk / Gk), defined as ALARP (At Low As Reasonable Practicable), is defined, which means that risk is no longer accepted above this level.

Classification in a risk class - from negligible to severe - can be done according to a square matrix, in which each cell defines a certain category of risk.

| Impact | Probability | | | | |
|---|---|---|---|---|---|
| 5 (>v5) | | | | | |
| 4 (>v4) | | | | | |
| 3 (>v3) | | | | | |
| 2 (>v2) | | | | | |
| 1 (>v1) | | | | | |
| | A (rare) | B (unlikely) | C (possible) | D (probably) | E (frequently) |

Concerning impacts, the values that describe the negative impact value dimension are specified

In the field of industrial production, risk quantification is an essential and mandatory activity, an assessment of the likelihood of production and the severity of a possible accident, allowing for appropriate prevention measures, including risk acceptability by matching to the appropriate risk class.

In the field of activities where human accidents can occur, the analysis of failures, their effects and the criticality of those risks can be analyzed using an arborescence scheme in accordance with the international standard ISO 13849-1: 2008. This standard proposes a tree-level arborescent : level 1 - degree of severity of possible accident; level 2 - the frequency or duration of exposure to the hazard; level 3 - the possibility of avoiding or limiting the danger, each level being described by two opposite situations.

Estimate Risk Criticism

The criticism of certain economic and financial systems must be computed and analyzed, because the production of the estimated negative event would have serious consequences for people and / or the environment and / or the performance of the firm etc. Determining the criticality is not, however, an easy activity, so it becomes necessary to use methods based on the knowledge of some experts in the realization and operation of the analyzed economic processes. Among the most known and used methods of criticality determination are:

- the Osborn Brainstorming method, in which a group of experts expresses freely and independently the critical nature of the systems analyzed. Expert surveys are statistically analyzed, synthesized and presented in a final report;
- the Delphi method, developed in the 1950s by Olaf Helmer at Rand Corporation, involves an expert group responding anonymously and individually to a questionnaire made by a facilitator. Extreme responses, including respondents, are eliminated, then the process resumes with other questionnaires, etc., the synthesis of the successive stages, finally leading to a consensus;
- the Abaque de Régnier® method. The expert group is given a list of questions to which each expert should respond nonverbally using a seven-color code. In the synthesis, a numerical value is assigned to each type of answer, with which the colored tables present the consensus elements, but also the minority experts are identified;

- the BISF method (breakdowns, the importance of the equipment, the state of the process and its function). With this method, the criticality of the equipment can be precisely defined by notation. Depending on the field and the expert opinions, it is possible to choose evaluation scales with different weights, associated with criteria defined within the organization concerned.
- a method that summarizes the maintenance-based reliability (MBR) concepts and aims to define a preventive maintenance program only for critical equipment. This method presents the criteria recommended in the international centered maintenance (RCM) standards.
- the Ishikiwa method, also called the cause-effect diagram.

## 4. Methods and tools

Safety in operation is often defined as reliability, availability, security, but also as the science of failure and the maintenance of quality over time.

The notion of reliability means the probability that an entity can perform a required function under certain conditions within a certain timeframe and is also associated with the failure rate.

Maintainability is the ability of a component or system to be maintained or rehabilitated in order to maintain initial parameters, ie it shows, under given conditions of use, the ability of an entity to be maintained or restored in the form specified in the original technical specifications.

The tools that can be used to analyze and evaluate risks can be grouped into two categories:

- Semi-empirical instruments, such as APR (Preliminary Risk Analysis), which has led to the development of networks based on the use of risk-management experience; FMEA (Fault Analysis and Effects Analysis) and FMEAC (Normalized FMEA, of the same category), HAZOP (Hazard and Operability Studies), Functional Analysis;
- Logical tools such as logic arborescence schemes (arborescent fault schemes, causes and effects, etc.) and network tools such as Markov chains or Petri networks, all using probability calculations.

The typology of criticality assessment methods

The evaluation of criticality can be achieved by several categories of methods: deductive and inductive methods; qualitative, semi-quantitative and quantitative methods; methods for analysis of individual or combined failure, deterministic or probabilistic methods.

Deductive and inductive methods

The deductive approach (effect → causes, top - down) provides greater analytical power than the other methods. which are mainly inductive (causes → effects, bottom up).

Inductive methods are based on an analysis in which all possible combinations of elementary events are introduced which may lead to the occurrence of a single undesirable event: failure.

Qualitative, semi-quantitative and quantitative methods

Qualitative risk analysis methods are used in the preliminary risk assessment phase. Qualitative analysis defines the consequences, their likelihood of occurrence and the risks, for example, qualifying them with words like: very weak, weak, medium or strong. It is also possible to use a risk ranking hierarchy in terms of quality.

Semi-quantitative methods use numerical evaluation scales for probability of occurrence and their consequences. The score scale can be linear or logarithmic, then combining these values with the formulas specific to the economic sector in question.

Methods for independent failures or for combined failures

Analytical methods can be divided into two categories according to the number of failures considered:

- methods for a single failure, useful only when there is only one fault in the system;
- analysis methods that take into account the likelihood of occurrence of faults that can occur simultaneously are called methods for combined failures.

Deterministic and probabilistic methods

- deterministic methods take into account real equipment failures and quantify the consequences for different targets, such as people, facilities, etc.

- probabilistic methods are based on the assessment of the likelihood of occurrence of dangerous situations or the occurrence of a possible accident based on the probability of equipment failure.

Deterministic methods focus on assessing and controlling the consequences of an accident, while probabilistic methods focus on estimating the likelihood of an accident.

**EXAMPLES OF METHODS**

**Preliminary analysis**

Preliminary risk analysis is essential and highly structured, especially in terms of security, for any innovative project, be it changes to existing systems or new systems. This method is used before it is necessary to carry out the risk assessment (FMEA, AMDEC, others ...).

The Preliminary Analysis method can take very different shapes, but there are three systematic steps that are also three objectives:

- identification of hazards, unwanted events to be taken into account;
- evaluation and classification of associated risks;
- proposals for risk mitigation measures.

**Global risk analysis**

Global risk analysis is a global method of semi-qualitative or probabilistic analysis that allows for the assessment and control of different nature of risks, such as business risks, project risks, or the risks involved in running a process. The specificity of this method is due to the nature of the system considered and the mapping of the considered hazards (structural, cyclic or functional).

Hazard mapping is done using a list of twenty-six categories of generic hazards covering the following four major categories:

- external hazards of the system;
- the system management hazards;
- hazards related to the technical means of the system;
- the hazards associated with the system's own activity.

The structure of the dangerous situations mapping is done by cross-juxtaposing the system and mapping the hazards. Gambling / system interactions are the factors that generate dangerous situations. These are created by both intrinsic sensitivity and vulnerability.

**HAZOP (Hazard and Operability Studies)**

The HAZOP method is part of the dependability proposing an approach to improve the safety and the process of a system, whether it is an industrial plant from a new project or existing equipment. The method is particularly suited for complex thermo-hydraulic systems, its scope including procedures and processes in various sectors such as chemistry, petrochemistry, oil processing, hydraulics, nuclear industry, transport, industry, etc. The

HAZOP method is currently one of the sixty existing risk analysis methods among the most widely used in the world.

**Analysis of operating errors, their effects and their criticality**

The Failure Modes Effect and Criticality Analysis (FMEA) method is an inductive method that starts from the elementary defects of system components to deduce what results in the whole, and therefore what will be the final state of the entire system. This method adds a dimension to assessing the severity of failures.

**Tree structures of operating errors, factors and events**

The three types of methods based on arborescence structures of errors, causes or factors and events are representations of the logic of a system or part of a system, in the form of arborescence branches.

The Tree of Defects is a method that starts from an event to return to the causes and conditions that their combinations can produce.

The cause tree starts at an event that takes place and organizes the set of events or conditions that have been combined to produce it.

The event tree starts from an event and describes the various consequences that it might produce depending on the conditions in which it took place and the events with which it combines. An event tree is built and used in an a priori evaluation process. The starting point is an incident, a failure, an error, an aggression, etc., the possible consequences of which, depending on a number of factors, must be assessed. If the probabilities associated with these factors are known, it is possible to calculate, based on the event tree, the probability associated with each of the possible consequences of the initial incident.

**Qualitative method of bow tie risk analysis**

The foundation of the "bow tie" method is relatively simple. For the same unwanted event, the method proposes to build a tree of defects to explain the causes and a tree of events to explain the consequences. The main interest of the bow tie method is that it allows the visualization of all paths that go from basic events to the occurrence of dangerous phenomena. Each path describes an accident scenario, defined as a chain of events that leads to an unwanted event with major consequences or effects.

**The systematic method of risk analysis MOSAR.**

The MOSAR method uses systemic modeling, by which, after decomposing the system into subsystems and systematically looking for the dangers presented by each of them, those subsystems are pooled to develop major risk scenarios. The system approach proposes methodological principles for investigating natural and artificial systems to improve their design, operation and management.

The MOSAR method is based on two visions:

- a macroscopic vision, concretized in a first module, which consists in carrying out a proximity risk analysis, a major safety analysis or an analysis of the main risks. The macro appearance occurs because the elements that make up the system are very close in their operation, so that the risks that appear are often major. Subsystems are modeled to make it possible to identify sources of danger, then look for interferences between them and the outside environment to generate accident scenarios. In order to use the MOSAR method, it is necessary to implement the MADS (System of Fault Analysis Methodology) model, which includes a negotiation step with stakeholders to establish an acceptable consensus on acceptable risks in the form of a gravitational probability network;

- a microscopic vision, concretized in a second module, consisting in carrying out a detailed and complementary analysis of the technical and operational malfunctions identified in the first module. This sequence is in fact a "safety-of-operation" approach that makes the previous analysis in-depth. In the scenarios set out in the first module, malfunctions of an operational nature and those of a technical nature will develop. At this level, we will implement tools such as AMDEC, HAZOP, and Logical trees. The module ends with the collection and organization of the information collected for risk management, ie the identified scenarios in case they occur.

In conclusion, to apply the MADS-MOSAR methods to perform a risk analysis with this reference engine, it is necessary to perform the following sequence of activities:

1. modeling the studied system by dividing it into subsystems;
2. identifying the sources of malfunctions;
3. identifying the correlations between events;
4. modeling the process;
5. building scenarios;
6. elaboration of logical trees;
7. identification of risk control measures;
8. identifying sustainability measures.

**Risk analysis of dynamic systems**

Probabilistic modeling of dynamic economic systems requires the use of stochastic processes, including: Markov chains, Monte Carlo simulation, LOPA method, PDS method, HACCP method, QRA method, etc.

The method using Markov chains is the most commonly used method for analyzing the probability of dynamic systems, one of the most important features of which is the possibility of graphical representation, which allows risk assessment without the need for detailed knowledge of the mathematics on which it is based.

The statistical analysis, known as Monte Carlo, simulates the evolution of the studied process using a broad basis on previous situations where the system - or a similar one - is in place, which allows for appreciation of reliability, availability, etc. to it.

**The LOPA (Layer of Protection Analysis) method** is a semi-quantitative method developed in optics and subsequently extended to other economic systems, which aims at:

- assess the degree of adequacy between the barriers implemented and the level of risk involved;
- decide on the need to implement new barriers;
- define minimum requirements for the probability of failure of the barriers to be implemented where the existing barriers do not justify an acceptable risk;
- evaluate the frequency of residual occurrence of an accident scenario.

**PDS** is a Norwegian acronym for the reliability and security of security systems systems. The PDS method allows quantification of security unavailability and loss of production in security systems. This method is commonly used in offshore industry, especially in Norway.

The PDS method introduces the Critical Safety Unavailability Note CSU, which means the probability that a system or component will fail to perform its safety function at the time of a dangerous event or accident.

## Hazard Analysis Critical Control Point (HACCP)

The HACCP (Hazard Analysis Critical Control Point) method was adopted by the Codex Alimentarius Commission in 1997 as a seven-pronged approach to protecting all food insecurity by establishing operational activities, pre-established technical means and solutions, proving at the same time, the truth of the affirmations. In this way, the HACCP method ensures and trusts demonstrating the organization's ability to identify the dangers that truly threaten the hygiene of its products and allows it to organize its activities to control them effectively.

The regulatory status of the HACCP method has changed, especially in Europe. First, recommended, then mandatory, after transposition into national legislation, the HACCP method is currently an integral part of EC Regulation 178/2002 on food law and is applied to all food industry companies across the European Union. Beyond its mandatory nature, the HACCP method represents for these companies a real tool for continuous improvement and, pragmatically applied in the logic of the 12 steps, is the best way to ensure the safety of finished products.

**The QRA (quantitative risk assessment)** method is particularly applicable in public utility systems. Losses in the sewer system represent a significant part of the undesirable events identified in territorial risk analyzes, as well as in the so-called QRA studies (quantitative risk assessment).

To quantify the occurrence of a pipeline leakage, one of the commonly used methods is to extract a so-called linear (annual, monthly, etc.) frequency from a database and multiply it with pipe characteristics. This way of doing has the main advantage of being relatively simple to implement. On the other hand, a series of questions arise as to the use of the average values reported in the databases, which makes it necessary to distinguish between two types of databases:

- data banks that are specific to a particular industry, such as the public utilities sector, such as the sewer system, gas supply networks, hydrocarbon pipelines, etc. ;
- multi-sector data banks, known under the purple book.

To quantify the frequencies of undesirable events, there are two approaches:

- the so-called direct approach to assigning the unwanted event to frequencies extracted from a database;
- the so-called computational approach, which consists in evaluating the frequency of the undesirable event based on knowing the frequencies of the initial events and the probability of failure of the preventive measures.

## Conclusions

Risk management is based, on the one hand, on the setting of acceptable or tolerable risk objectives defined by a risk acceptance reference and, on the other hand, by planning resources or means of intervention to reduce the initial risks and maintain under control of residual risks. In other words, the risk reduction plan, such as the security parameters catalog, can only be put into practice if a financing plan - called risk financing - has been planned and consolidated.

This approach must be focused on compliance with the effort / loss constraint ≤ 1 which expresses that the effort that corresponds to the cost of the risk intervention should remain less than the corresponding cost loss that would be paid in the absence of intervention.

In such situations the ratio is considered: K = effort / loss, where:

- the loss is the cost of the risk corresponding to the amount or the equivalent of the gross financial loss in the absence of the risk control action;

- the effort is the cost invested in the risk intervention, ie the financial value or the equivalent of the reduction actions and, in general, the risk control.

As part of the risk control action, two cases should be considered:

- K <1, ie the cost of the loss is greater than the cost of the treatment effort. In this case, there is an unrestricted interest in intervening, what is called economic treatment of risk;
- K> 1, where the cost of the loss is less than the cost of the intervention effort, in which there is no logical interest in dealing with the risks, except in case of force, a situation called political risk treatment.

International Risk Standards

According to ISO Guide 73 - "Risk Management Vocabulary", revised by ISO 31000: 2009 - "Risk Management - Principles and Guidelines", the definition of risk management combines the notion of risk with the objectives of the organization: "Risk is the effect of uncertainty on the achievement of objectives" .

ISO / IEC 31010: 2009, Risk Management - Risk Assessment Techniques has been developed jointly by ISO and its IEC (International Electrotechnical Commission) partner.

The ISO / IEC 31010: 2009 risk assessment standard includes several tools for managing risk factors, making it possible to analyze and evaluate any types of risk that companies may face. ISO 31000 and ISO Guide 73 can be applied to any public or private organization at group or individual level. ISO / IEC 31010: 2009, Risk Management-Risk Assessment Techniques has been developed jointly by ISO and its IEC (International Electrotechnical Commission) partner.

European Directives on Analysis, Evaluation and Prevention of Economic Risks

As a result of catastrophic industrial accidents, major risk situations have been analyzed in the European Union and it has been decided to impose mandatory measures to prevent and mitigate the dangerous situations that may arise in European industrial sites. Thus, the SEVESO Directive - named after the disaster that took place in Italy in 1976 - is currently in its third form, namely the Seveso 3 Directive (2012/18 EU Directive of 4 July 2012) common policies on the prevention of major industrial risks.

Enforced in 2015, the SEVESO Directive obliges Member States to carry out potential hazard studies in industrial areas, inventory these sites, prepare possible accident scenarios, provide for appropriate interventions, cooperate to limit domino effects, to inform all the communities that could be affected by unwanted situations, etc.

The Directive lists industrial industrial sites classified under SEVESO thresholds - low, high - and provides for a report on high threshold sites, a report to be updated every five years, which will form the basis for drawing up contingency plans and .a.

Another European Directive, Directive 2008/1 / EC on Integrated Pollution Prevention and Control (IPPC), requires a comprehensive approach and refers to the most polluting industrial installations.

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