OPERATIONAL RISK

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Risk Management - Servizio Rischi Operativi

Outline

1. What is operational risk?
2. Real-world examples of major risk events
3. Operational Risk Management Framework in CDP
4. A practical application of operational risk assessment

What is operational risk?

It ain't what you don't know that gets you into trouble. It's what you know for sure that just ain't so

Mark Twain

Introduction

Banks face a number of challenges which may lead to operational risk exposures

- **Complex** geographical and organisational structures
- **Greater reliance** on technology
- **Growth of E-commerce**
- **Mergers and Acquisition**
- **Increased regulation**
- **Growing** trend towards **outsourcing**
- **Terrorism** (domestic and international)

What is Operational Risk?

Basel Committee's definition for the banking industry

The risk of loss resulting from:

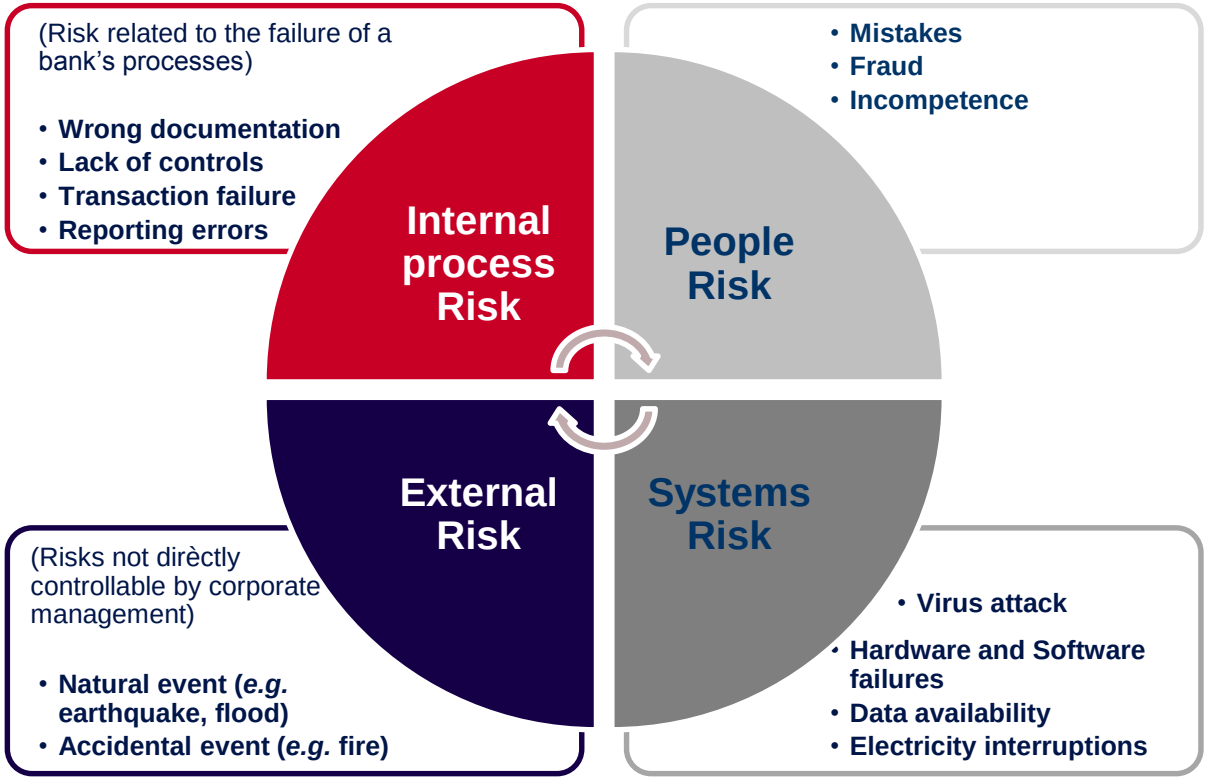
- **inadequate or failed internal processes**
- **people**
- **ICT systems**
- **external events**

Operational risk includes losses resulting from internal or external fraud, human error, employment relationships and workplace safety, business disruption, system unavailability, breach of contract, process management, damage to company assets and natural disasters.

Operational risk includes **legal risk** but not **strategic** or **reputational risk**.

Risk Factor

Causes



Failure to manage operational risk can result in losses in a number of ways

- Business interruption
- Financial losses and costs
- Regulatory penalties / loss of banking licence
- Legal liabilities (legal costs)
- Loss of reputation
- Loss of customers / deposit
- Injury to staff and environmental damage

The Principles for the Sound Management of Operational Risk *(Basel Committee, 2003)*

BANK FOR INTERNATIONAL SETTLEMENTS

Role of Disclosure

Business Continuity

Risk Management: Identification, Assessment, Monitoring, and Mitigation/Control

Developing an Appropriate Risk Management Environment

cdp
cassa depositi e prestiti

The Operational Risk Universe

Loss event Type: the possible types of events can be grouped into 7 categories (according to Basel Committee)

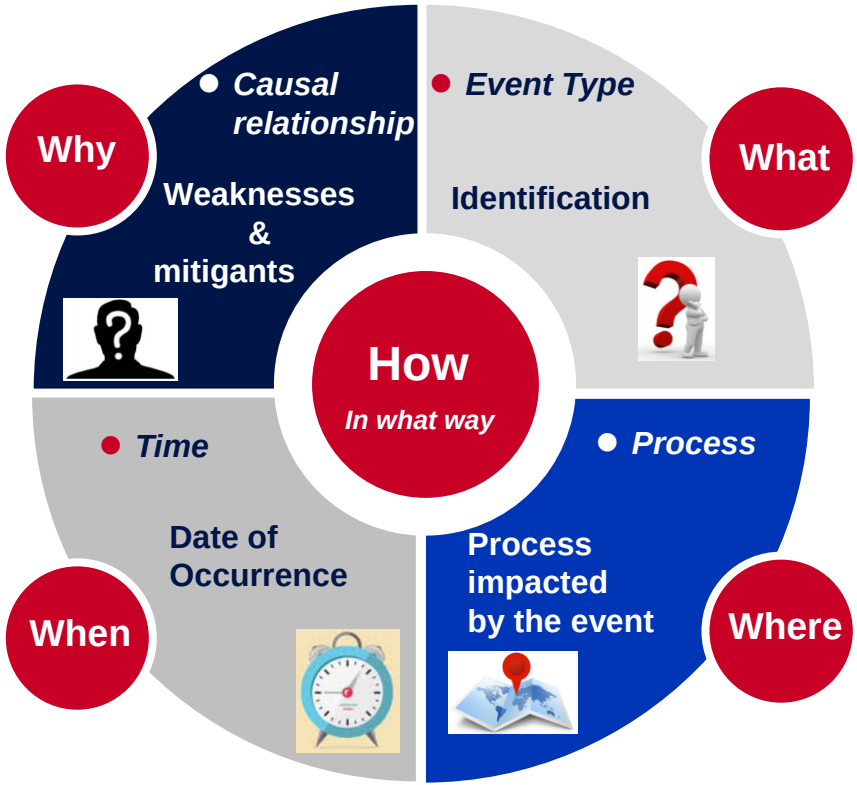
What are the Company's Top Risks

Discussion questions

- **What are the Company's Top Risks? How big are they? How often are they likely occur? How/When is this list updated?**
- **What is Management doing about each of the Top Risks it faces?**
- **What size operating or cash loss has management and the board agreed is tolerable?**
- **How do you measure the success of risk management activities?**

Questions&Answers

Driver (4W + 1H)



Classification of Operational Risk

Operational risk can be classified according to the following factors

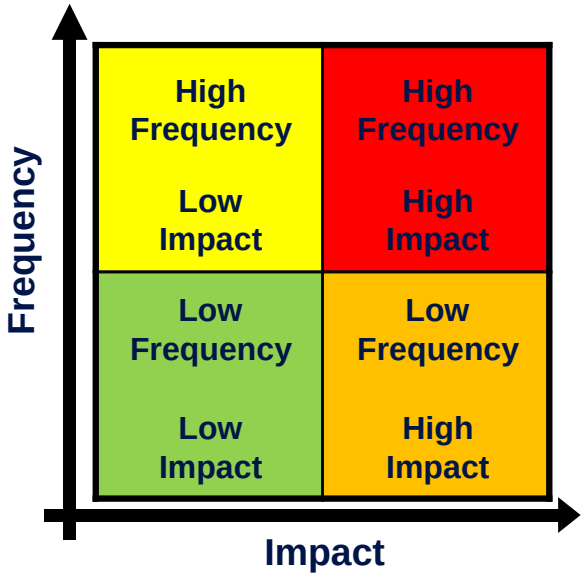
- The **nature of the loss**: internally inflicted or externally inflicted
- The **impact of the loss**: direct losses or indirect losses
- **Risk Factor (causes)**
- The magnitude (or **severity**) of loss and **frequency** of loss

Risk:

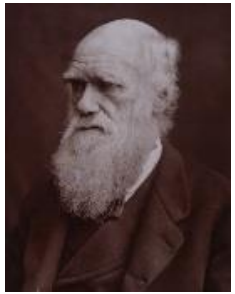
A x B

A **Frequency** - how often the event occurs

B **Impact** - the amount of the losses resulting from the event



Real-world examples of major risk events



It is not the strongest of the species that survives, nor the most intelligent, but rather the one most adaptable to change

Charles Darwin

Major Losses raise importance of incident management

A study of major risk events

- **Many crisis are due to events of operational risk**

- Space Shuttle Challenger disaster,1986
- Salomon Brothers treasury bond scandal, 1991-92
- Orange County bankruptcy, 1994
- Mexico earthquake, 1995
- Barings Bank bankruptcy, 1995
- Sumitomo trading fraud, 1996
- Long-Term Capital Management collapse, 1990
- 9/11 Terrorist attacks, 2001
- Enron/Andersen scandal, 2001
- Space shuttle Columbia disaster, 2003
- Hurricane Katrina, 2005
- Real Estate Bubble bursts, 2007
- Lehman Brothers bankruptcy, 2008
- Bernard Madoff investment fraud, 2008
- Haiti and Chile earthquake, 2010
- Deepwater Horizon Accident, 2010
- Volcano eruption in Iceland, 2010
- Japan earthquake and tsunami, 2011

Major Losses raise importance of incident management

BARINGS PLC – 1995, USD 1.3 Bln – unauthorized trading by Nick Leeson

- **Nick Leeson** (the man who destroyed a bank):

  <<*I knew I'd still lost millions of pounds, but I didn't know how many. I was too frightened to find out—the numbers scared me to death. . . . I'd gone in trying to reduce the position and ended up buying another 4,000 contracts. . . . Traders looked at me and knew I'd done an amazing volume of trade; they marvelled at the sheer amount of business I'd got through.*

They wondered whether I was dealing for myself or for clients, and whether I'd hedged, protected my position. But they knew - as the whole of Asia did - that I'd built up an exposure to over £11 billion worth of Japanese shares. They were doing their sums and they reckoned I was well long: it was hard to conceal it when you stand for over 40 percent of the Singapore market. The rest of the market had smelled what Barings back in London were completely ignoring: that I was in so deep there was no way out>>.

Operational Risk Management Framework in CDP

Risk comes from not knowing what you're doing

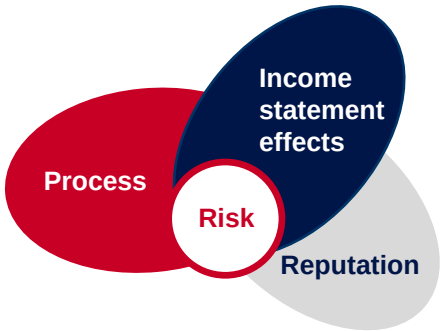
Warren Buffett

Identification and assessment of the operational risk in CDP

Operational Risk Management Framework in CDP

In CDP Operational Risk Management identifies and assesses the operational risks in all processes of the company

1) It is important to verify the impact



2) We have to implement an Action Plan

3) The identification of operational risks includes:

TOOLS

- **LOSS DATA COLLECTION**
- **RISK SELF ASSESSMENT**
  - ✓ **Risk mapping**
  - ✓ **Risk and Control assessment**

Loss Data Collection in CDP

Internal loss data is crucial for tying a Company's risk estimates to its actual loss experience

1 Scope of Loss data Collection

- **Loss Data** recorded in the income statement
- **Near miss** (event that do not lead to a loss)

2 Collection and classification

- **ORM Referent**
- **Events should be categorized into one of the 7 categories of Basel Committee**

ORM Referents are the people in CDP involved into the collection of information about the events of operational risk

3 Database

- **Events should be collected in a DB** in order to ensure the **integrity, confidentiality, and availability** of collected information

4 Accounting reconciliation

- Verify that all relevant losses **are recorded in the database**

Risk Self Assessment in CDP

Risk mapping

1 Risk Mapping

Identification of the operational risk in all processes

What can go wrong?

Process Model		Loss Event Type		
I level	**II level**	**Internal Fraud**	**External Fraud**	**ICT failure**
Operational Process	Credit	✔		✔
	Lending	✔	✔	✔
	Finance		✔	
	ICT			✔

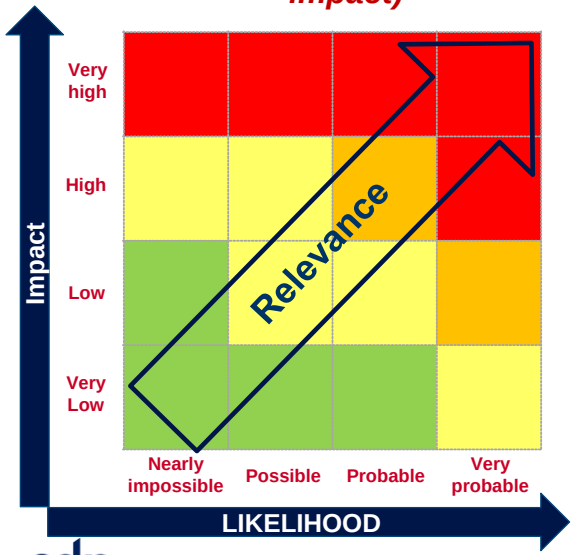
Risk Self Assessment in CDP

Risk and Control assessment

2 Risk and Control assessment

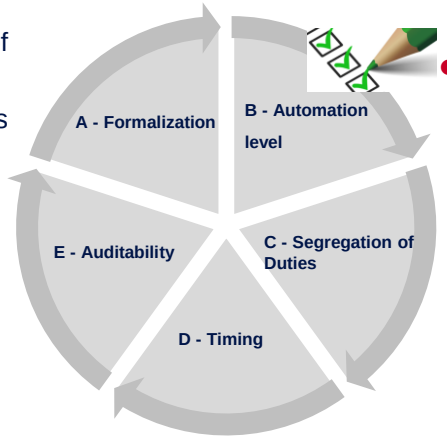
Evaluation of the exposure to Risk in the Heat Map

(combination between the probability and impact)



Assessment of controls' adequacy

- Representation of the control in the Company policies
- Possibility to reperform the control

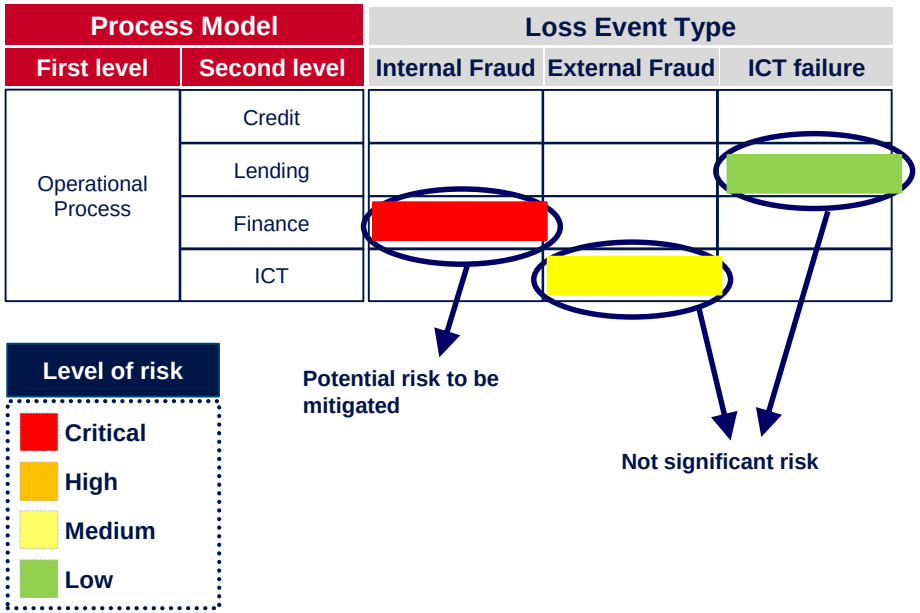


- Automatic control *vs* manual control
- Who controls is not the one who makes the activity
- Ex ante control *vs* ex post control

Risk Self Assessment in CDP

Actors and Goals of RSA

Identification of the mitigant



Roles and responsibilities

- **Business:**
  - Identifying and managing risk
- **Risk Management:**
  - Ensure that the Risk Self Assessment reflects the risk profile of the business
  - Making sure the RSA is updated by the process owners in case of changes in the processes
- **Regulators, Internal Audit and Control**:
  - Periodically review and test to validate the results of RSA

How can we make this?

Main steps

- The first step of operational risk management is related to do **a list of possible events** that are considered under this category of risks.

- It's important to develop **a common language that is shared** - at every level of a Company -, in order to avoid overlap with other types of risk or misunderstanding.

- According to definition of Basel Committee, risk factor can be divided into **4 cluster**:
  - **internal process risk**
  - **people risk**
  - **systems risk**
  - **external risk**

A practical application of operational risk assessment

People asking questions
lost in confusion.
Well I tell them there's no problem.
Only solutions.

J. Lennon, 'Watching the wheels' (Double Fantasy, 1980)

New product

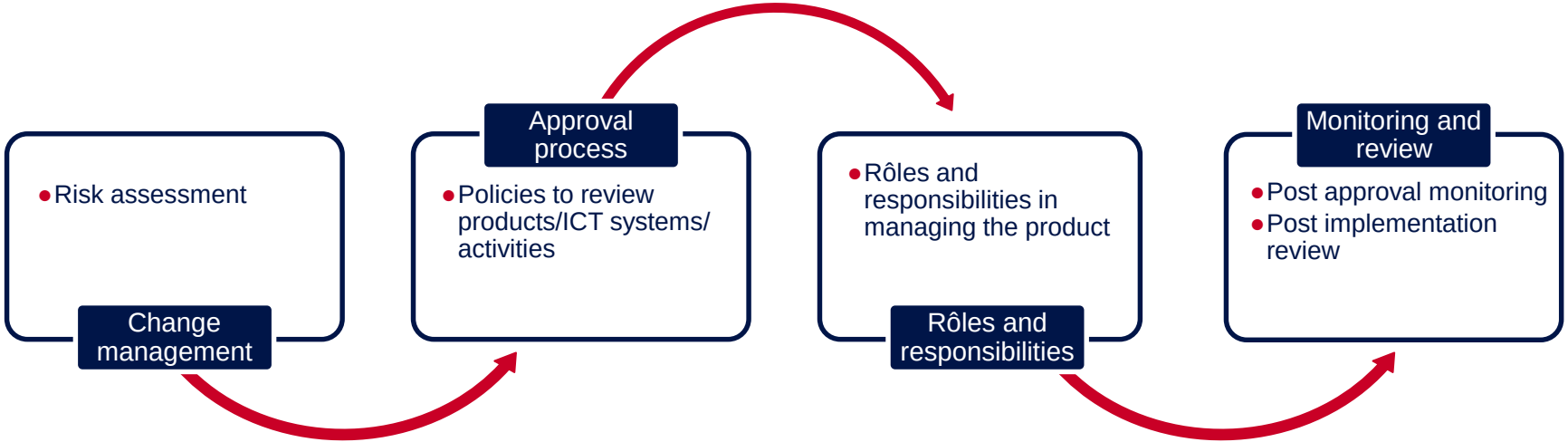
Definition *(1/2)*

Regulations

A **Principles for the Sound Management of Operational Risk**

Description

- Senior management should ensure the identification and assessment of the operational risk inherent in all material products, activities, processes and systems to make sure the inherent risks and incentives are well understood [Basel Committee et. al (2011)].



New product

Definition *(2/2)*

- A product is new when the current operational context of a company (e.g., pricing models, ICT systems, and organizational models) does not allow it to develop, distribute, manage, and control it.

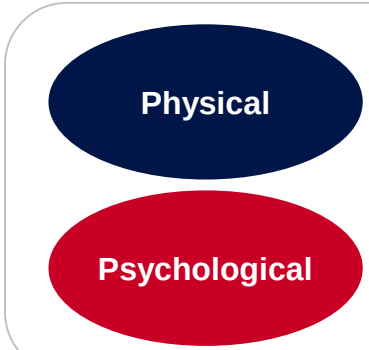
It is difficult to apply classical Risk Assessment techniques without expertise and historical operational losses

The Analytic Hierarchy Process

Introduction

AHP

- The Analytic Hierarchy Process* (AHP) is a **theory of measurement** through pairwise comparisons which relies on the judgements of experts to derive priority scales. It allows to study the following **events**:



- kind of **objective reality** outside the individual conducting the measurement
- **subjective ideas and beliefs** of the individual about himself or herself and the world of experience

AHP is a **decision-making framework** for the multi-criteria analysis, indeed, it considers - at the same time - both **qualitative and quantitative factors**

The AHP provides many criteria and sub-criteria used to rank the alternatives of a decision (in our case, the operational risk events).

* Model developed by the mathematician Thomas L. Saaty (1926-2017) during the 1970s.

The Analytic Hierarchy Process

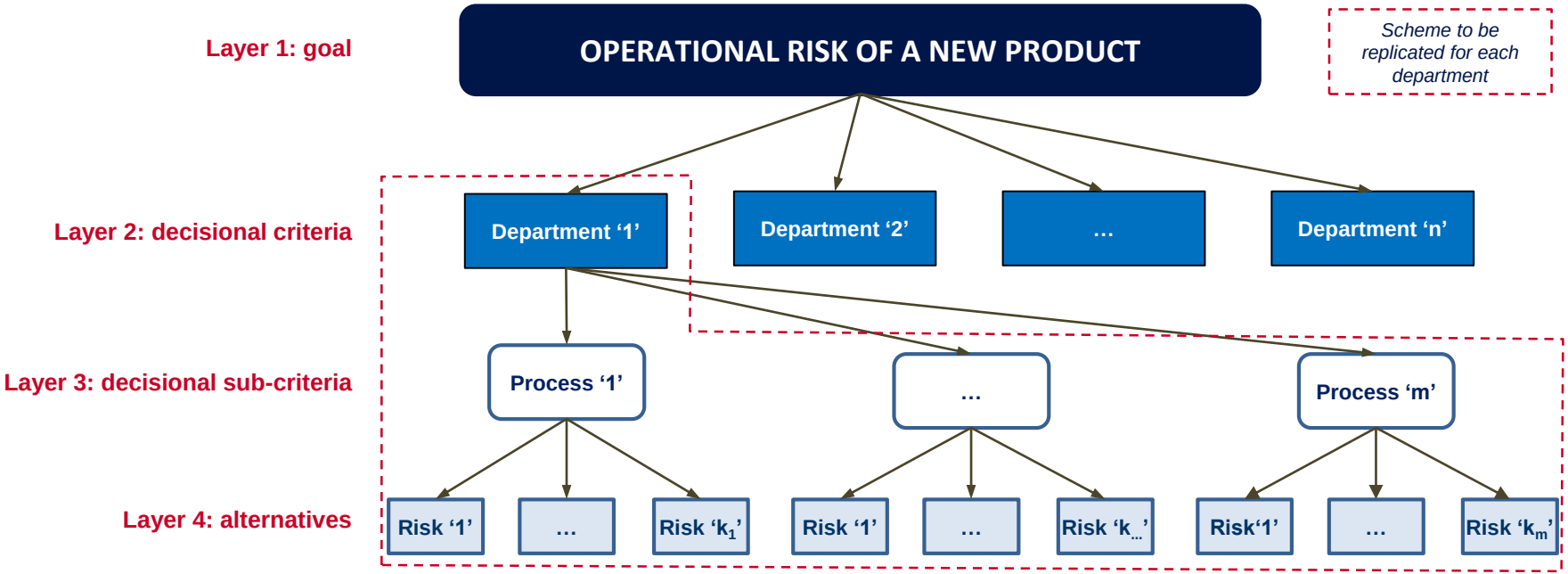
Pros

	PROS	DESCRIPTION
A	Synthesis of subjective ideas/beliefs in an **objective reality**	Coherent quantification of qualitative judgments
B	Coherent assessment in **absence of historical losses**	Possibility to analyze a product whose **operation** is **unknown**
C	**Less time** needed to solve conflicts among process owners	Providing techniques to weigh judgements of different experts on the same scope
D	**Increase** in the **detail of the analysis**	The output of the model is a **rich set of information**
E	Reduction of the **cognitive biases**	Possibility to **quantify process owner's cognitive biases** by means of simple calculations

The Analytic Hierarchy Process

Hierarchy

- AHP provides the representation of a problem through a **multi-layer hierarchy**



The Analytic Hierarchy Process

Semantic scale

- A cluster is a set of elements related to the same upper-layer element of the hierarchy
- The items of a cluster are pairwise compared by means of a semantic scale

Intensity of importance on an absolute scale	Definition	Explanation
1	Equal importance	Two activities contribute equally to the objective
3	Moderate importance of one over another	Experience and judgment slightly favour one activity over another
5	Essential or strong importance of one over another	Experience and judgment strongly favour one activity over another
7	Very strong importance of one over another	An activity is favoured very strongly over another; its dominance demonstrated in practice
9	Extreme importance of one over another	The evidence favouring one activity over another is of the highest possible order of affirmation
2, 4, 6, 8	Intermediate values between the two adjacent judgements	When compromise is needed

The Analytic Hierarchy Process

Pairwise comparison matrices

- The judgments of the experts are collected into a square matrix

GENERIC PAIRWISE COMPARISON MATRIX WITH '*N*' ITEMS

Goal	*Item 1*	*Item 2*	*Item ..*	*Item N*
Item 1	1	a_{12}	$a_{1..}$	a_{1N}
Item 2	$1/a_{12}$	1	$a_{2..}$	a_{2N}
Item ..	$1/a_{1..}$	$1/a_{2..}$	1	$a_{..N}$
Item N	$1/a_{1N}$	$1/a_{2N}$	$1/a_{..N}$	1

The matrix is 'reciprocal': one has to just fulfil a triangle to complete it!

Each item is equally important to itself (the diagonal elements are equal to unity)

In making clusters, an operational risk analyst should try to pick **few elements** to simplify the analysis

The Analytic Hierarchy Process

Risk ranking

- For each matrix, one can calculate the '**n**' **eigenvalues** (where n is the dimension of the square) by means of the following equation

$$det(A - \lambda I_n) = 0$$

dove

det *= determinant of the matrix* $(A - \lambda I_n)$

A *= pairwise comparison matrix*

λ *= eigenvalues*

I_n *= identity matrix of dimension 'n'*

- Given the **maximum eigenvalue**, we calculate its **normalized eigenvector**, which provides '**n**' **priorities** (%) that constitute the relative weight of an item in a cluster (so called '**Local Scale**')

- To rank the items of a given layer in a decreasing order of relevance, we weigh their priorities with those of the upper layer items to which the former are linked (so called '**Global Scale**')

Our aim is to achieve a ranking of the risk events

EXAMPLE

ID	Descrizione del rischio	Process	Department	Priority
1	Risk '1'	Process '1'	*Dep. '1'*	'x_1%
…	…	…	…	…
i	Risk 'i'	Process '2'	*Dep. '2'*	x_i%
…	…	…	…	…
j	Risk 'j'	Process 'i'	*Dep. 'i'*	x_j%
…	…	…	…	…
N	Risk 'N'	Process 'm'	*Dep. 'n'*	x_N%

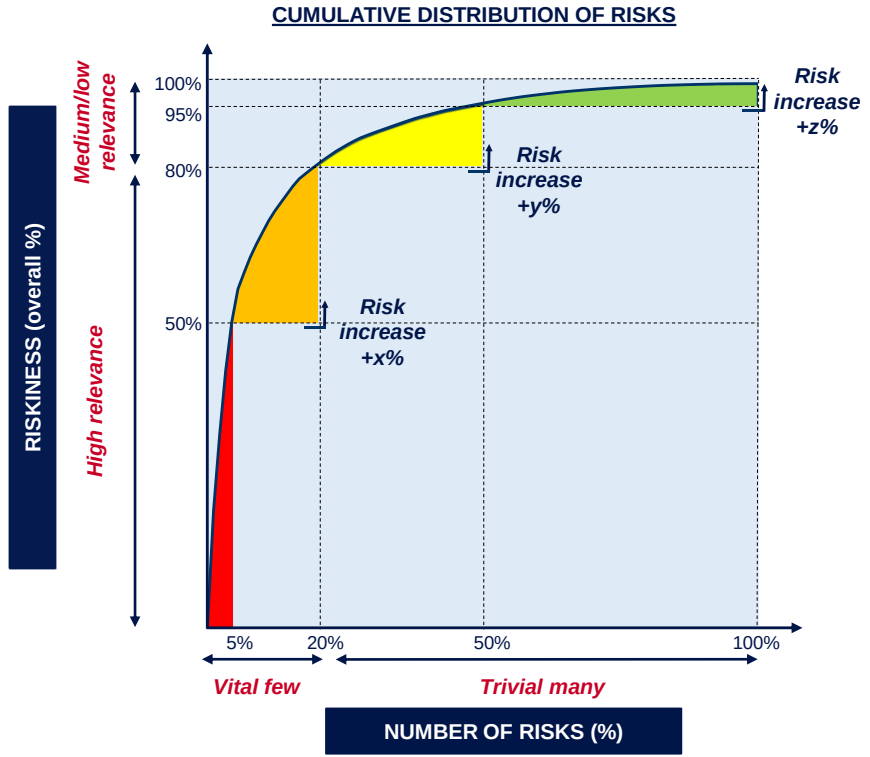
80/20 rule

Pareto distribution

Risk ranking
≠
Risk rating

‘80/20 rule’

From the **CDF** of risks (listed in a decreasing order of relevance), we can deduce the **relative contribution of each risk class** to the overall exposure arising from the new product



* This rule has been introduced by V. Pareto (1848-1923) and later theorized by M. Juran (1904-2008).

80/20 rule

Risk rating

By means of appropriate **cutoffs on the cumulative distribution function of risks** we can define risk rating classes

High relevance risks

- Although they only constitute the 20% of total risks, their relative contribution to the overall risk of the product is approximately equal to the 80%

Medium/low relevance risks

- About 80% of total risks, they contribute in a residual manner (≃20%) to the overall risk of the product

	Risk rating	Relative contribution to risk	No. of risks
High	Critical	≅50%	≅5%
	High	≅30%	≅15%
Medium/low	Medium	≅15%	≅30%
	Low	≅5%	≅50%

Annex ‘AHP real-world applications’

Annex

AHP real-world applications

Inter-American Development Bank

The Inter-American Development Bank made up internal workforce selection teams, using AHP to support decision-making. These selections concerned, for instance, the choice of the best system for automating both the investment activities and the accounting reconciliation process

Source: Forman, E., & Selly, M. A. (2001). Decision by objectives (How to convince others that you are right). Washington DC: World Scientific.

Nuclear Regulatory Commission

The government agency used AHP to simplify the decision-making process (involving 35 people) on the optimal allocation of an IT projects portfolio (greater than $ 100mln)

Source : Saaty, T. (2008). Decision making with the analytic hierarchy process. International journal of services sciences, 83-98.

Department of Defense (USA)

The american Department of Defense developed a AHP model to help decisions for the project *'Base Realignment and Closure*' aimed at enhancing the placement of military installations at the end of the Cold War

Source : McMillan, C., "The Tough Job Someone Has To Do," Defense, pp. 16-23, May/June 1991.

Annex

AHP real-world applications

British Airways

During 1998, the british airline company used AHP to select the best ICT system to handle cargo operations

Source: Roper-Lowe , G., & Sharp, J. (1990). The analytic hierarchy process and its application to an information technology decision. Journal of the Operational Research Society, 49-59.

United States presidential election, 1992

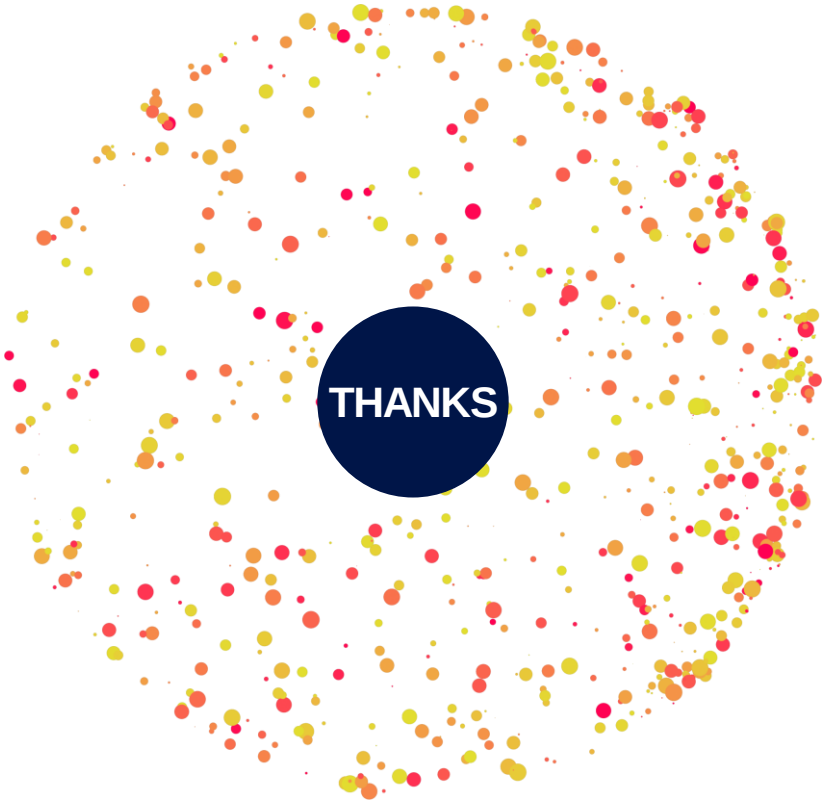
Saaty made an analysis based on AHP to guess the candidate who would win the 1992's United States presidential election (Clinton-Bush-Perot), besides, he also came close to the the effective percentages of preference

Source: Saaty, T. (2005). Making and validating complex decisions with the AHP/ANP. Journal of Systems Science and Systems Engineering, 14(1), 1-36.

Superbowl 1996

Saaty and one of his PhD student, by means of the AHP, guessed which teams would have joined the *Superbowl* (namely, Pittsburgh e Dallas) and which would have win (namely Dallas, with regret of the same Saaty, Pittsburgh fan)

Source: Saaty, T. (2008). Decision making with the analytic hierarchy process. International journal of services sciences, 83-98.



References:

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