# THE EVOLUTION OF APF: ENAV APPROACH

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# Introduction

The EUROCONTROL APF ESARR2 introduces a new approach to safety, based on the evaluation of ATM performances, integrating the principles of a Multicriteria Decision Making methodology: the Analytic Hierarchy Process.
This flexible tool presents a set of features that can be investigated, to extend this first application towards an effective managerial decision support system.
In the next 15 minutes, a project of evolution will be presented, based on ENAV requirements to go beyond the synthetic evaluation of ATM Safety, exploring all the possibilities that MDM analysis allows. To this extent, La Sapienza (partner of Italian AHP Academy through the skills of its spin-off aiComply) was called to design the research path.

ENAV S.p.A.

aiComply

Spin off di

SAPIENZA
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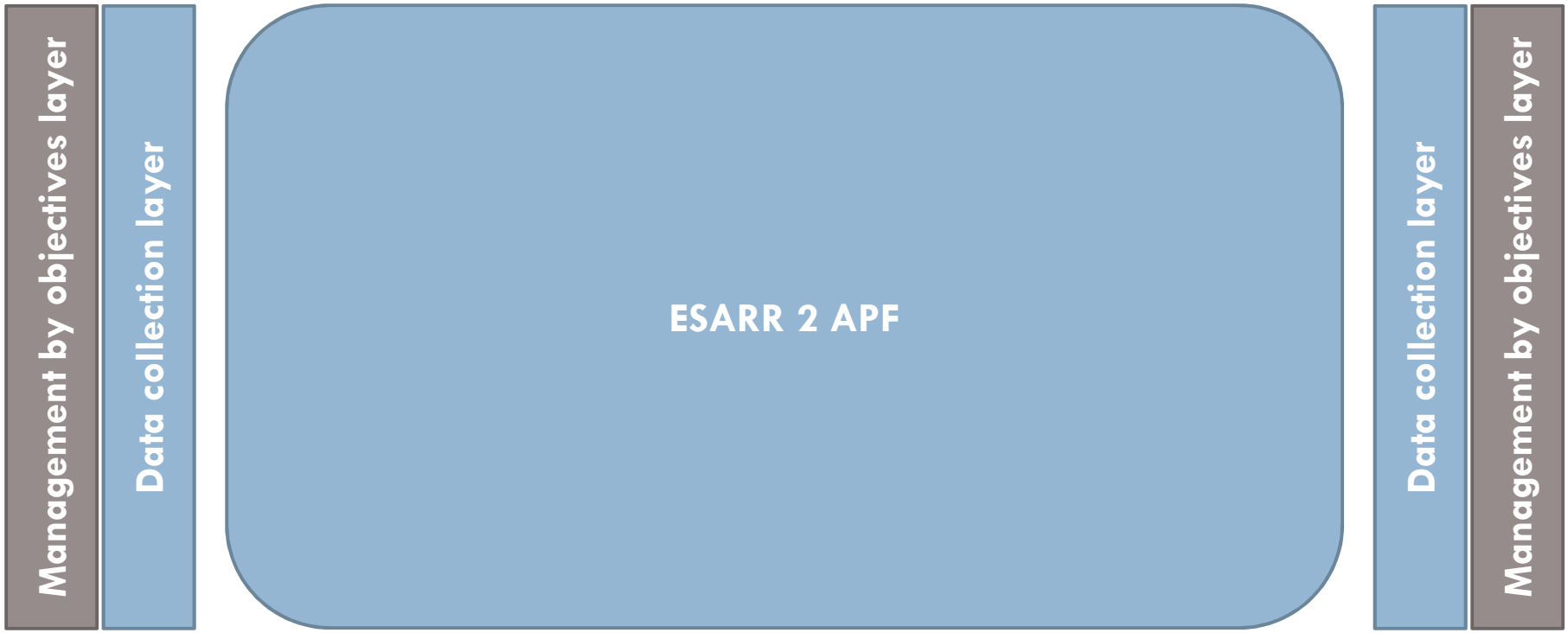
# ESARR 2 Aerospace Performance Factor


- Data related to different ATM events can be combined (and weighted) to define a global index of safety
- Trend and threshold analysis can identify a general level of safety, according to the scope of the study (local airports, regional, entire organization, etc.)

# The ENAV path of APF evolution: 1st stage



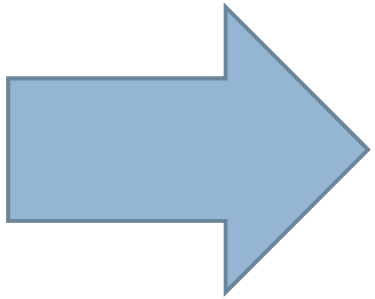

- The ESARR 2 APF is a tool to evaluate past events, as it's based on historical data
- Beyond ESARR 2, ENAV needs a strategic perspective: this can be realized, combining APF with a "management by objectives" layer

# Management by objectives

The AHP is a framework that can be expanded adding different level of analysis, criteria of evaluations and alternatives to compare and weight. The scope of the **Management by Objectives layer** is to improve the APF, adding and integrating elements that could contribute to better evaluate the capability of the organization to define and reach objectives:

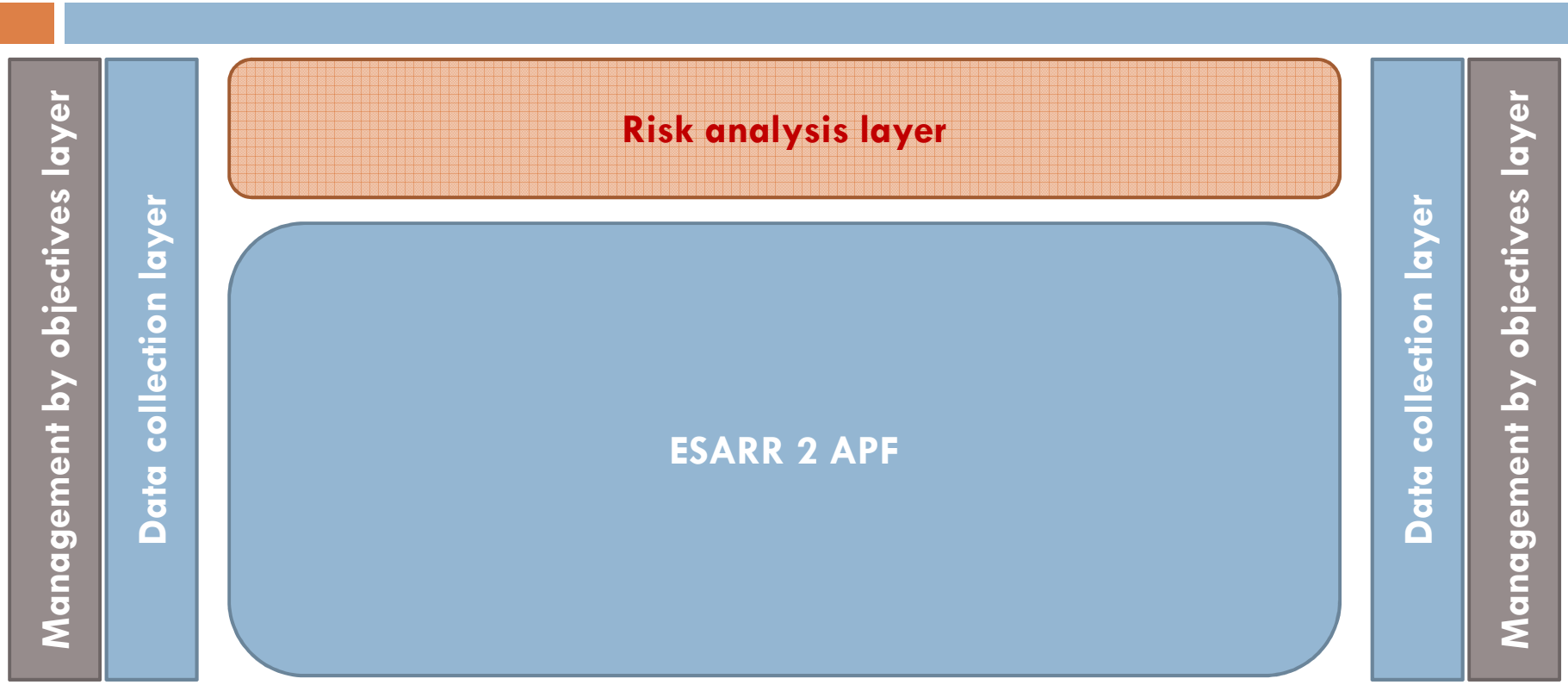
- determining targets to reach (absolute or relative values)
- weighting their influence
- assessing the general tendency of improvement according to the program scheduled and the results achieved

**From an absolute evaluation of the APF (weighted sum of data)**



**To an evaluation of the degree of completion of APF programs (weighted sum of results)**

# The ENAV path of APF evolution: 2nd stage



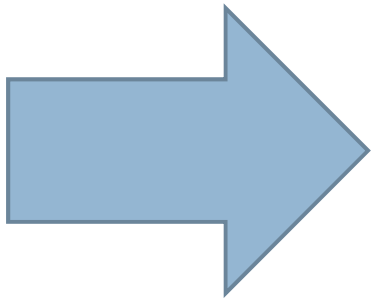

- Pair-wise comparisons in terms of "importance" or "riskiness" of events and targets in the mind map are not easy to make: the reliability of this process depends on the structure of preferences of the experts
- A "risk analysis" layer can define specific criteria to refer in the evaluation processes

# Risk analysis

The process of evaluations grants the coherence of the opinions of experts, but on which criteria are they expressed? Do they have the same background and vision ? How can this process be assisted to grant a risk assessment perspective (in terms of impacts and frequencies)? A **Risk analysis layer** can act as a level 0 of the mind map to represent the criteria of the analysis:

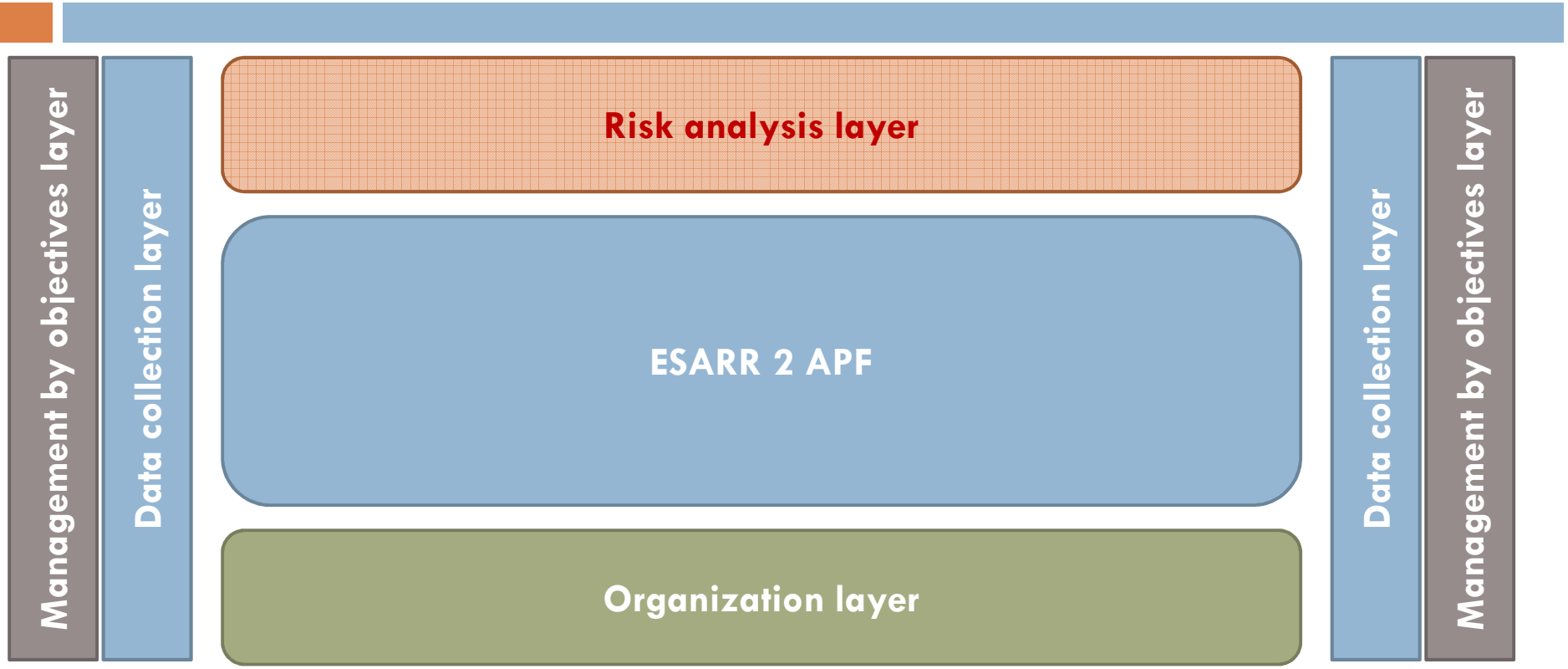
- describing risks in its characteristics of impact and frequency :
  - *magnitude of impact*
  - *reversibility of impact*
  - *chain effects*
  - *occurrence*
  - *degree of exposition*
  - *possibility of avoidance*
- allowing no more comparisons on a simple scale of "importance" but directly on dedicated risk metrics

**From an evaluation of the relative degree of importance of factors (Saaty's traditional scale)**



**To a dedicate risk management perspective (risk assessment indicators, to build on needing)**

# The ENAV path of APF evolution: 3rd stage



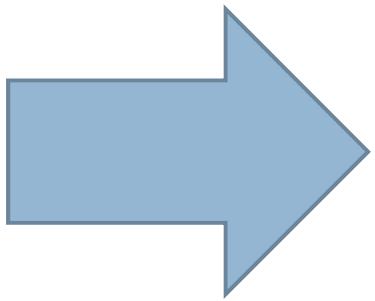

- ESARR 2 mind map refers only to tangible and reported events
- Safety is generally affected by intangibles and indirect causes and can be improved by right management decisions (as for training, investments, resources allocation etc.)
- An “organization” layer helps to complete the evaluation, extending the mind map with new elements

# Organization

A level of safety can be represented by the correlation of the events, opportunely combined, but in which measure managerial leverages can contribute to its improvement? Even if events (incidents or accidents) didn't happen, how can we ensure a level of safety? It's the results of the process of corporate governance or it's just a matter of chance? An **Organization layer** can represent both intangibles and actions that can influence future and long term results:

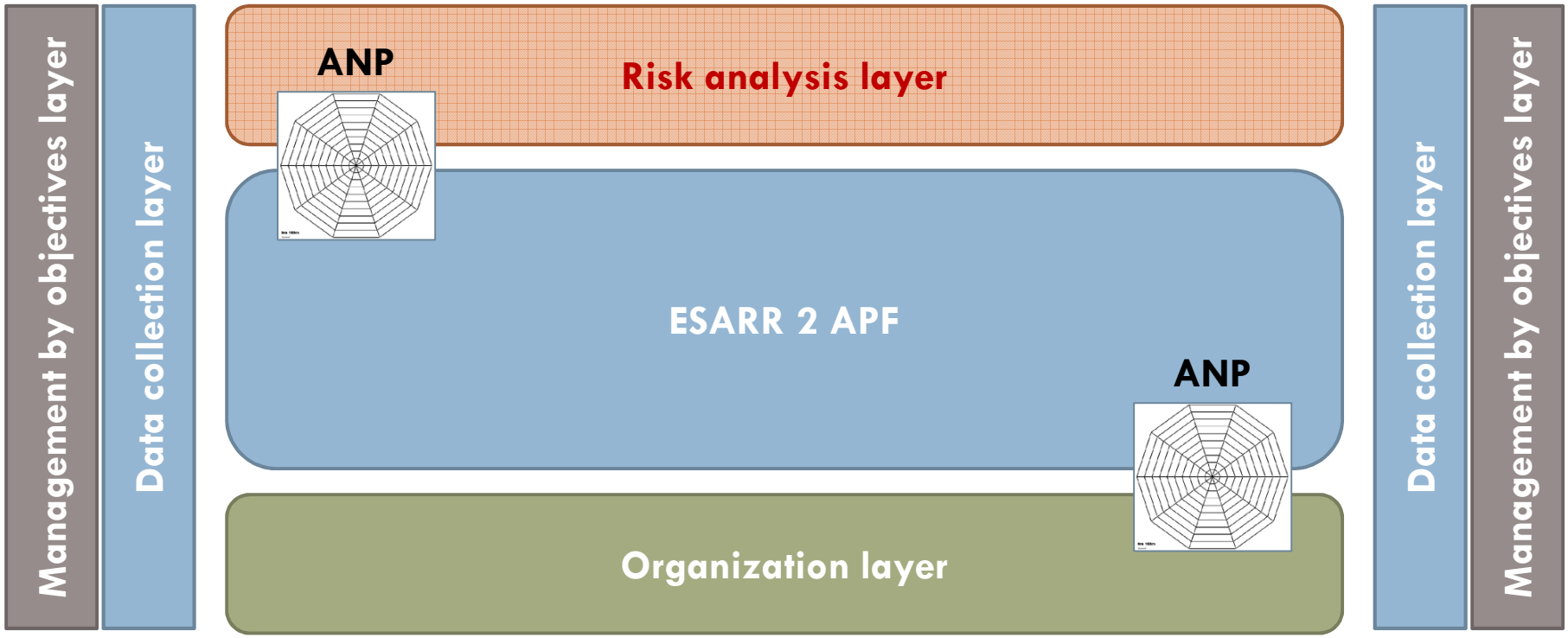
- putting the basis to evaluate actions and their expected benefits
- coordinating these actions in a framework that could assess impacts and cause-effect relations
- proposing a tool of "what-if" analysis, simulating different scenarios, depending on the different management policies

**From an evaluation of the actual status (situation "as is" on data)**



**To an evaluation of future possibilities (situation "to be" through management choices)**

# The ENAV path of APF evolution: 4th stage



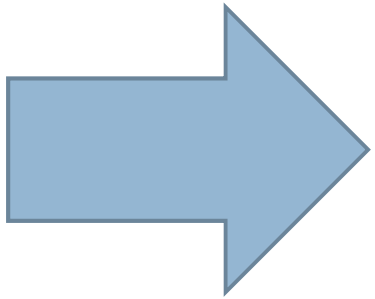

- AHP is a framework for weighting and selecting alternatives where the elements (events and criteria) can be considered independent
- As the introduction of the "organization" layer as an impact in terms of correlations among the elements of the mind map, an Analytic Network Structure has to be developed to assess these impacts

# Analytic Network Process

In a hierarchy (as for Analytic Hierarchy Process) the criteria and their importance are often brought to evaluate alternatives and to make a decisions from previous knowledge of the subject.
Complex problems involve dependence and feedback. In a network (as for **Analytic Network Process**), the elements in a component may influence other elements in the same component *(inner dependence)* and those in other components *(outer dependence)* with respect to each of several properties. The pair-wise comparison process is so extend to evaluate correlations.

***Feedback improves the priorities derived from judgments and makes prediction more accurate.***

**From an Analytic Hierarchy Process (independence of criteria)**



**To an Analytic Network Process (correlations among criteria)**

# The APF evolution: an example

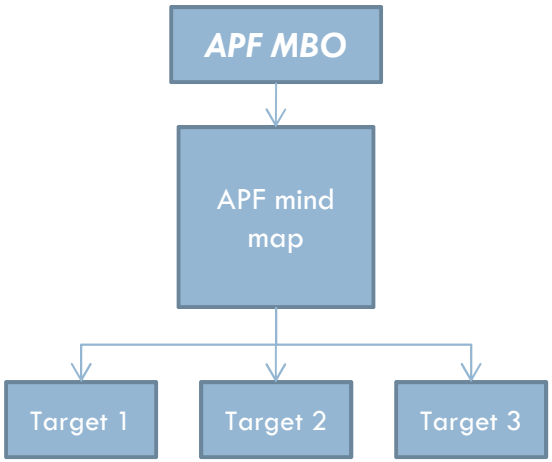
After this evolution, the extended APF management tool will be implemented in scorecard that could include:

**APF ESARR 2** → **Defines the level of SAFETY according to the data collected**

**APF MBO** →

**Periodically, ENAV could define target to reach for some elements of the APF mind map in terms of:**

- **threshold values to reach/to keep ("keep Level Bust below…")**
- **trends to invert/maintain ("invert Inadequate Separation annual trend from +…% to -…%")**
- **qualitative or quantitative improvements ("strongly reduce Runaway Incursions")**




**Simply speaking, only these elements are "turned on" in the mind map and the % level of completion of these targets is combined (weighted) to determine a level of PLANNED SAFETY**

# The APF evolution: an example

**APF RISK**


**According to the new ANP mind map (which integrates Organization as elements and Risk Analysis as criteria), a risk evaluation can be made. Every element of the map is pair-wise weighted on frequency and impact criteria, allowing also internal feedback.**

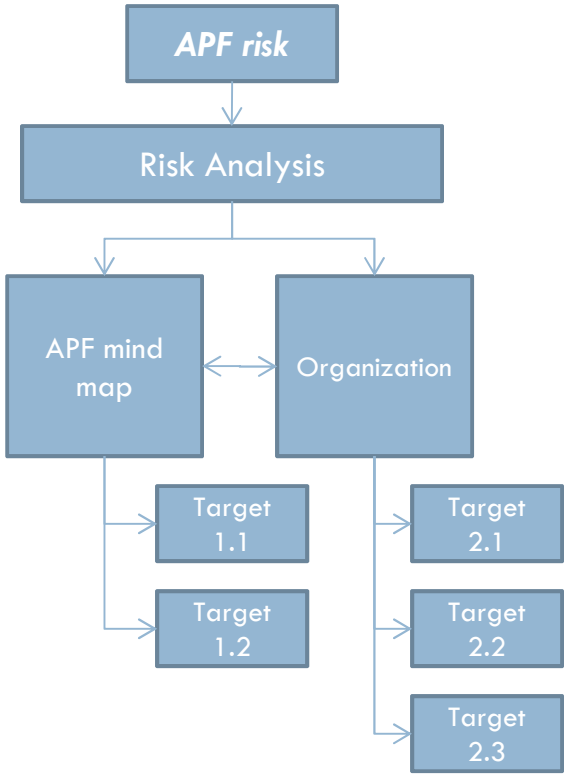
**Here is a limited set of sample questions:**

- **in terms of "possibility of avoidance", what is more risky between "Failure Communication Function" and "Failure Data Processing Function"? (APF AHP)**
- **in terms of "possibility of avoidance", what is more effective between "Training" and "Investments"? (Organization AHP)**
- **what is more effective on "Failure Communication Function" between "Training" and "Investments"? And on "Failure Data Processing Function"?**

**Data of all these elements can so be combined in a level of INTEGRATED RISK**

# The APF evolution: an example

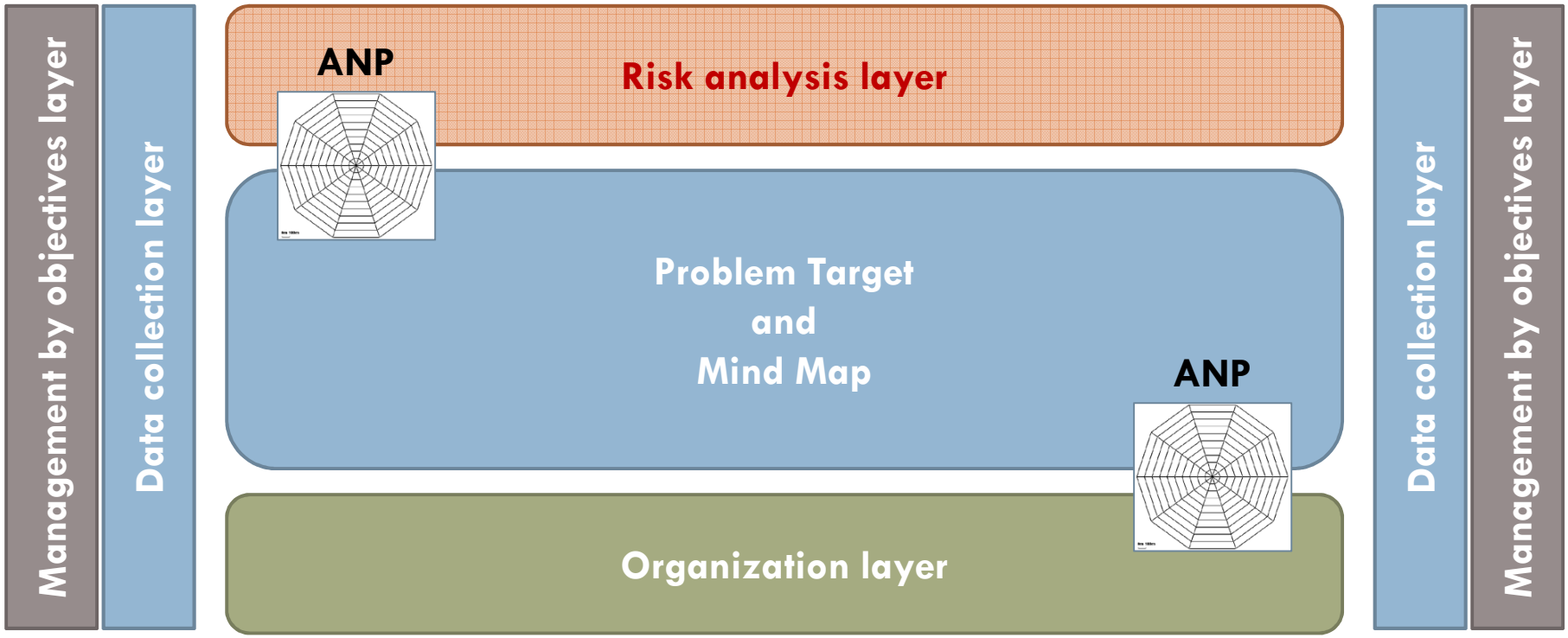
**APF RISK MBO**




**With the same approach of APF MBO, targets can be periodically defined both on APF and Organization elements (i.e. amount of investments, number of audit on the management systems, level of training).**

**At the end of the project, the scorecard is so completed with a level of PLANNED INTEGRATED RISK**

# The decision support system



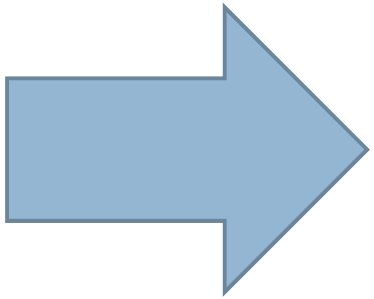

- This framework can be applied in terms of risk management and management by objectives, defining new mind maps of problems to evaluate (i.e. operational quality, systems validation, impacts of regulations or standards, supplier selection, etc.)
- It can be seen as a management standard and a decision support tool for strategic improvement of the organization

# The decision support system

Once all the layer of analysis are built, a new **decision support system** is generated. Once having represented different problems in terms of mind map (i.e. security of information), the same structure of evaluation can be applied in few stage of comparisons. The quality of the analysis, as for APF, depends mainly on the quality of experts and on the reliability of data, as the logical architecture to represent organization's priority remains stable.

***Try to think this as a CULTURAL CHANGE***

**From a traditional Management by Vision (strategic decisions are addressed by the capacity of "divination")**



**To a new Management by Performances (strategic decisions and their impacts on processes are assessed in terms of risks and opportunities)**

# Questions & Answers

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...thanks for the attention