



Risk Management in Construction and Public Works

Luís Loureiro Tavares

Risk Management in Construction and Public Works Contents

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2. A Vision of Civil Engineering 2025 as outlined in ASCE Summit 2006 Virginia / USA
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Risk Management in Construction and Public Works

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Panel Five – Territorial Management / Gestão do Território

3.P.2.2 – Natural Disasters and Risk Management / Desastres Naturais e Gestão do Risco

Risk Management in Construction and Public Works

What Risks are we talking about?

Traditionally, risks have been managed (implicitly/indirectly) through the engineering decisions taken during the project development;

We assume the question of “Risks” to be transversal to all Civil Engineering activities following a systematic (overall) risk management

All five themes of this Summit, including this panel on “Natural Disasters & Risk Management” ought to be seen on the perspective of an integration of different Civil Engineering activities , structural, environmental, etc. – “Risks” sould not be apart...

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1. Context of this Civil Engineering **Summit 2019**

Opening address by the President Carlos Mineiro Aires : to discuss the main Challenges and Opportunities that Civil Engineering is facing nowadays and will face in the future;

2. A Vision of Civil Engineering 2025 as outlined in **ASCE Summit 2006** Virginia / USA

We take this inspiration on the Future of Civil Engineering in 2025 as outlined in The Summit held in Virginia, USA, June 2006

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Entrusted by society

to create a sustainable world and enhance the global quality of life, civil engineers serve competently, collaboratively, and ethically as master:

- Planners, designers, constructors, and operators of society's economic and social engine—the built environment;
- Stewards of the natural environment and its resources;
- Innovators and integrators of ideas and technology across the public, private, and academic sectors;
- Managers of risk and uncertainty caused by natural events, accidents, and other threats; and
- Leaders in discussions and decisions shaping public of risk environmental and infrastructure policy.

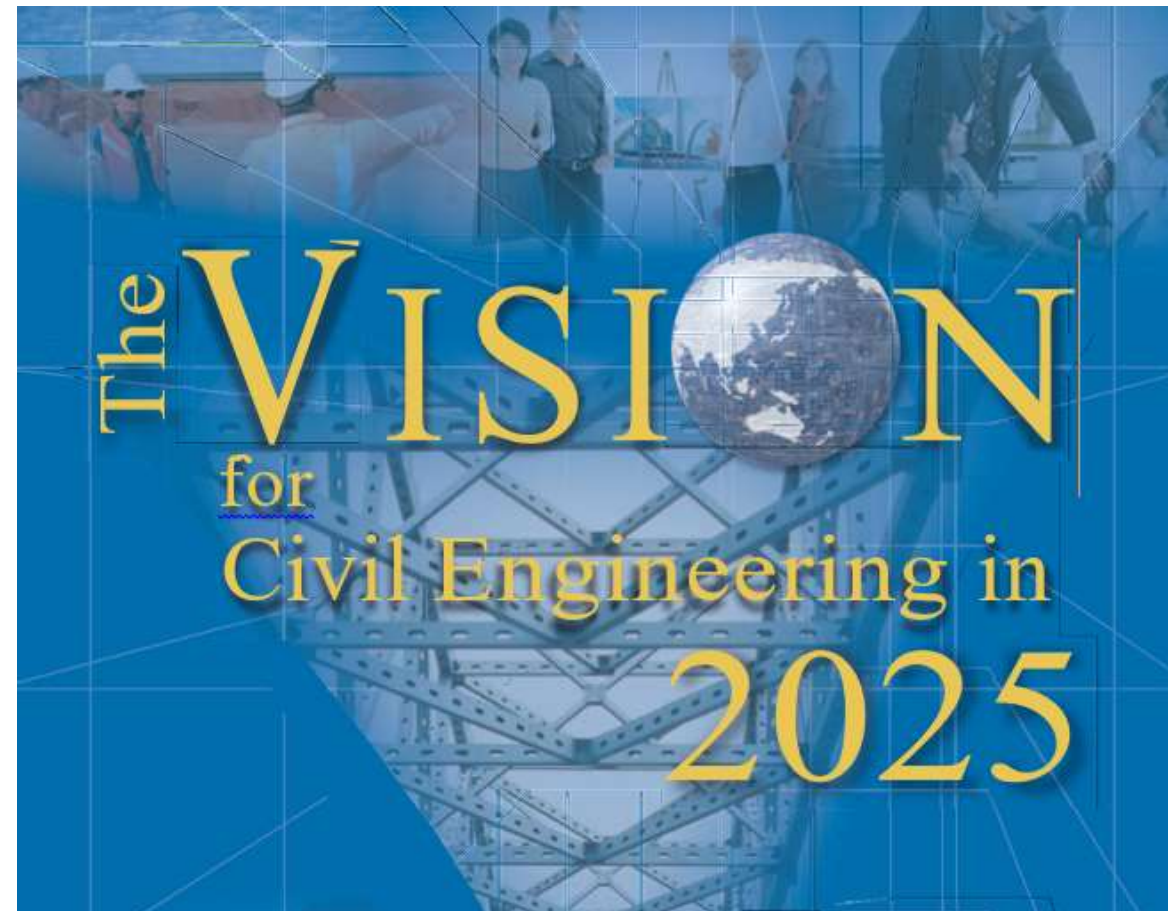
Prepared by the ASCE Steering Committee to Plan a Summit on the Future of the Civil Engineering Profession in 2025

The resulting integrated global aspirational vision is:

Panel Five – Territorial Management / Gestão do Território

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The **VISION**
for
Civil Engineering in
2025

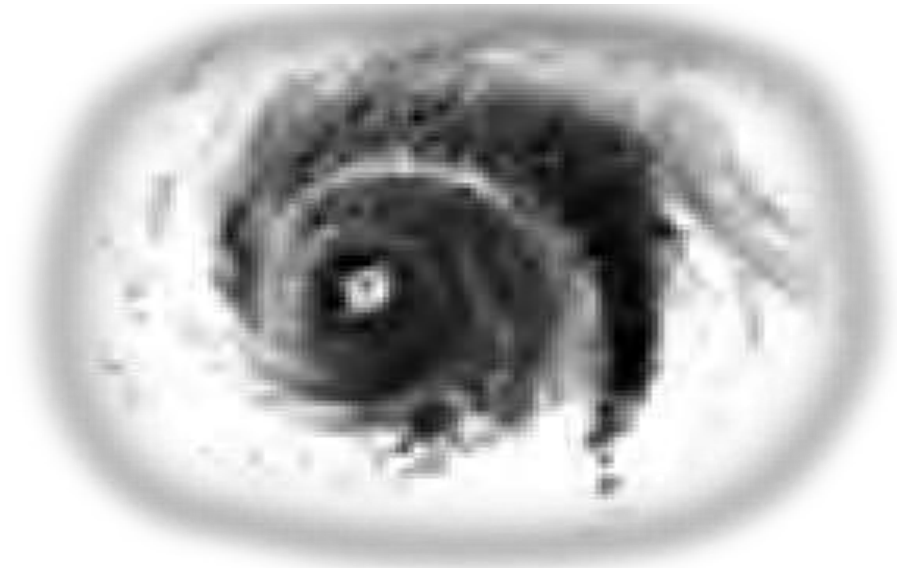


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Civil engineers will assess and manage risk and thereby reduce the incidence and effects of natural and man-made disasters.

Managers of Risk



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3. Risk Management principles and tools in Civil Engineering Projects (infrastructures works) with an approach based upon ISO 31000:2018 – Risk Management (Principles, Framework, Process)
4. – Risk and Risk Management:
 - Risk versus Uncertainty, **Threats** versus **Opportunities**; **Challenges** and **Opportunities**
 - Risk Management tools and techniques (ISO 31000:2018, ISO/IEC 31010: 2018) with a systematic approach

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ISO 31000:2018 Risk and risk management

APQ CT180 “Gestão do Risco”
Portuguese Mirror Committee of ISO TC 262 (Risk Management)

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ISO 31000:2018
 Framework
 Risk



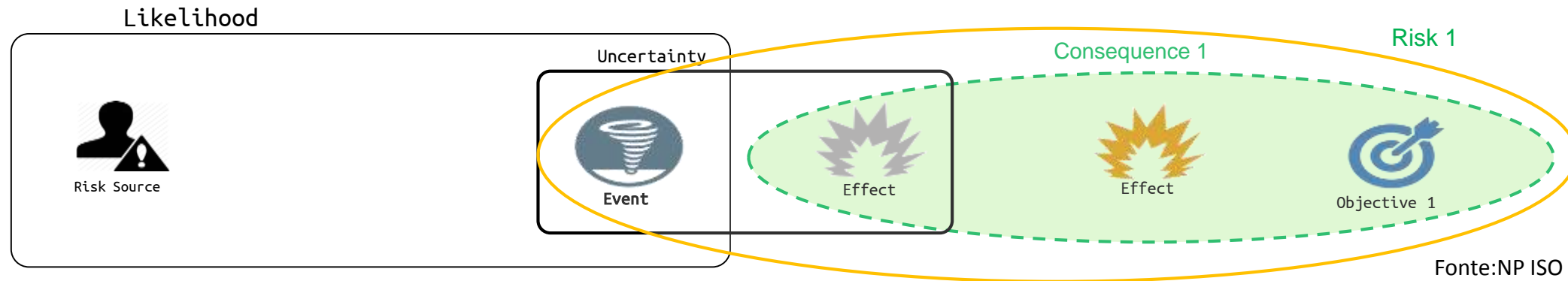
risk

Effect of uncertainty on objectives.

Note 1: An effect is a deviation from the expected. It can be positive or negative or both, and can address, create or result in opportunities and threats (related to the objectives).

Note 2: Objectives can have different aspects and categories, and can be applied at different levels.

Note 3: Risk is usually expressed in terms of **risk sources**, potential **events**, their **consequences** and their **likelihood**.



Fonte: NP ISO 31000

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ISO 31000:2018
 Framework
 Risk management



risk management coordinated activities to direct and control an organization with regard to risk

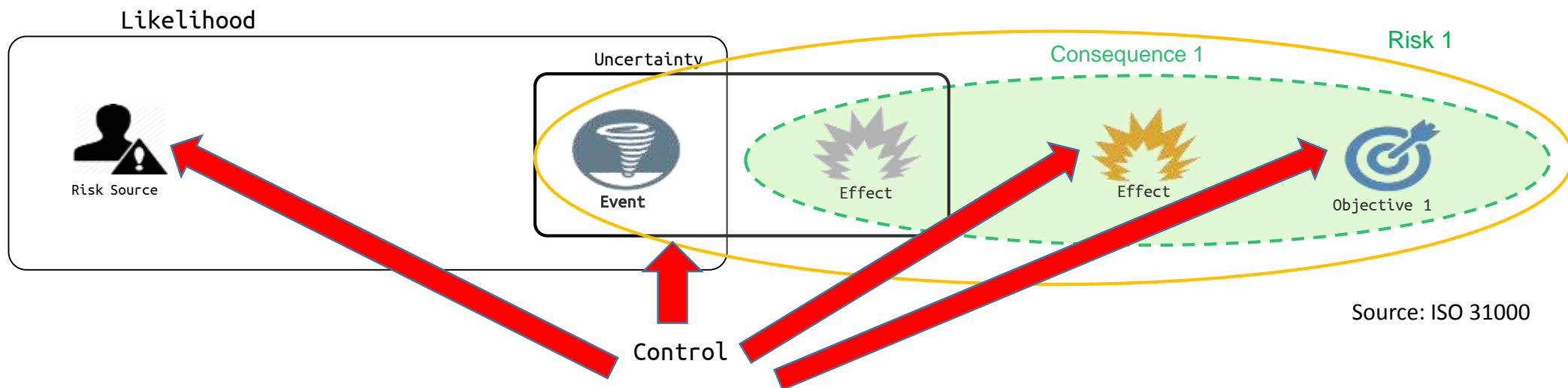
risk source element which alone or in combination, has the potential to give rise to risk.

event occurrence or change of a particular set of circumstances.

consequences outcome of an event affecting objectives.

likelihood chance of something happening.

control measure that maintains and/or modifies risk.



Source: ISO 31000

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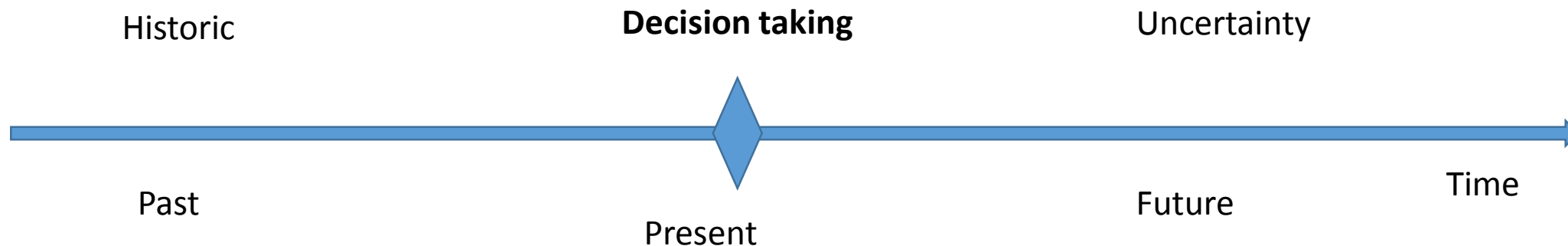


ISO 31000:2018

Risk and risk management

How does risk management creates value?

Risk management creates and protects value in the organizations through informed decision making, the setting and prosecution of objectives and performance improvement.



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ISO 31000:2018

Framework

Risk management



Risk management creates and protects value in the organizations **through informed decision making**, the setting and prosecution of objectives and performance improvement



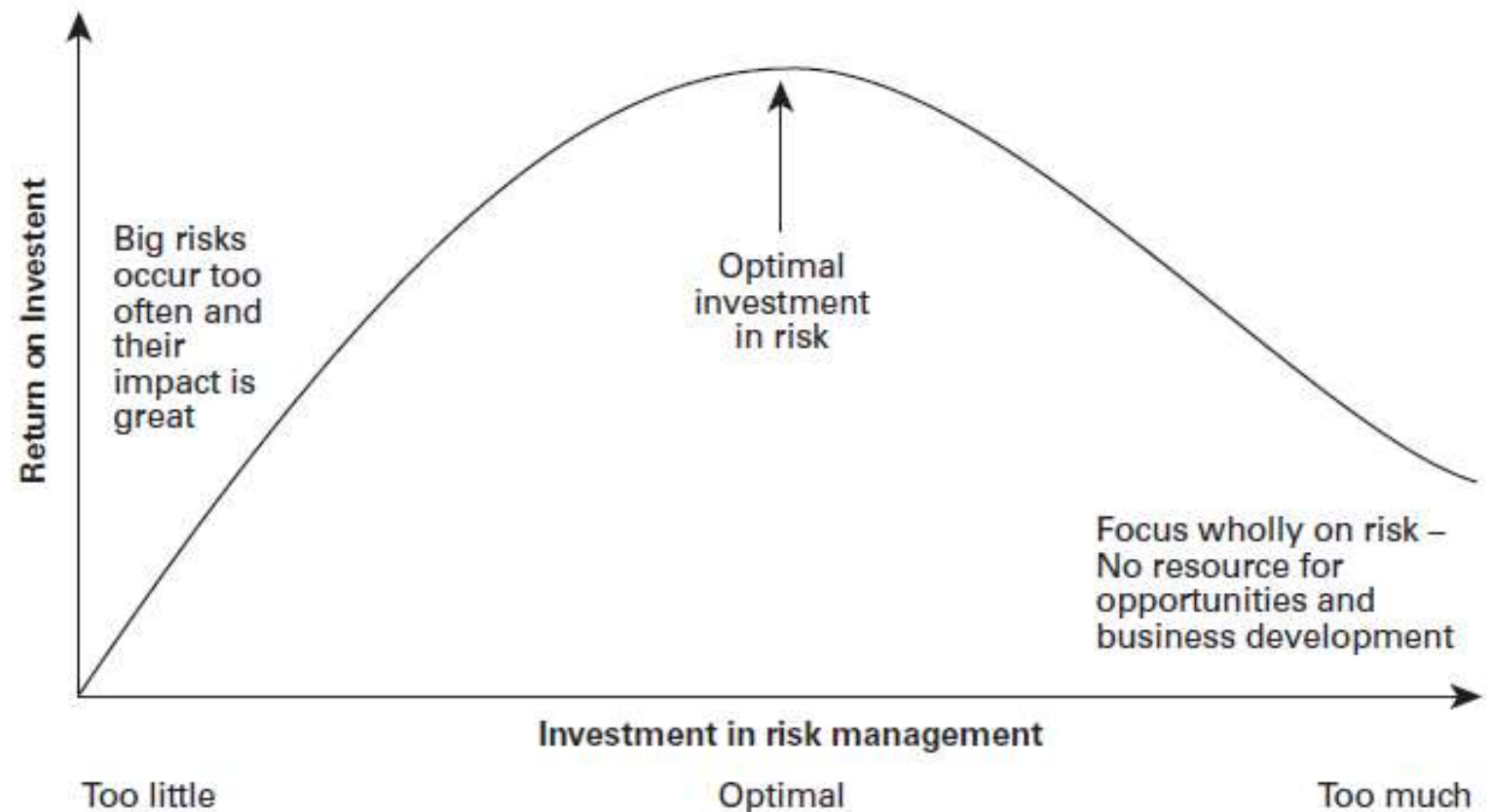
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ISO 31000:2018

Framework

**How does risk management
creates value?**

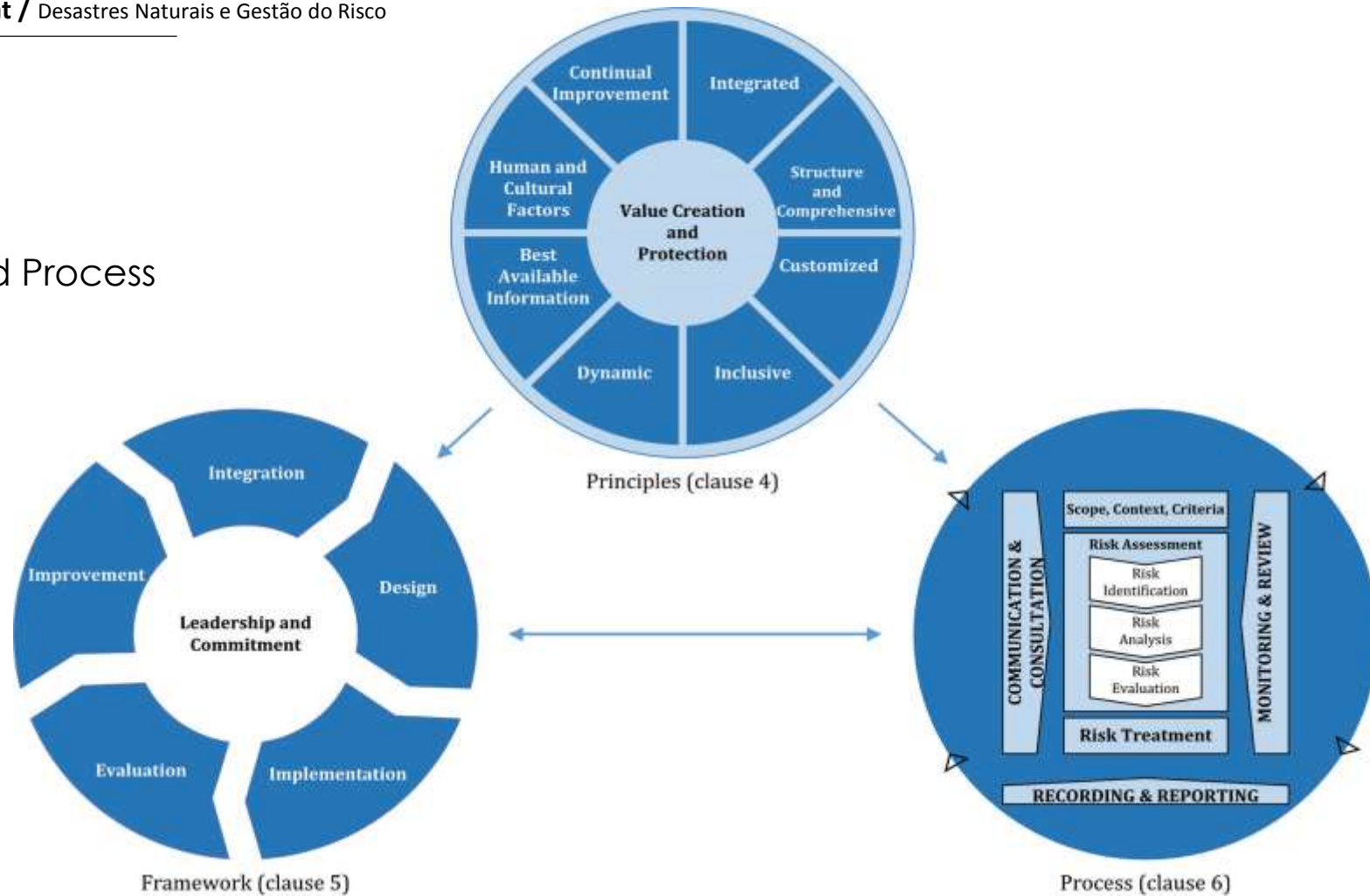


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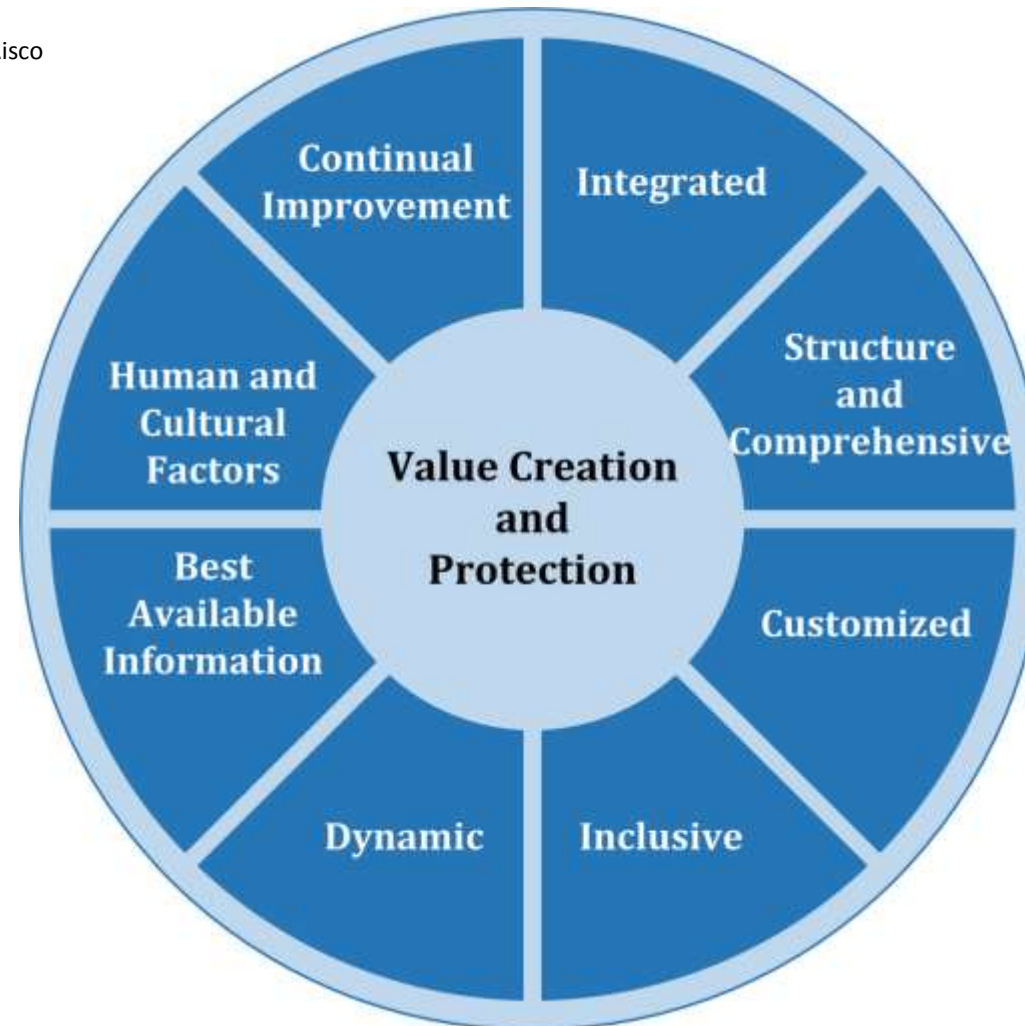
ISO 31000:2018

Principles, Framework and Process



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ISO 31000:2018

Principles

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ISO 31000:2018

Framework

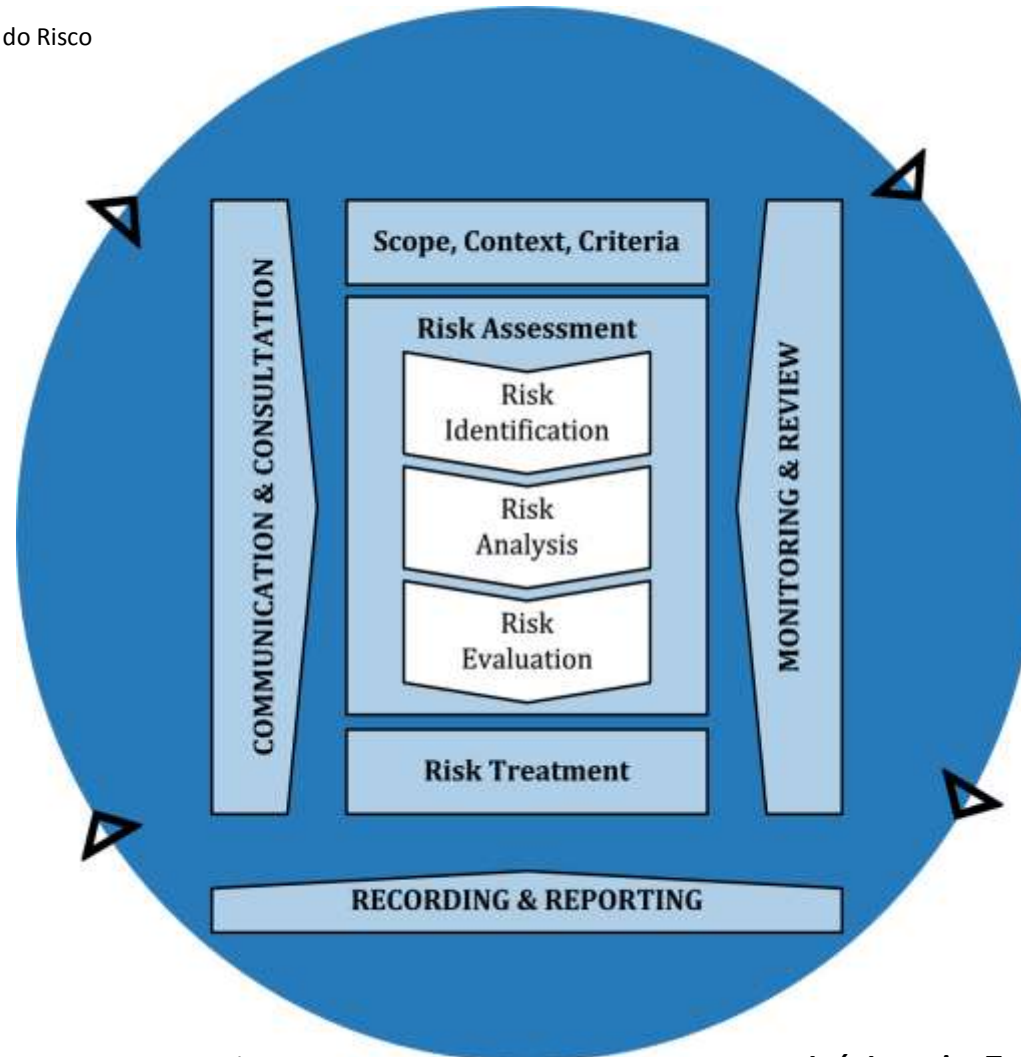


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ISO 31000:2018

Process



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5 - Risk Management in practice; Risk Management in organizations and in specific works

-Risk management plan definition: scheme within *risk management framework* specifying the approach, the management components and resources to be applied to the management of risk;

-Risk management framework definition: set of components that provide the foundations and organizational arrangements for designing, implementing, monitoring and continual improvement risk management throughout the organization;

-Risk Management plans applied to specific infrastructures projects (Dams, Tunnels, Geotechnical works, etc.)

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**ALQUEVA II
REPOWERING PROJECT
/ REFORÇO DE POTÊNCIA**



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ISO 31000:2018 Process

Risk management plan (RMP) / Plano de gestão do risco (PGR) [Repowering Project of Alqueva II Hydroelectrical Dam](#)

Activities in the process of risk management

Establishment of context (scope and criteria)

Risk identification

Risk analysis

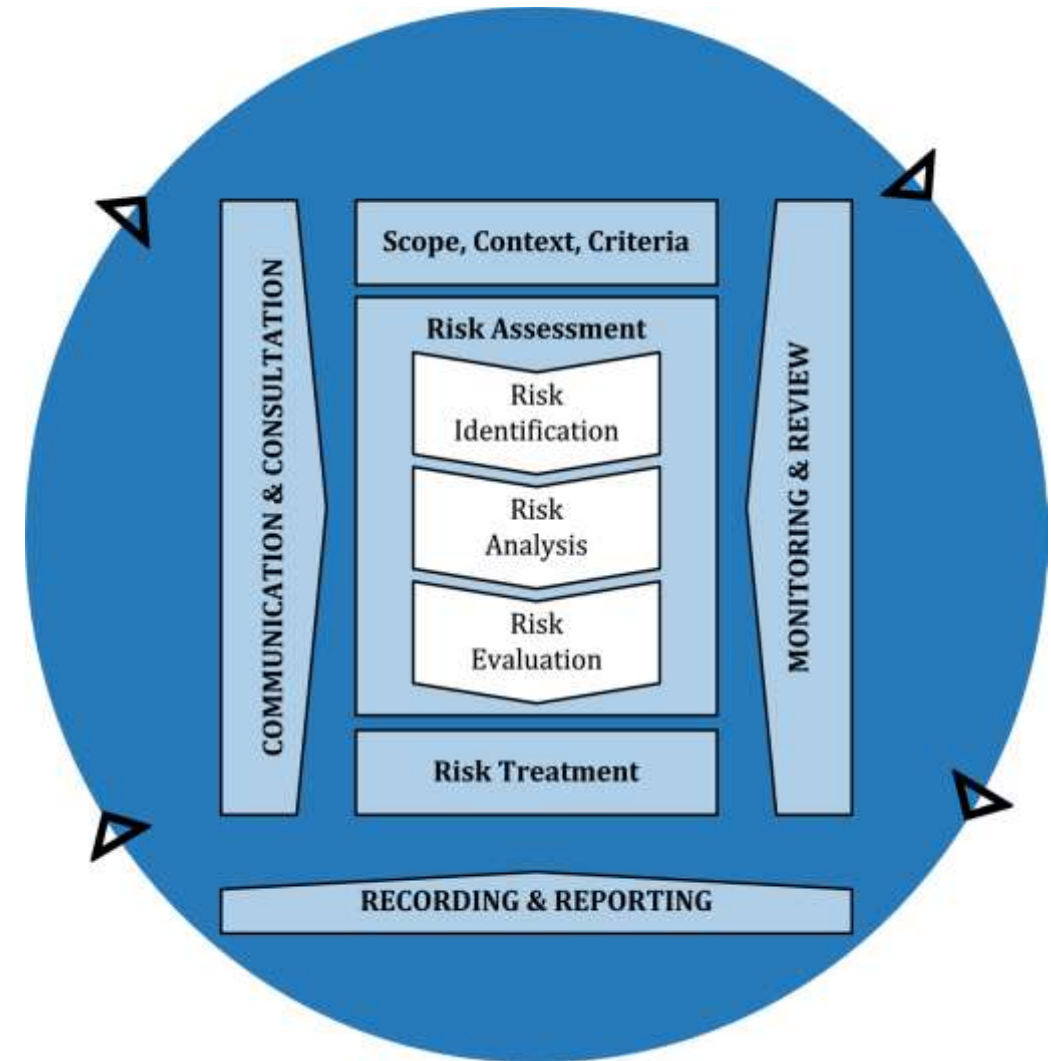
Risk evaluation

Risk treatment

Communication and consultation

Monitoring and review

Recording and reporting



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The following starting risk areas (categories) were defined:

Planning: risks related to terms and costs of the project

Project: risks related to conceptual design

Construction : risks related to site and construction execution

Environmental: risks related to environmental conditions, both in phase of conceptual design and due to local conditions

Health and safety: risks related to construction working conditions and procedures

Societal security: risks related to incidents, emergencies and disasters caused by intentional or unintentional human acts, natural hazards and/or technical failures

Natural phenomena: risks related to occurrence of natural disasters

Social consequences or events: risks related to occurrence of direct or indirect human hazards and/or property damages with impact on public opinion

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Headings of Risk Matrix

ID	Identification and preliminary risk analysis ("cenario" or failure mode)				Initial evaluation			Treatment				Residual Risk			Review
	Risk area (categories)	Risk cenario (failure mode)	Comprehensive description (effects)	Context and additional comments (causes)	Consequences	Probability	Risk degree	Treatment strategy	Risk control measures	Approved action	Implementation	Consequences	Probability	Risk degree	Status control

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Matrix subtitles:

- (1) *ID* – identification number unique for each risk cenario
- (2) *Risk area/category*: planning, design, construction/execution, safety, environment, quality, economic/financial, societal security, natural phenomena, social events, legal
- (3) *Risk cenario designation* (failure mode)
- (4) *Comprehensive description* of risk and how the consequences are perceived by the accountable technical responsible (effects)
- (5) *Short description* of the context and possible causes of the failure
- (6) *Comprehensive description of consequences* (effects)

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Matrix subtitles:

(7) *Probability*

(8) *Risk degree*

(9) *Risk cenario designation*

(10) *Treatment strategy*

(11) *Approved action*

(12) *Implementation*

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6 - Risk Management throughout the different phases of a project implementation:

- Conceptual design phase,
- Tendering and contract negotiating phase,
- Construction phase, etc. (along the life cycle of project);
- thus, we, Civil Engineers, have different roles and responsibilities according to the phases and the stakeholders we work with along the project.

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7 – Risk allocation in projects of infrastructures

- Roles and responsibilities of Civil Engineers;
- In different phases of the works and with different types of stakeholders;
- Models of contracting large projects of infrastructures

Risk allocation under different models of contracts; FIDIC types of contracts :

Construction contracts (Red book);

Turnkey contracts EPC (Engineering, procurement, construction); (Silver book)

Plant and design built contract; (Yellow book)

Role of DAB (Dispute adjudication board)

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RISK ALLOCATION UNDER FIDIC CONTRACTS

(Red Book) – **Construction contract** – (Silver Book) – **Turnkey Projects** – EPC (**Engineering, procurement, construction**)

(Yellow Book) **Plant and Design-Build**



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Scenario for the year of 2025

Two questions:

What will be different in the world in 2025 and ahead...?

What could civil engineers be doing in that different world?

The Scenario Begins

The year is 2025. At the second World Civil Engineering Societies Triennial Symposium in Rio de Janeiro, Brazil, engineers from industry, education, and government met to continue the collaboration started six years ago in Porto, Portugal.

At the conclusion of deliberations, conference organizers submitted the following reports about the status of the sustainability of the world, research and development, risk management, innovation and integration, and reform in the preparation of engineers.

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- 8 – Challenges and skills required for Civil Engineers in the future
 - The Vision_2025
 - Challenges and skills;
 - Education & qualifications;
 - Mobility of engineers.

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THANK YOU!