

Decision analysis for the very long run: what is a (climate) scenario ?

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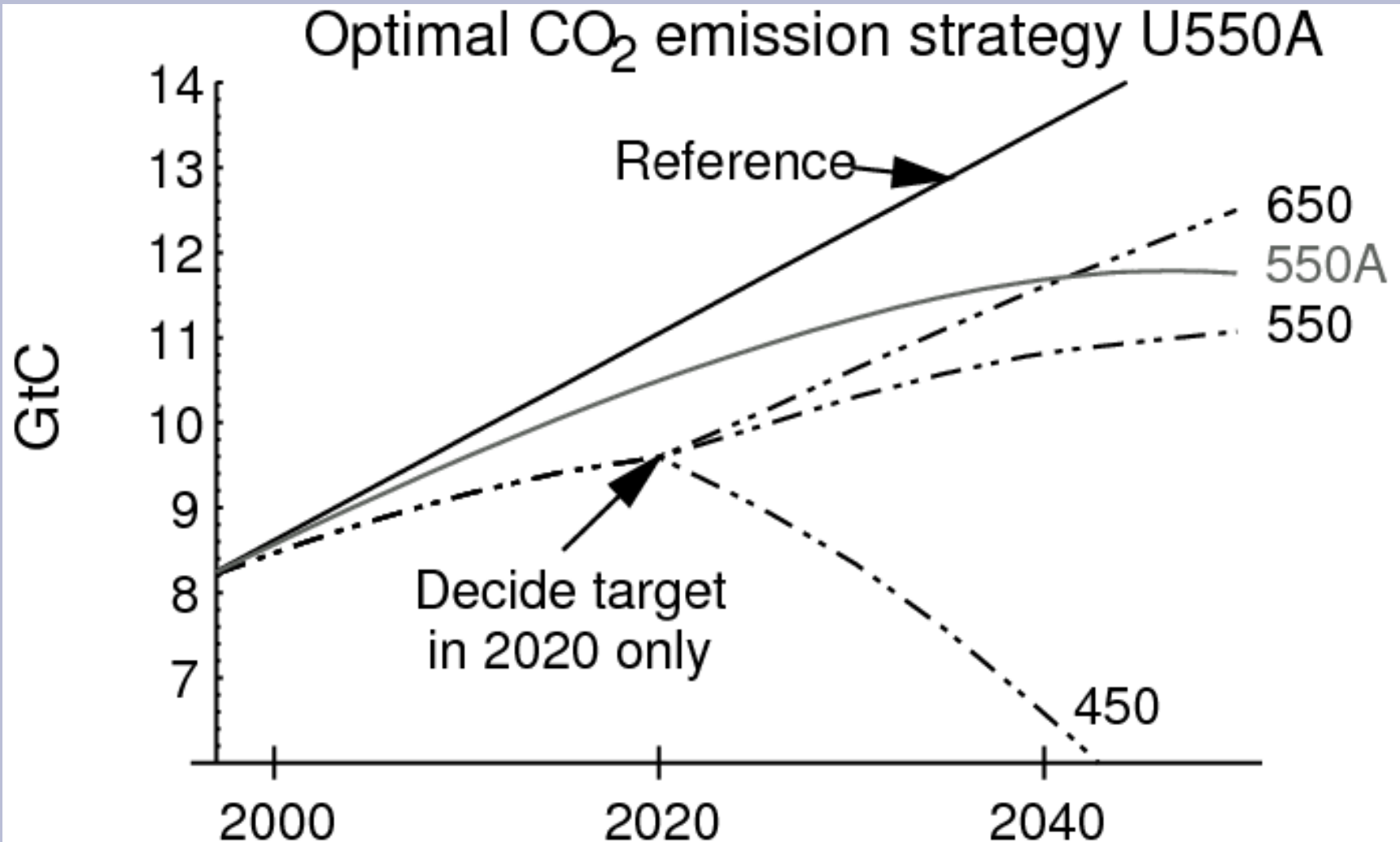
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NICE Spring School

Outline

- Optimal policies for economists
 - Example
 - How we deal with risk
 - Limits of the standard model
- The art of scenario making
 - Why?
 - How?
 - Scenarios for action

Example of economically optimal climate policies



Optimal means

Maximizing expected “utility”

A short course in decision theory:

1. Decision criteria
2. Utility maximization
3. Information and option
4. Limits of the standard model

A toy decision problem

The ice cream truck

4 possible locations: $x = \alpha \beta \gamma \delta$

Weather will be Hot or Cold: $s = C, F$

	α	β	γ	δ
C	10	6	11	8
F	2	4	0	3

Profit $\Pi(s, x)$

Many behavioral rules

- Maximize expected gain
- Maximin (precaution)
- Maximax

Who decides the criteria?

Is there a criteria general enough to represent any “rational” decision maker ?

The Utility of wealth

Increasing

But at a slower rate as wealth increases

Standard decision model

- Monetary gain $\pi(s, x)$
- Alternative outcomes s with probability $p(s)$
- Utility function $U(\pi)$

Choose the decision x maximizing expected utility

$$\Pi^* = \max_x \sum_s p(s) u(\pi(s, x))$$

Pros and cons of the standard economic model

General enough: changing u allows to represent the various criteria.

Rationality guaranteed

Separates u , p , and π .

But:

Observing parameters?

Adaptation and irreversibility?

Information and option

- Contingent strategy
- Information value
- Option value

The ice cream truck again

Expected gain, if we can adapt to s ?

	α	β	γ	δ
C	10	6	11	8
F	2	4	0	3

Profit $\Pi(s, x)$

Value of information

Expected gain of the contingent strategy:

$$\Pi^{\#} = \sum_s p(s) \left(\max_x u(\pi(s, x)) \right)$$

Expected value of information

$$EVPI = \Pi^{\#} - \Pi^*$$

The value of flexibility (avoiding irreversibility)

Assuming that information will be

- perfect
- Free

Then we can account for the option value

$$OV = \Pi^{\#} - \Pi^*$$

More limits of the standard model

- Long term benefits
- Probability is too simplistic
- Real life decisions are not rational

Discounting in the long term

1€ at future time t is worth
only $1/(1+r)^t$ € today

r discount rate

Future generations weighted shockingly low
Hyperbolic discounting

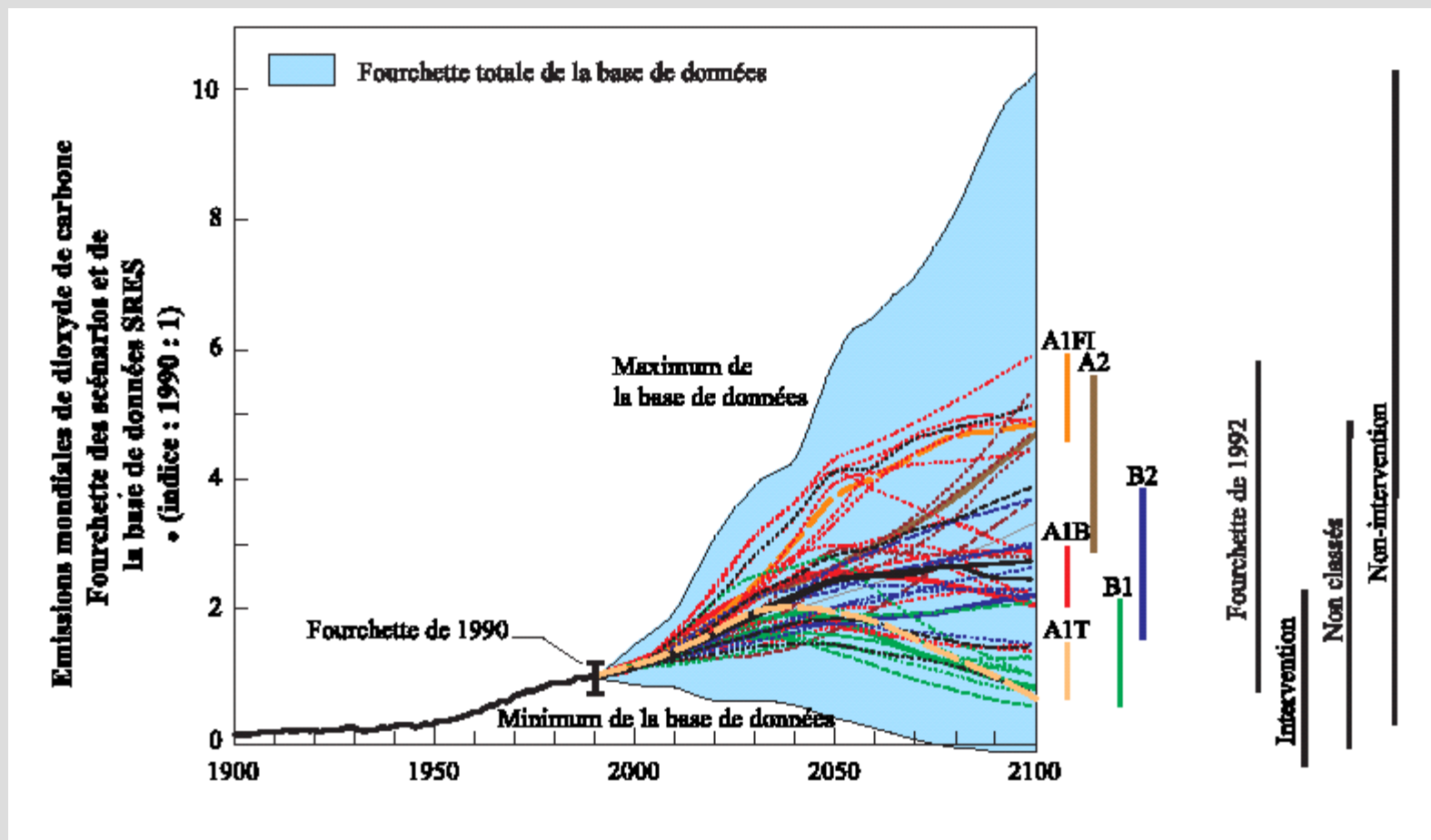
Degrees of ignorance

- The probabilistic model starts with an exhaustive partition of the future into mutually exclusive states, and assign each state a specific weight
- Uncertainty: states are known
- Incompleteness: unknown unknowns

Real decision making

- Rationality is a normative assumption, not a descriptive fact: habits, emotions !
- Society is not a single decision maker: confidence and strategic games

On the art of scenario making



Outline

1. What to expect from a scenario exercise?
2. A method
3. Using scenarios for action

1. Prospective \neq simulation

- Multidisciplinary, system-based (holistic)
- Long time (past, present, futurs).
- Uncertainties, tipping points, signposts

A short history of scenarios

- After the war (1950's) : 2 traditions.
 - Rand, SRI, ... Delphi techniques and scenario methods for defense et security
 - «French school » : holistic and philosophic analysis (rapport DATAR).
- Popularized by the first oil shock :
 - Royal Dutch Shell & Pierre Wack.

Two kinds of scenarios

Exploratory :

Explore possible futures without limits.

Look at tendencies, predetermined constants, uncertainties, tipping points, ...

Normative/strategic:

Focus on choices to be made, the sensitivity of operational results to risks

Specifications ?

- Always : more than 1
- Simplicity: less than 5
- Exploratory: BAU/central scenario or not ?
- Normative: Wished or feared ?

2. Method

- Define problem and time horizon
- System analysis: choose key variables
- Actors
- Microscenarios
- Combination into coherent scenarios
- Dynamic modelisation
- Implications for choices

Problem and time horizon

- Literature survey
- Time series
 - Backcasting at 2 x horizon
- Horizon: far enough for structural changes

Key variables

- Influence the operational result of interest
- Small number
- Looked at in detail

- Example: Kaya identity

$$CO2 = POP * \frac{PIB}{POP} * \frac{ENE}{PIB} * \frac{CO2}{ENE}$$

Co-construction of the future

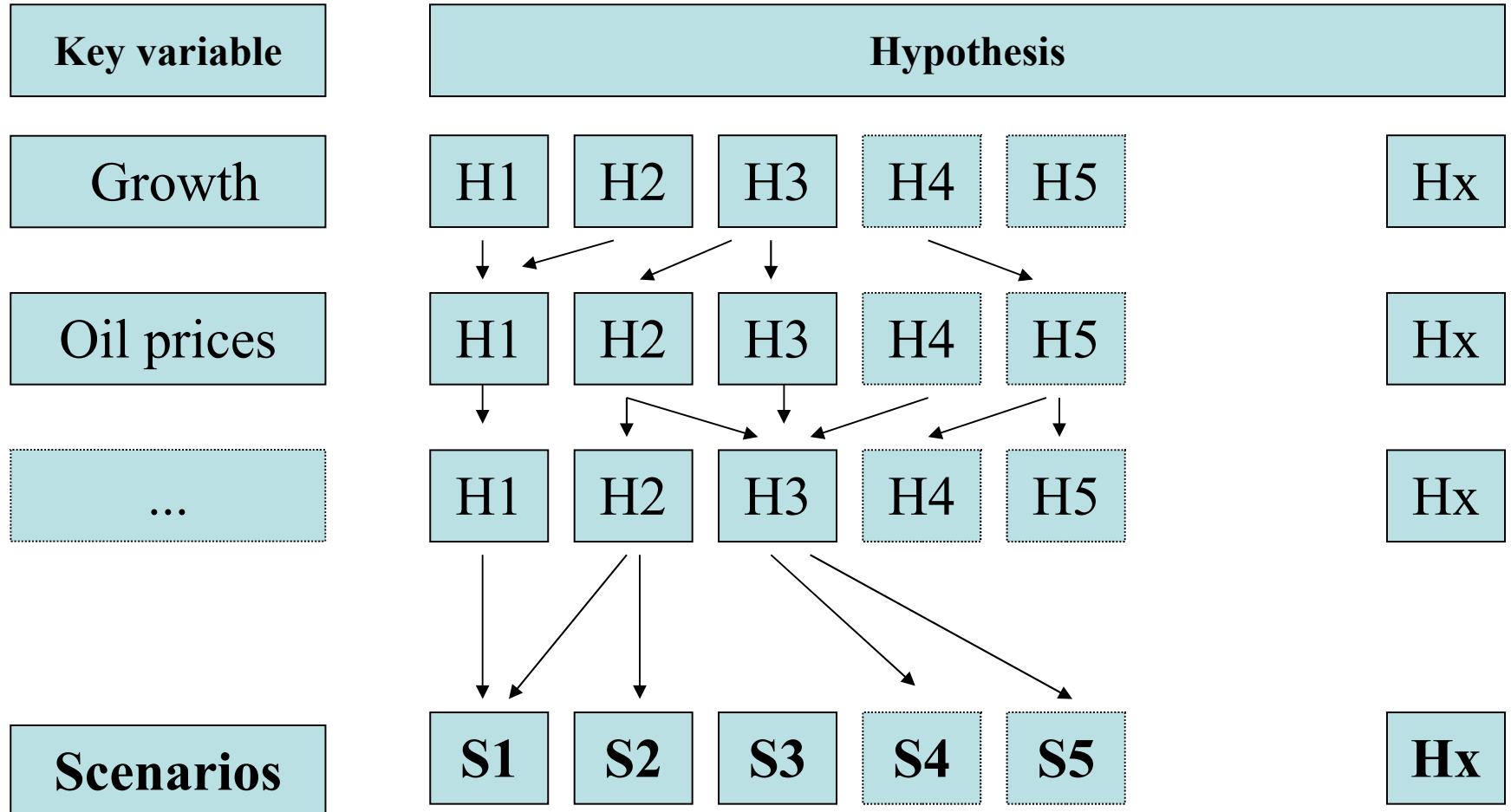
- « Ni prophétie ni prévision, la prospective n'a pas pour objet de prédire l'avenir – de nous le dévoiler comme s'il s'agissait d'une chose déjà faite – mais de nous aider à le construire. Elle nous invite donc à le considérer comme à faire, à bâtir, plutôt que comme quelque chose qui serait déjà décidé et dont il conviendrait seulement de percer le mystère ».

Hugues de Jouvenel, « Invitation à la prospective », Futuribles Perspectives, 2004.

- Nous devons « considérer l'avenir non plus comme une chose déjà décidée et qui, petit à petit, se découvrirait à nous, mais comme une chose à faire ».

Gaston Berger, « L'attitude prospective », Prospective, n°1, 1958.

Seeking coherence and plausibility



Models vs. scenarios

- Models
 - Cartesian division in subsystems
 - Quantitative, (falsely) precise
 - Convincing
 - Must be parametrized
- Scenarios
 - First a narrative
 - More vague (more right ?)
 - Can use models
 - Base + Trajectory + final image

3. Scenarios and decision making

- Analysis tool for strategic decisions
- Provides a common frame of reference
- Warn about possible surprises
- Increase sensitivity to early warnings

☠ Paralysis by analysis ☠

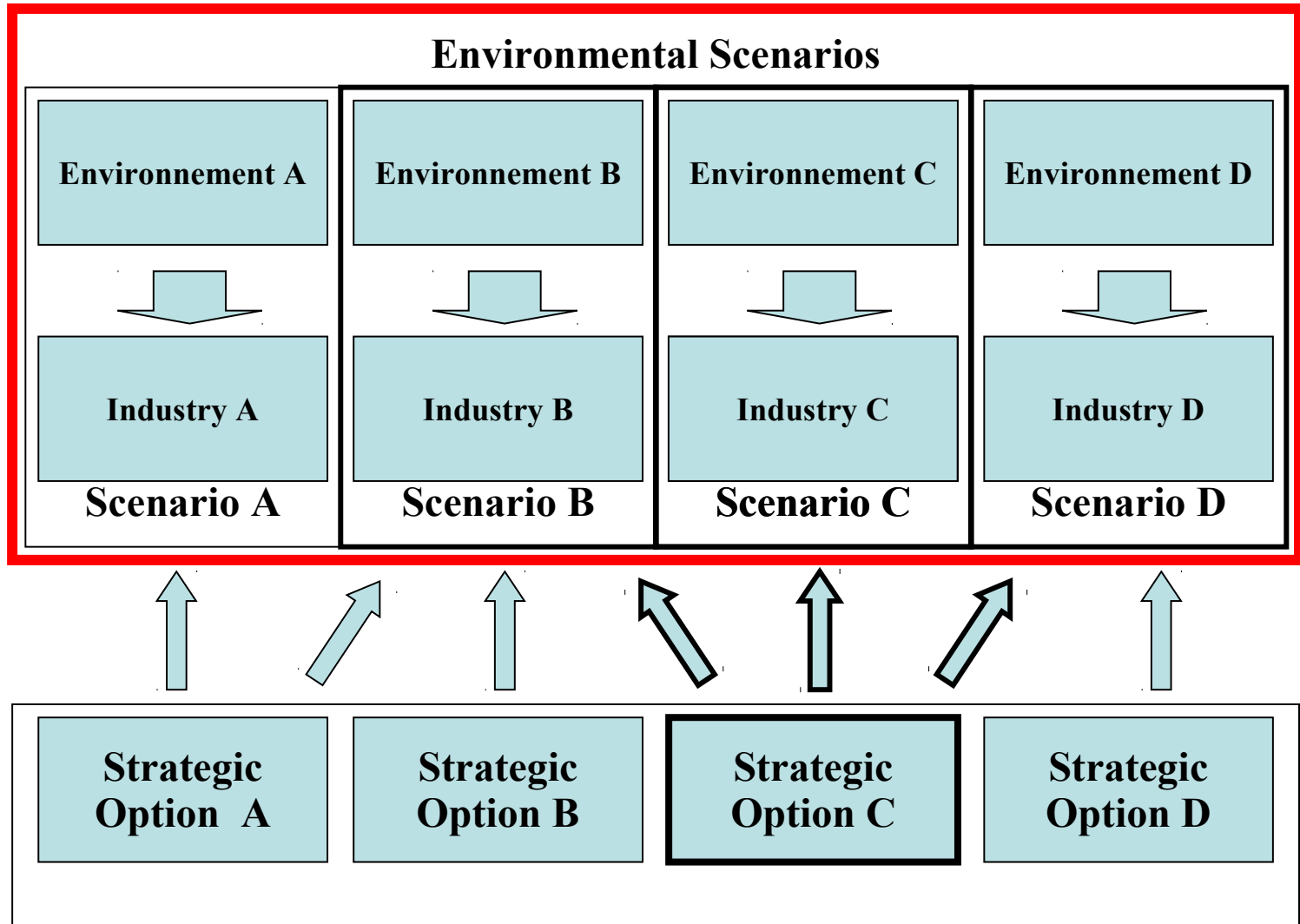
Necessary balance between:

- Reactivity and anticipation
- Strategic planning and execution

« Alors, au contraire, que l'avenir est pour l'homme, en tant que sujet connaissant, domaine d'incertitude, et pour l'homme, en tant que sujet agissant, domaine de liberté et de puissance ».

Hugues de Jouvenel, « Invitation à la prospective », Futuribles Perspectives, 2004.

Prospective & Strategy



Conclusion

- « Scenarios are attempts to describe in some details a hypothetical sequence of events that could lead plausibly to the situation envisaged ».

Herman Kahn.

- « Scénarios are stories about the way the world might turn out tomorrow, stories that can help us recognize and adapt to changing aspects of our present environment ».

Peter Schwartz.