
New Tools for Collaboration During Deeply Uncertain Times

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Evolving Logic



World Health
Organization





Triple Helix Collaboration Requires Analytical Support



- “Deep” uncertainty undermines triple helix collaboration
- Practical analytic applications under deep uncertainty:
 - Assumptions based analysis [options]
 - Model harmonization and integration [knowledge]
 - A robust decisions approach to action [analysis]

Many Issues of Collaborative Policy and Response Are Framed by Two Related Questions

- **“What are the possibly significant, long-term consequences of alternative near-term actions?”**

- Research and development
- Investment in new plant, equipment, products
- Nuclear waste storage
- Major infrastructure investments
- Constitutional changes
- Education reform



And...

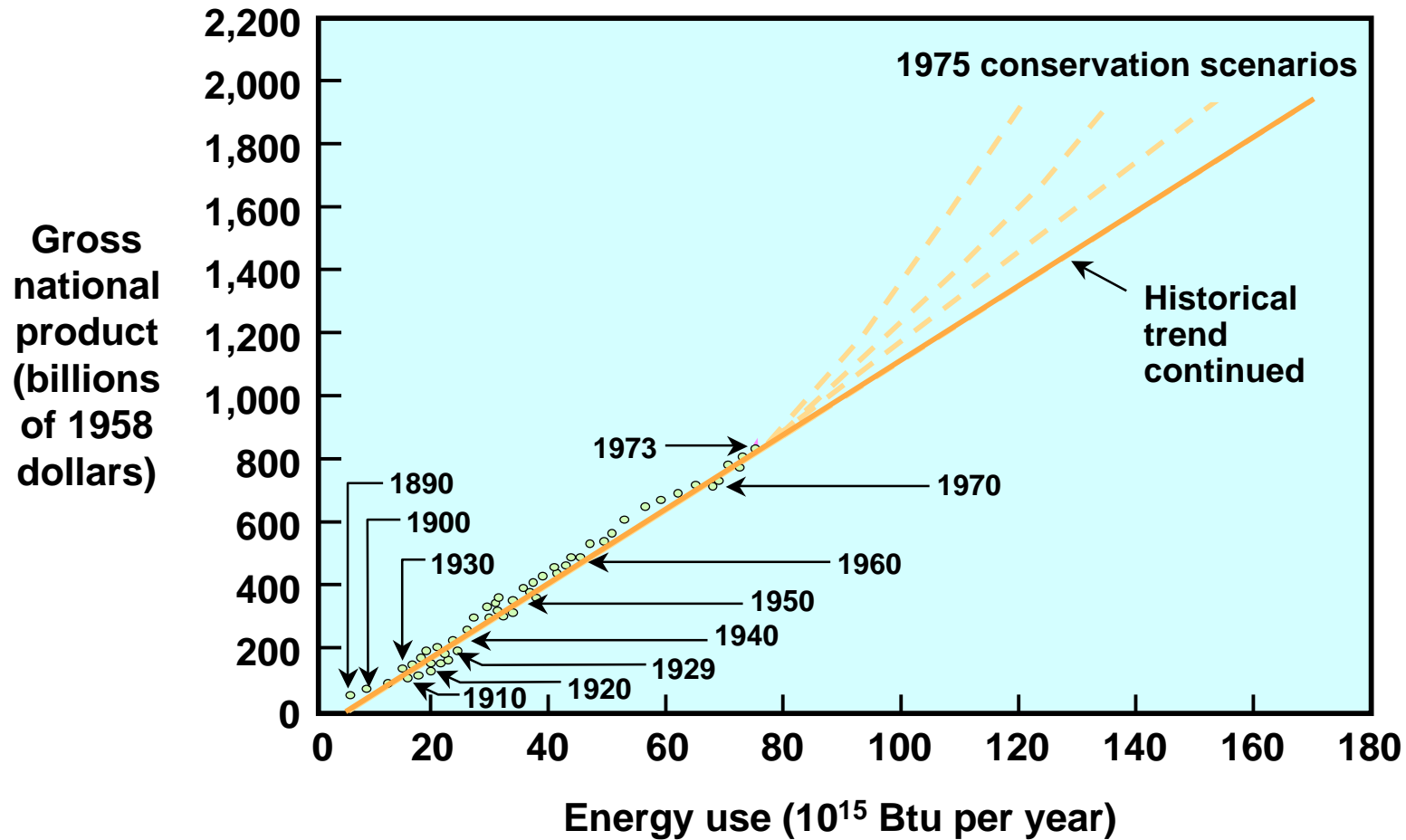
- “What near-term actions are most likely to achieve desired long-term objectives?”

- Economic stewardship
- Climate change
- Combating Terrorism
- Biodiversity
- National security
- Most long-term societal goals



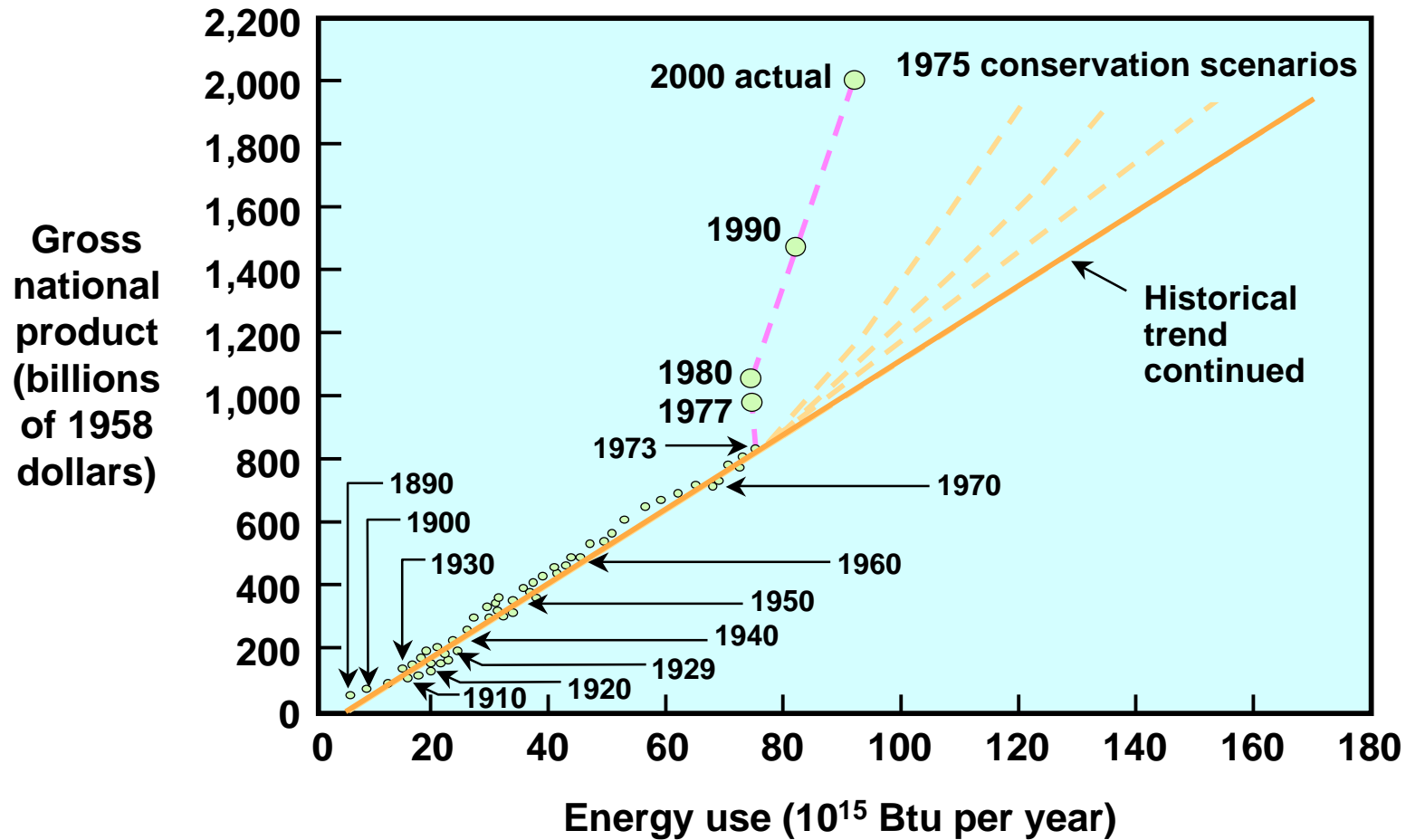


But We Often Stumble When We Apply Formal Analysis to Such Decisions



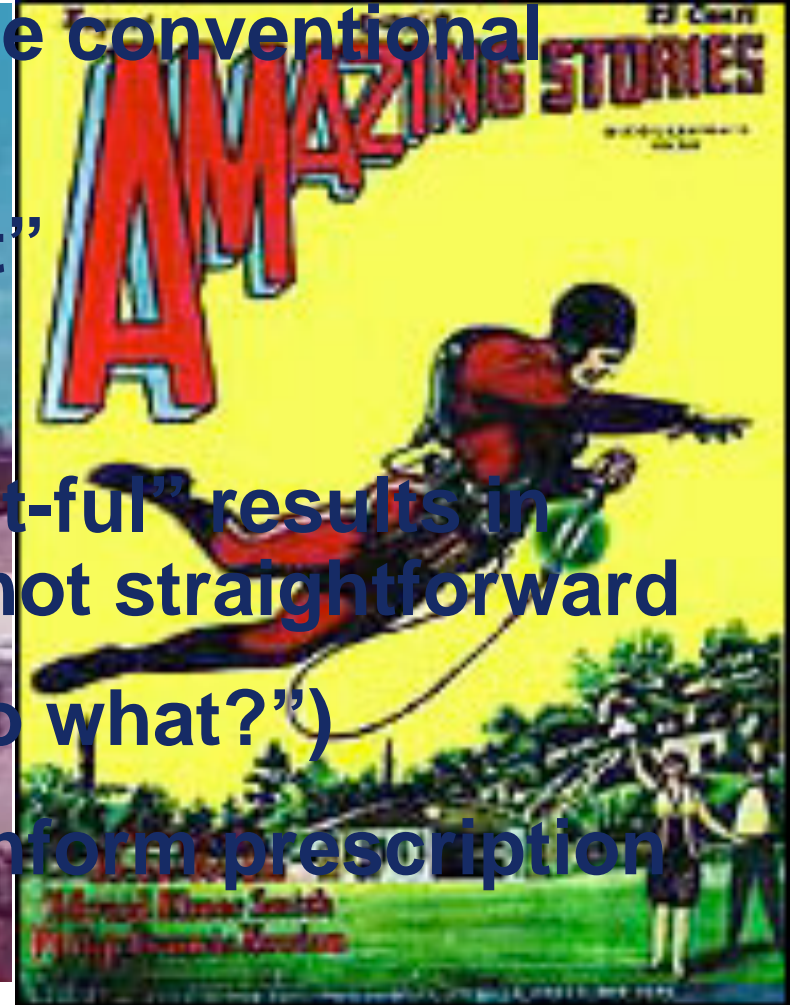


Our Tools Have Difficulty When Prediction is No Longer Feasible



Efforts to Apply “Foresight” to Policy Planning Face Common Challenges

- Tendency to recapitulate conventional wisdom
- “Tyranny of the present”
- Illusion of control
- Implementing “foresight-ful” results in existing institutions is not straightforward
- Defining next steps (“so what?”)
- Need for prediction to inform prescription



The Strands of the Triple Helix Are Neither Uniform nor of Consistent Composition

Unraveling forces and barriers to cooperative action are present:

- **Misunderstandings may arise among stakeholders.**
- **Or, stakeholders may understand each other all too well.**
 - differences among stakeholders inhabiting the same helical strand are not uncommon.
- **Differences can arise over any or all of:**
 - Perspective
 - Assumptions about presently unknowable futures
 - Values for assessing “goodness” of outcomes
 - Priorities among even agreed values
 - Sequencing of commonly agreed actions
 - Fundamental interests
 - Institutional and personal interests



Most Analytic Techniques Leave A Gap



Between what analysis can provide...

- Limited results framed by assumptions
 - (hence rich ground for contention and rejection)
- Only selected consideration of alternative futures
- Single-point solutions characterized by maximizing behavior

...And how **decision makers behave** by selecting strategies and plans that

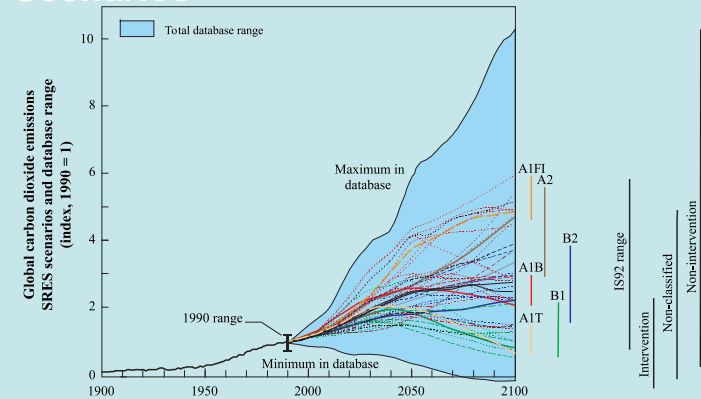
- Meet some threshold of “goodness” (satisficing)
- Are intended to be adaptive in the face of new info
- Are robust against a wide range of futures
- Satisfy the minimum demands of relevant communities of interest

Many Approaches Can Characterize Uncertainty

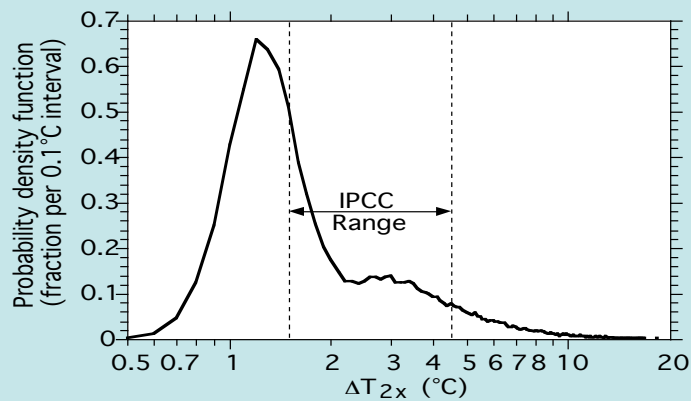
Best Guess



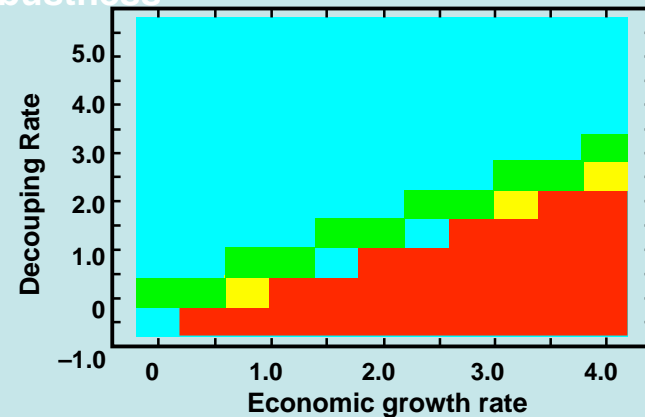
Scenarios



Probabilities



Robustness





Principles for a Policy Analysis to Support Triple Helix Collaboration



Not “what will happen” but “what should we do?”

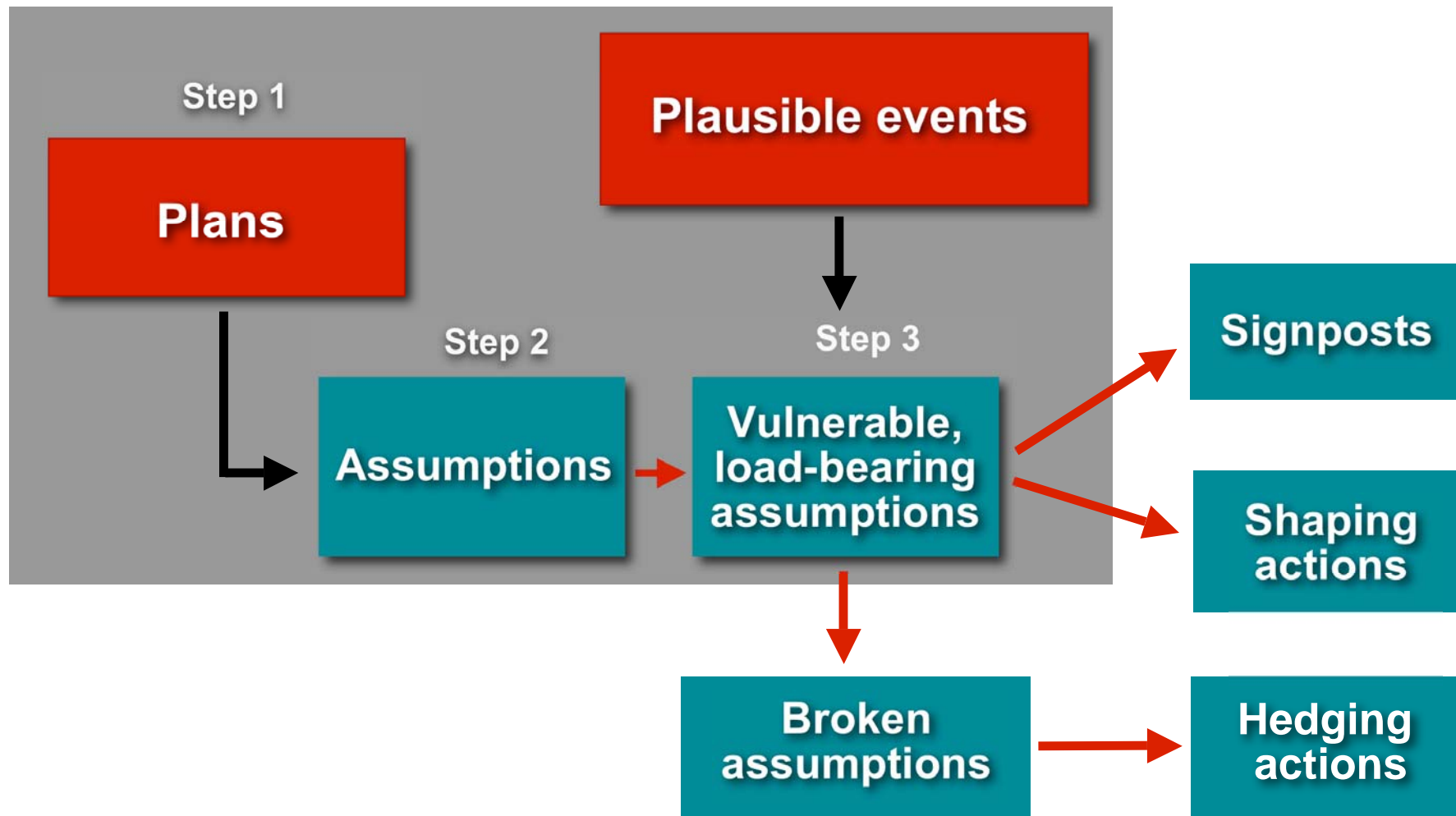
- **Ensembles** of scenarios contain more information than any single model – if deep uncertainty exists
- **Robust**, rather than optimal, strategies satisfice across a broad range of plausible scenarios and values
- **Adaptive** strategies evolve over time in response to new information to achieve robustness
- **Iterative reasoning** to **characterize uncertainties** by their implications for alternative strategies



Projects with Triple Helix Aspects

- Higher education planning (CA; KY; TX)
- Natural gas utilization and risk management in Israel
- Water resource planning in California
- Infrastructure planning in New Orleans and Gulf Coast
- Counter-terror strategies / asymmetric warfare
- Emerging infectious disease policy and strategy
- Science, technology, & regional policy planning, Mexico City
- National science policies, South Korea
- Strategies for meeting Millennium Development Goals
- Social security solvency
- Natural resource management
- Pre-conflict management, anticipation and shaping...

Discover Vulnerable and/or Load-Bearing Assumptions to Illustrate Choices





We Need a Scenario Generator to Explore Robust Alternatives



E <i>X</i> ternal Uncertainties	Policy <i>L</i> evers
<ul style="list-style-type: none">•Regional stability•Future energy prices•Fidelity to contracts by suppliers•Changes in technology•Pipeline break frequency; repair times...	<ul style="list-style-type: none">•Type, level of forward contracts•Energy storage and stockpiling•Infrastructure decisions (e.g, LNG)•Organization of domestic market•Degree of fuel & source diversity•National vs. regional energy grid•Conservation and efficiency...
<i>M</i> easures for Successful Outcomes	<i>R</i> elationships between factors
<ul style="list-style-type: none">•Primary energy costs•Measure of national security•Emissions and health measures•Land use•GDP growth...	<ul style="list-style-type: none">•LNG turns NG into a commodity•Future demand determinants•Response to conservation incentives...

Clarity about Unknowns Provides "Glue"...



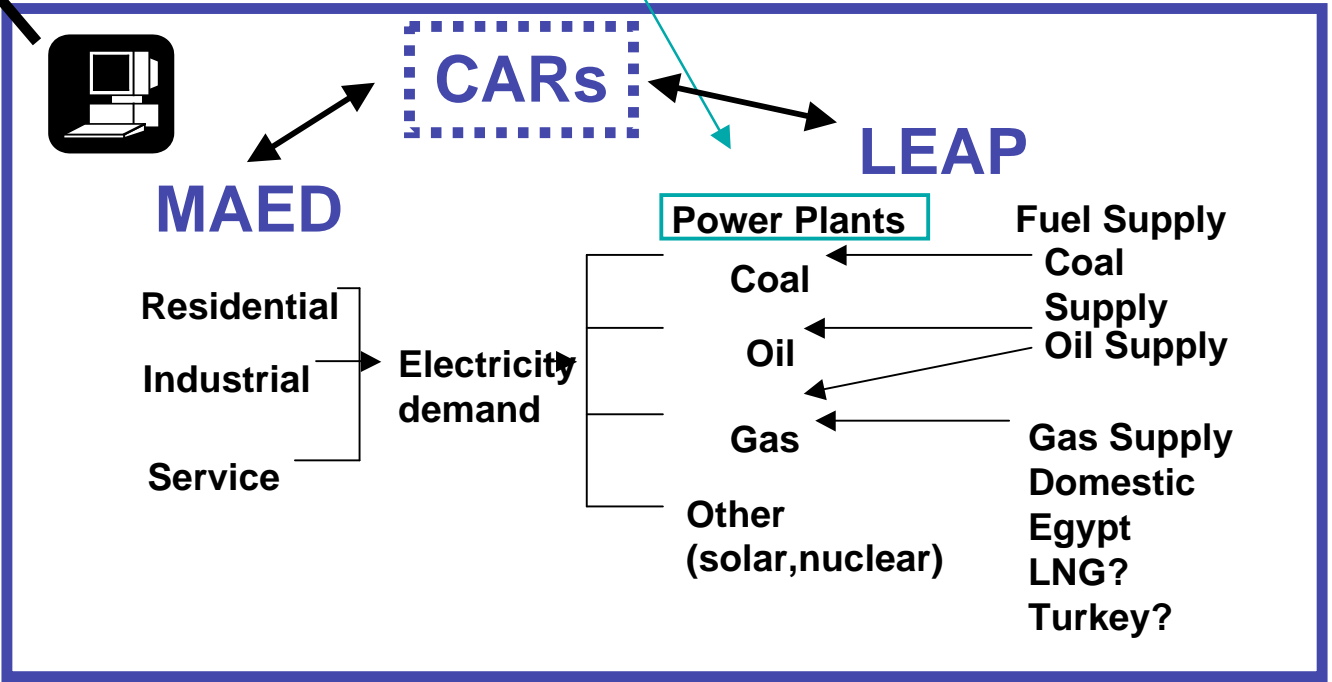
Type	Characteristics
CC NG	Technologies
Coal	Cost
Nuclear	Emissions
Wind	Fuels
Solar...	Sequencing...

WASP



Infrastructure plan α ,
 Infrastructure plan β ...
 ...Infrastructure plan η

...for legacy, trusted models & data



Identify Robust Strategies and Key Uncertainties with Iterative Process

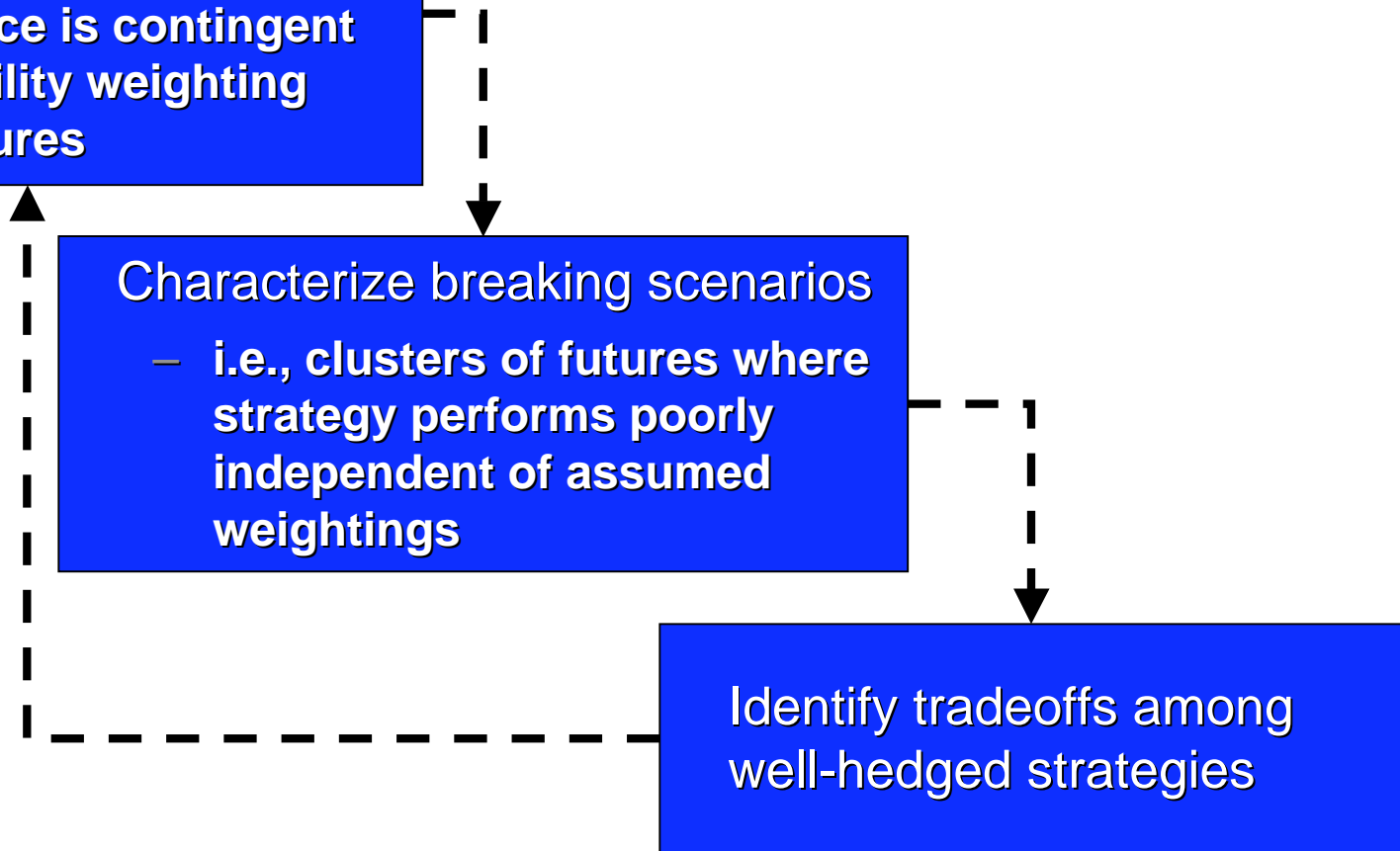
Suggest candidate robust strategy

- Initial choice is contingent on probability weighting across futures

Characterize breaking scenarios

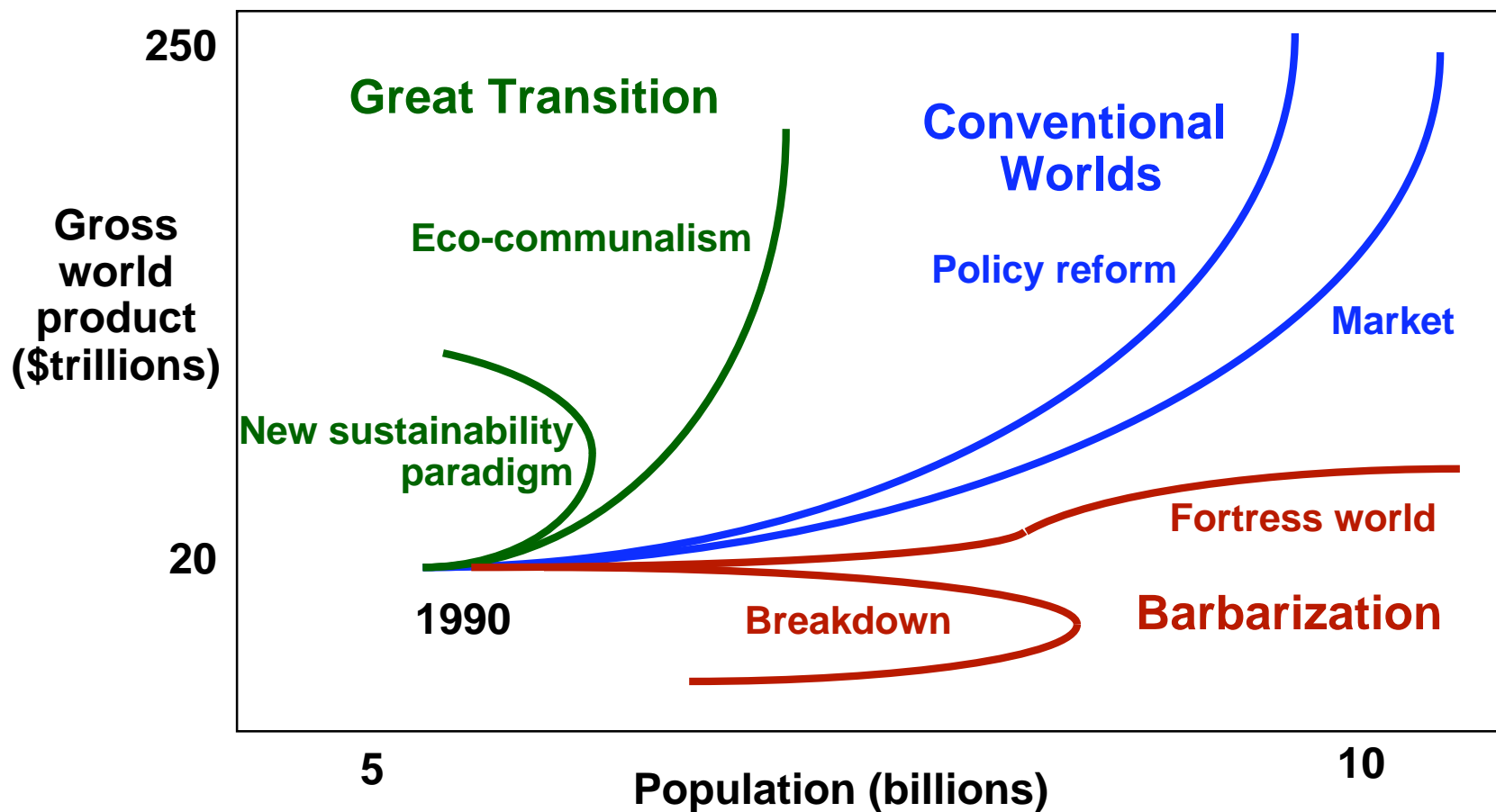
- i.e., clusters of futures where strategy performs poorly independent of assumed weightings

Identify tradeoffs among well-hedged strategies

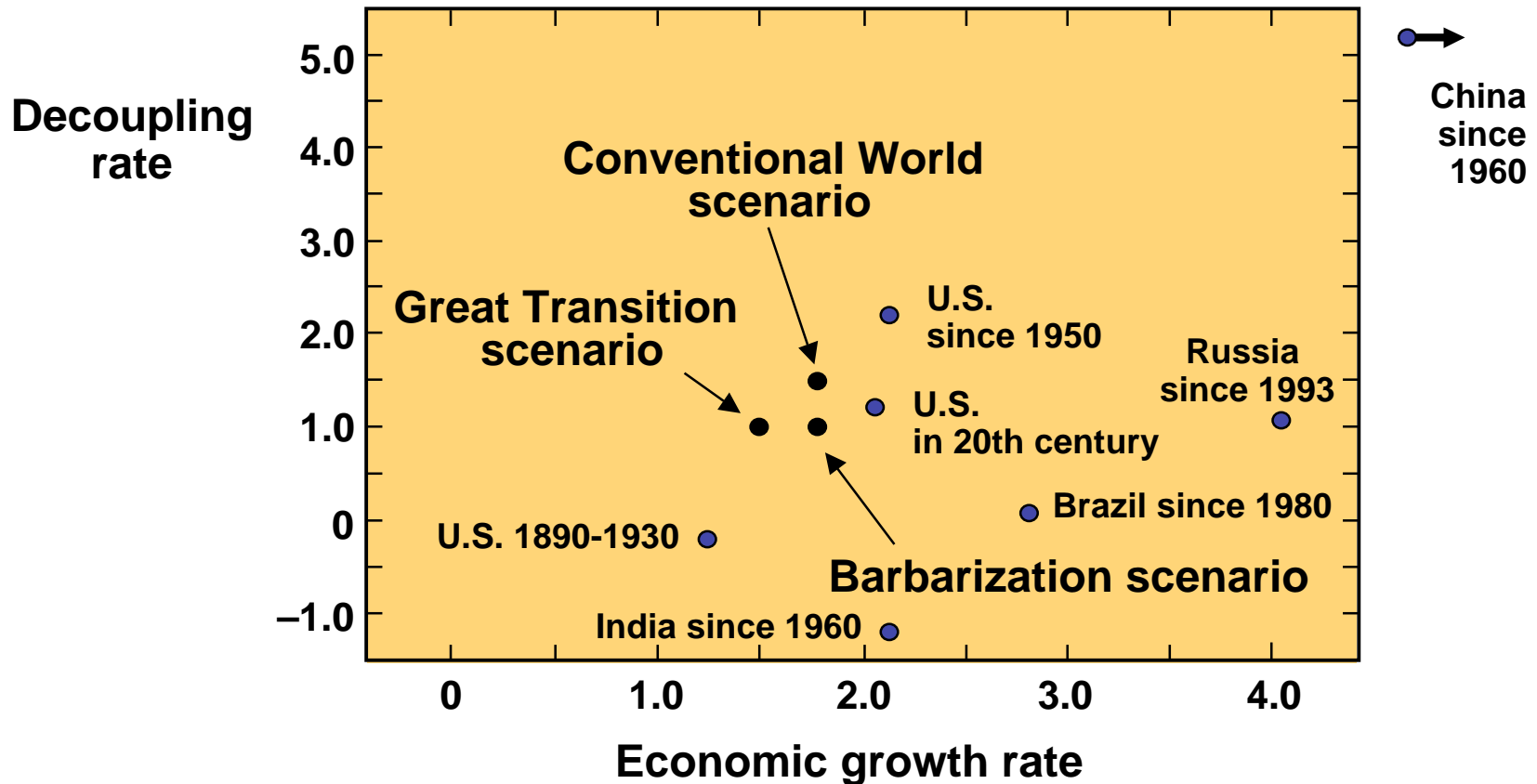




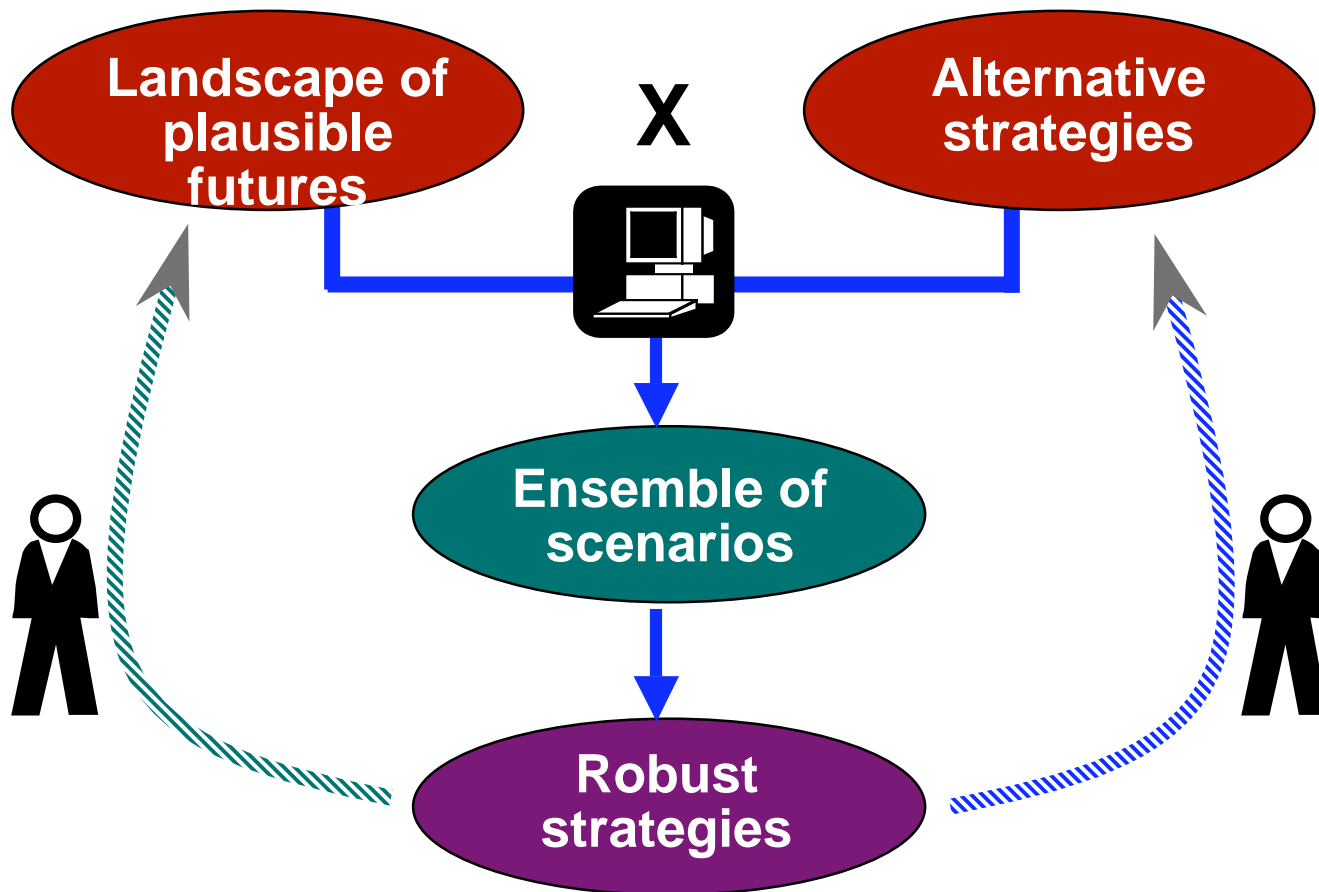
Example : What Strategies Would Lead to Sustainable World Growth in the 21st Century?



Method: Find Strategies that are Robust Across a Range of Possible Futures



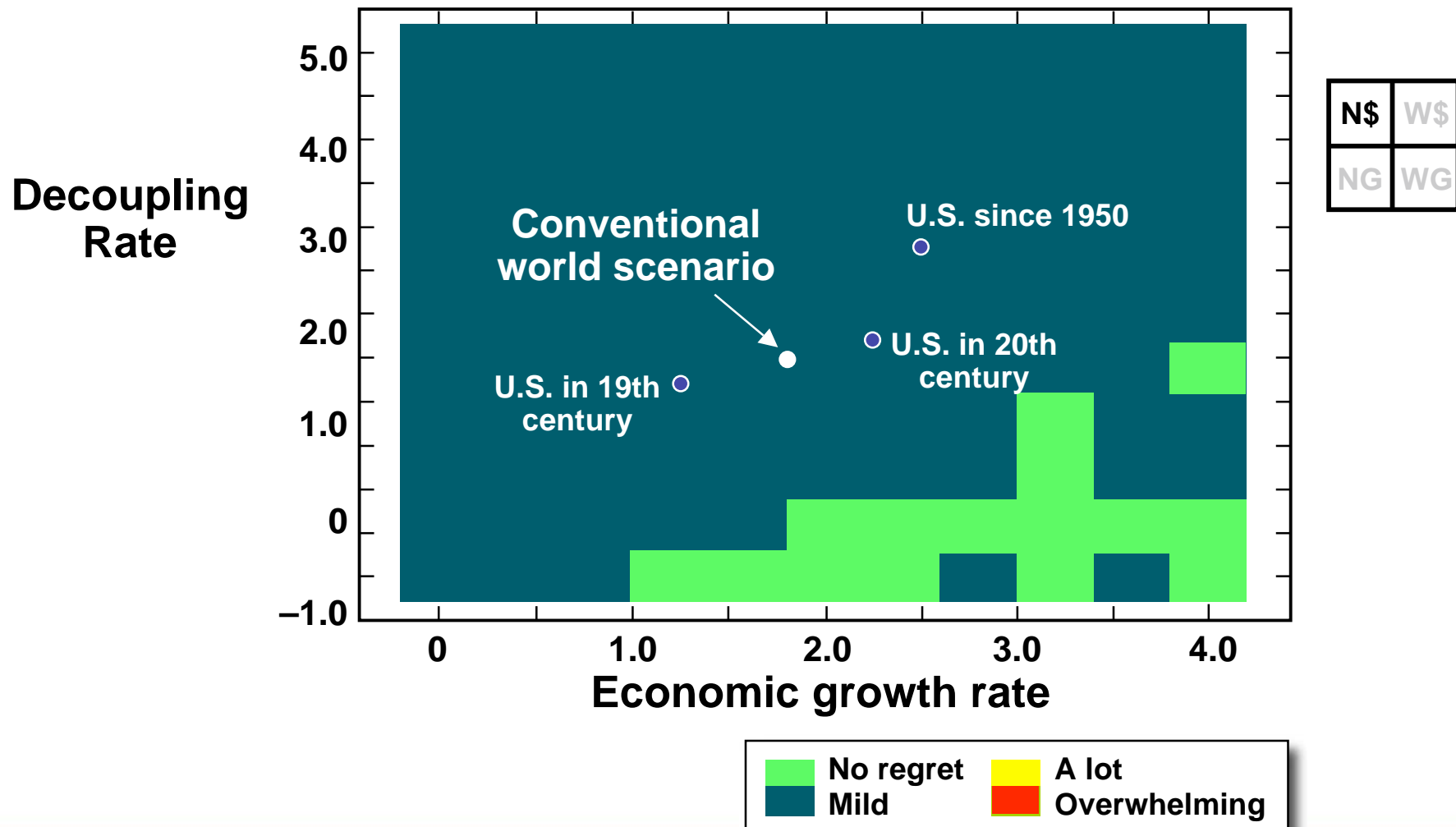
Look for Robust Strategies





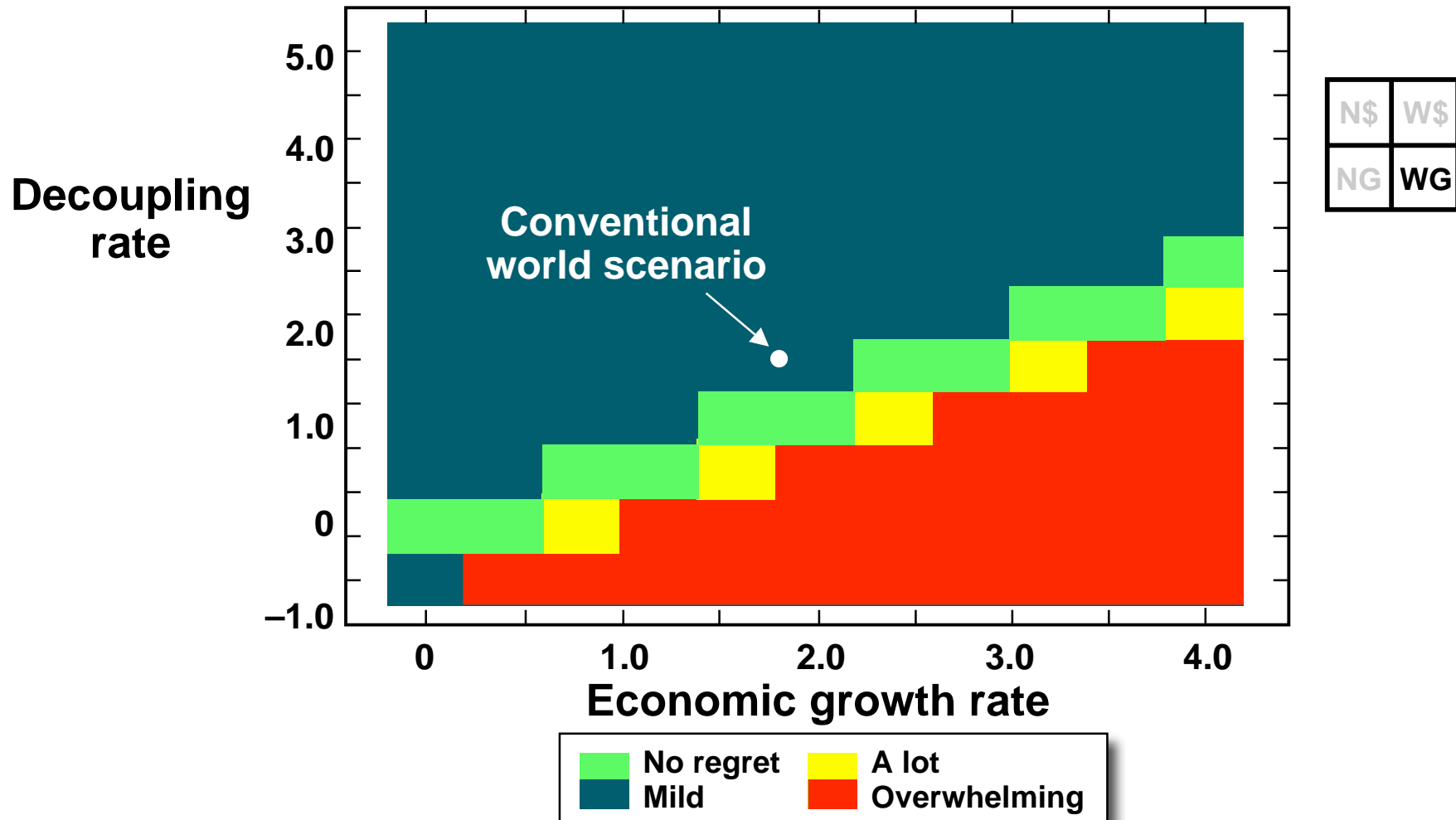
How Well Would Strategy Work in Different Futures Compared to Best Strategy?

“Slight speed-up”



Success Measured by One Value Often Fails When We Measure by Others

Slight speed-up

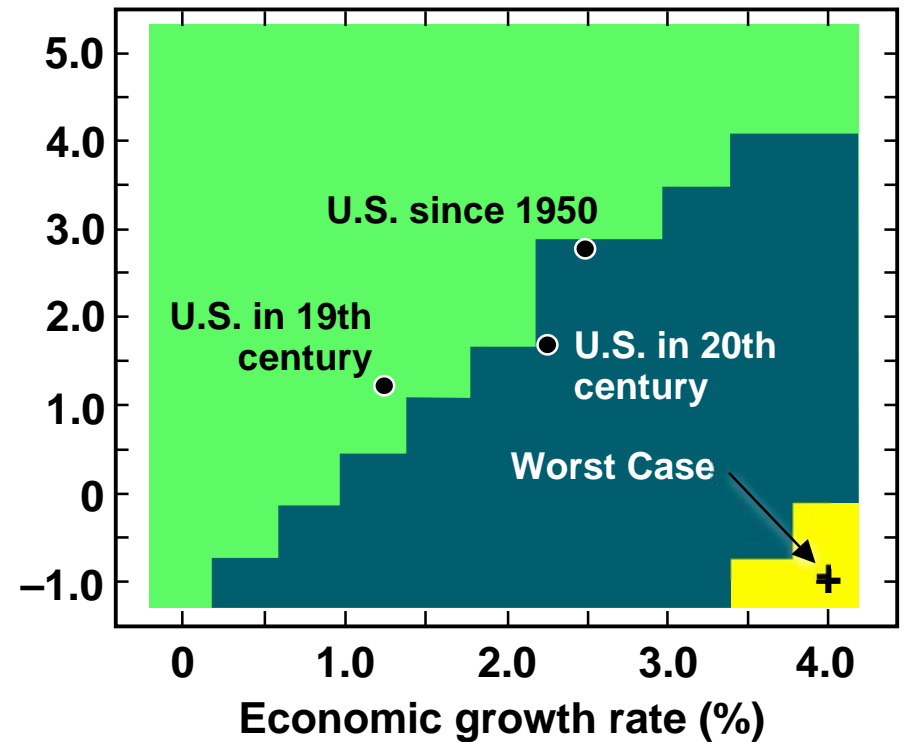
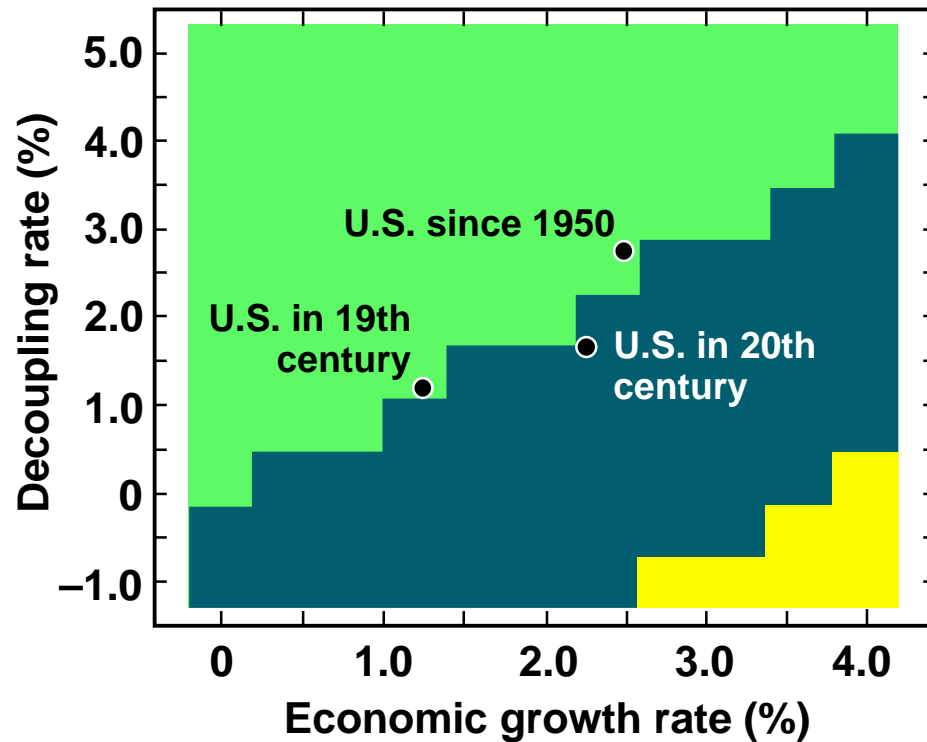




More Sophisticated "Milestone Strategy Performs Well Over Many Futures and Values



No increase

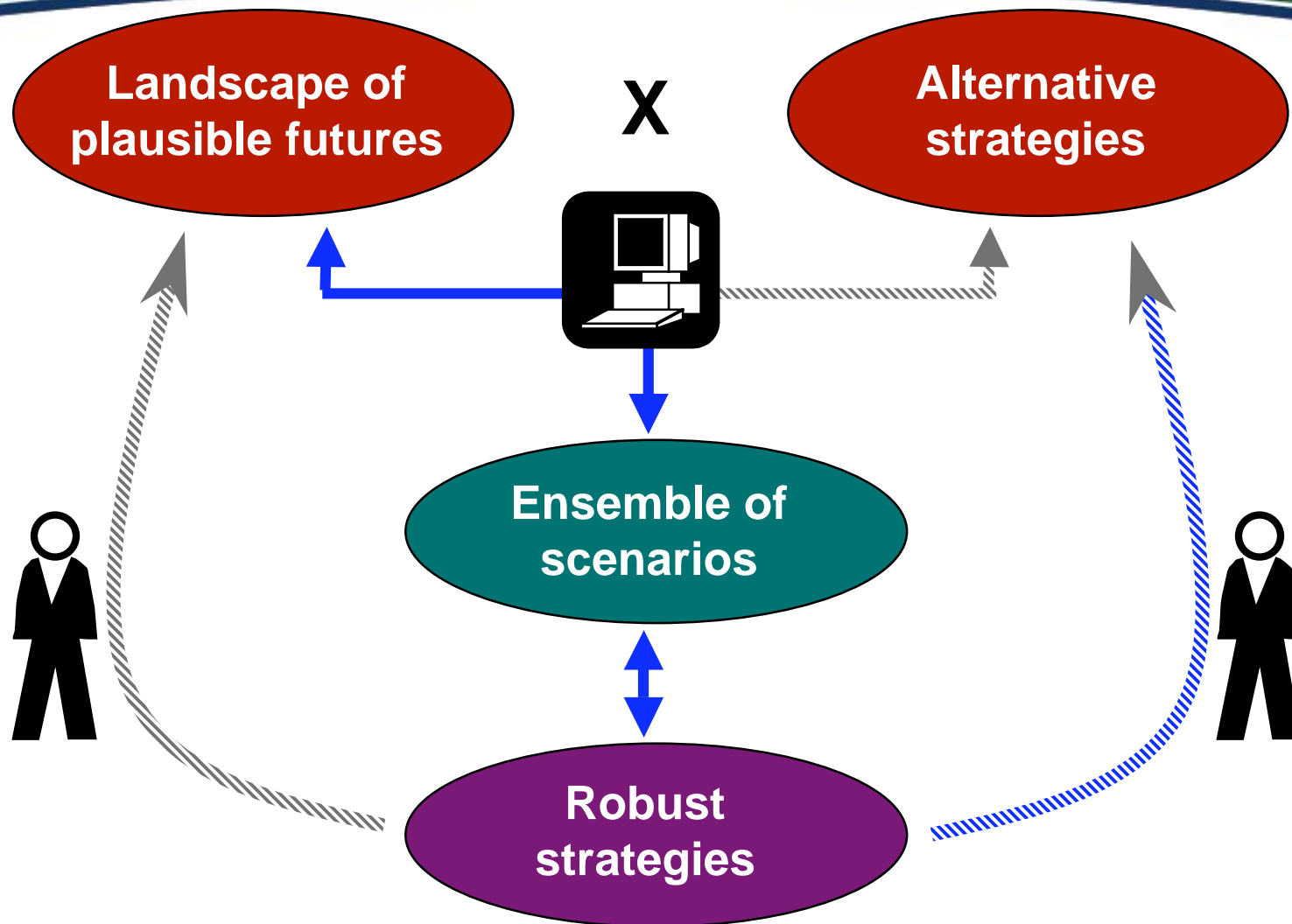


N\$	W\$
NG	WG



N\$	W\$
NG	WG

Look for Breaking Scenarios

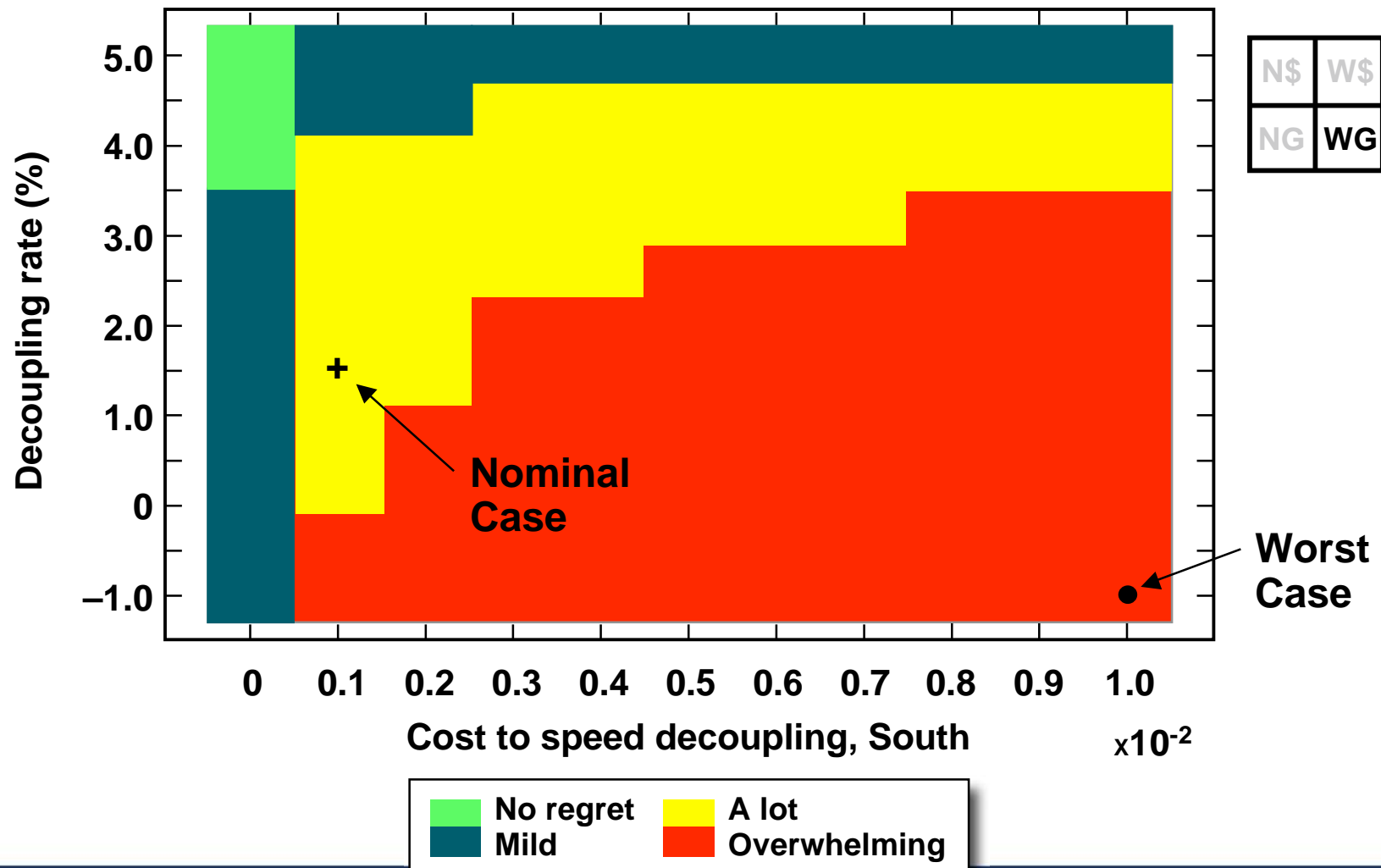




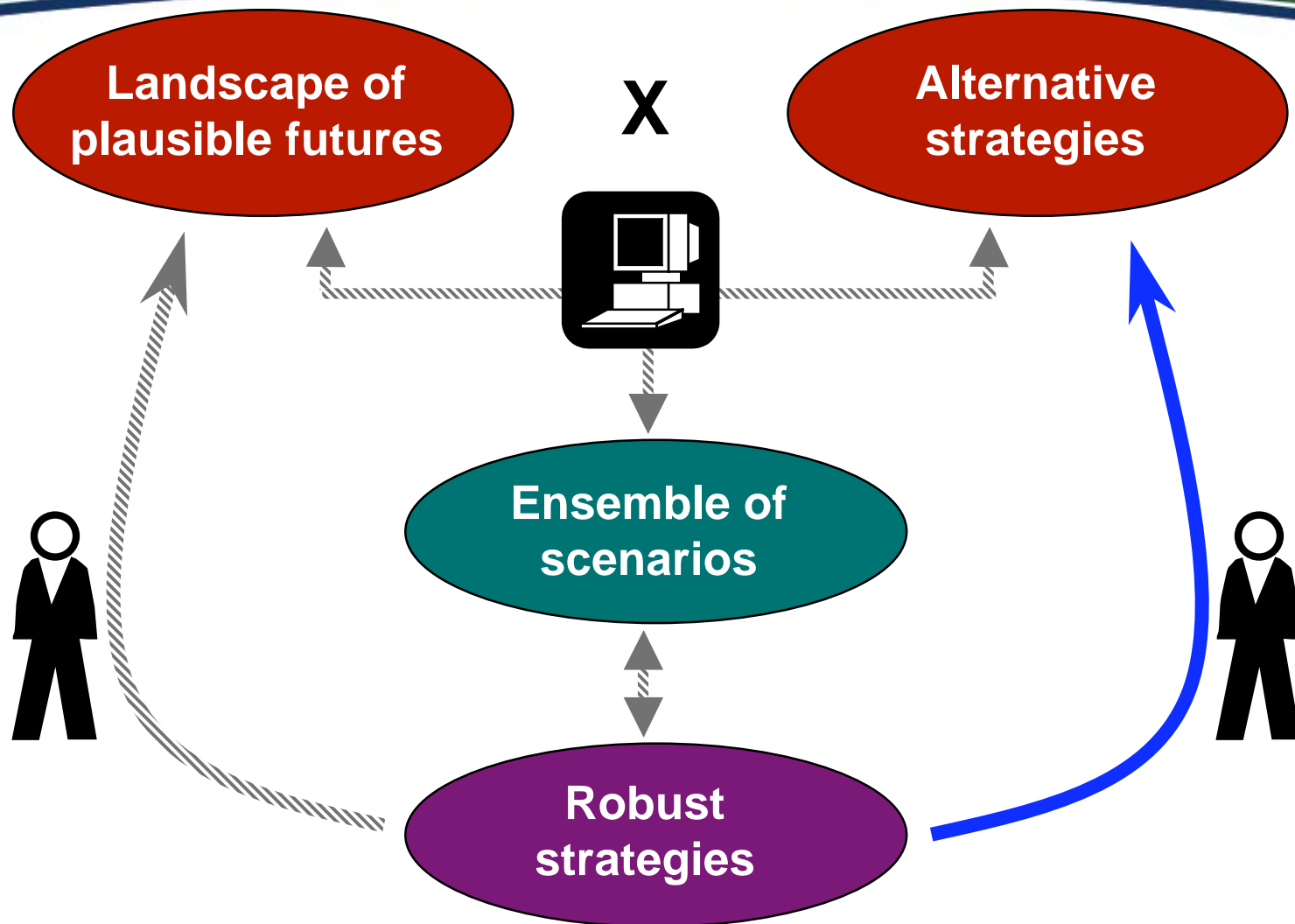
Computer Shows "Milestone" Strategy Can Fail Catastrophically



No increase



Design and Examine Additional Strategies

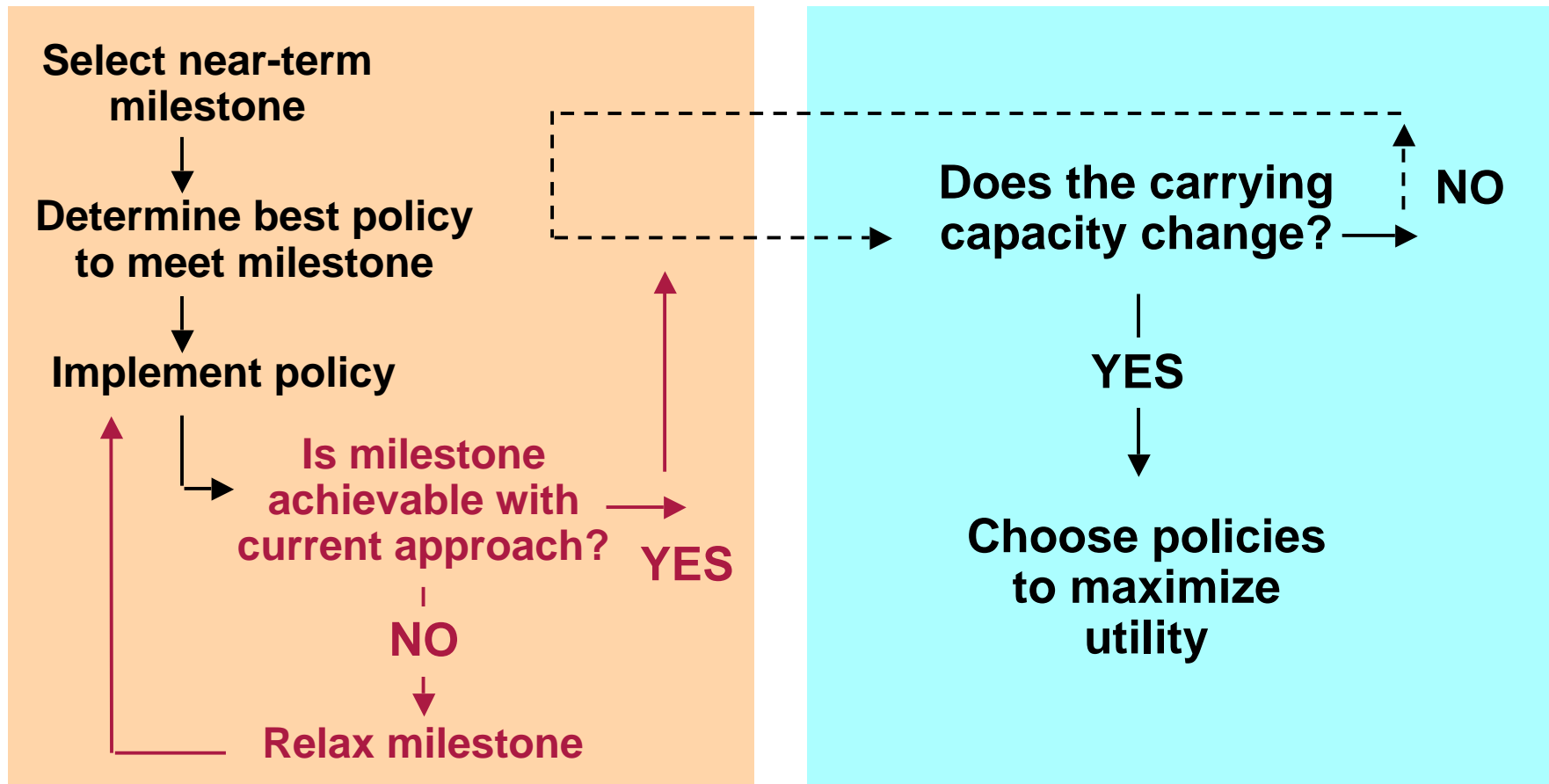




Start with Milestone, but Evaluate Progress and Modify If Necessary (Safety Valve)

Present

Future

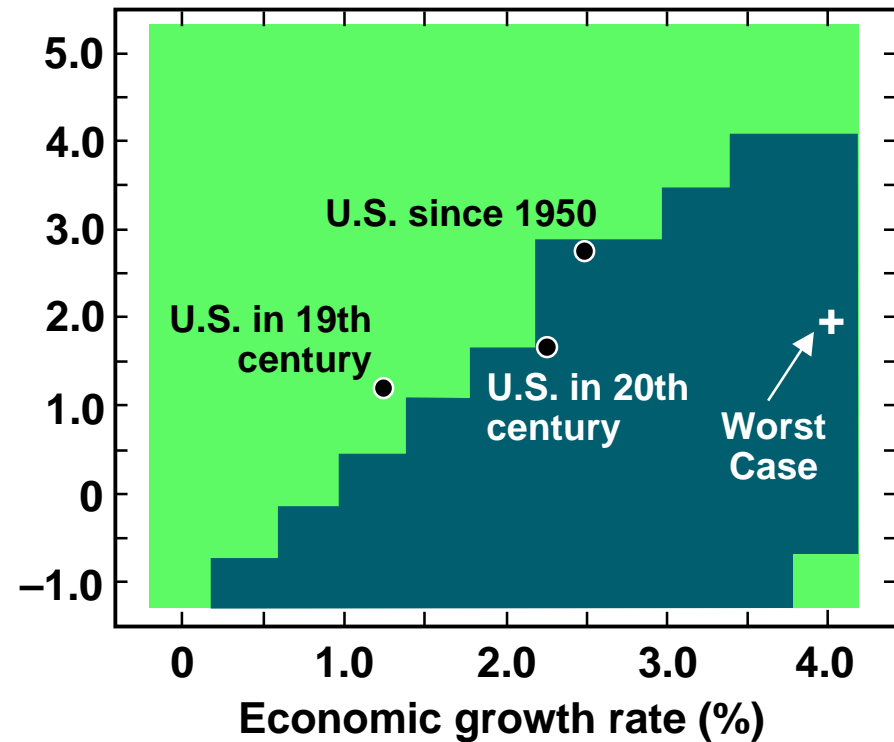
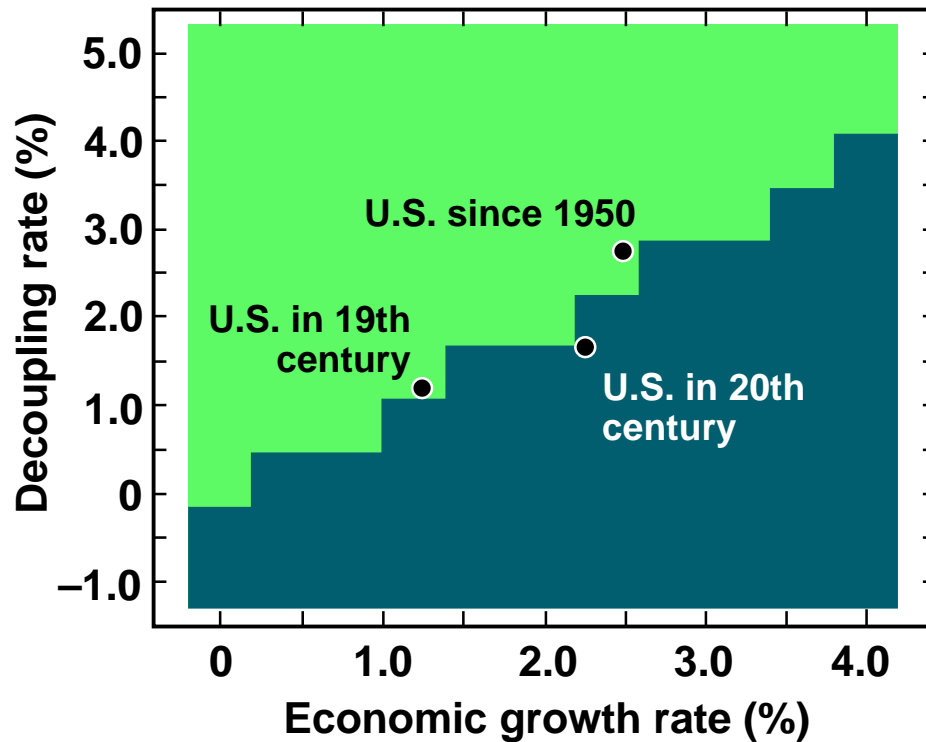




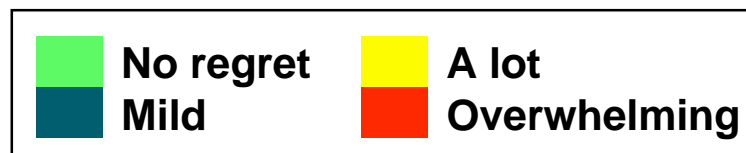
"Safety Valve" Strategy Appears Highly Robust



Safety valve



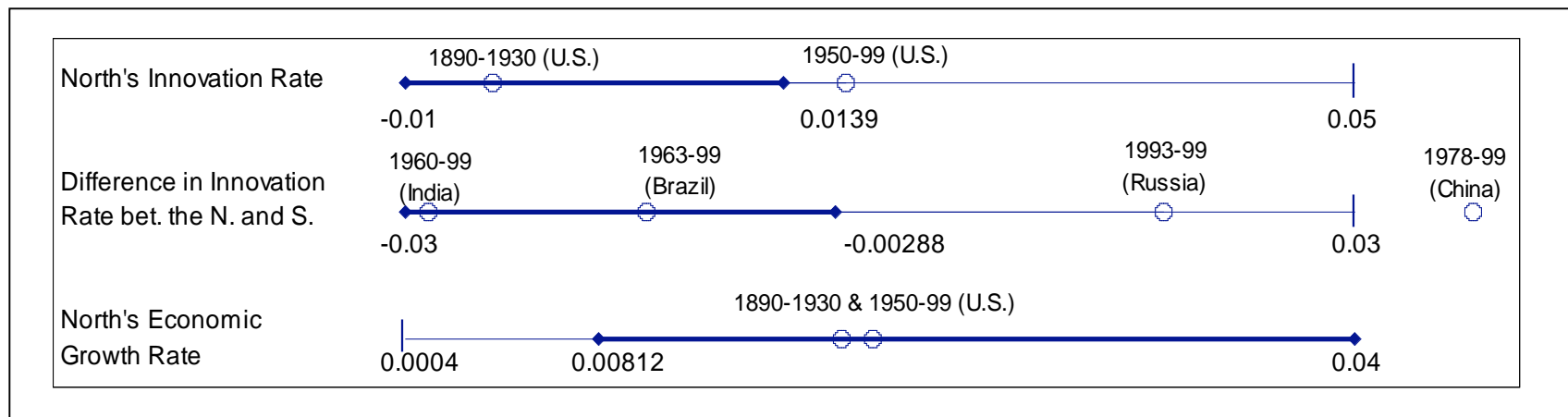
N\$	W\$
NG	WG



N\$	W\$
NG	WG

But We Still Find Failure Scenarios: What is Common Across Them?

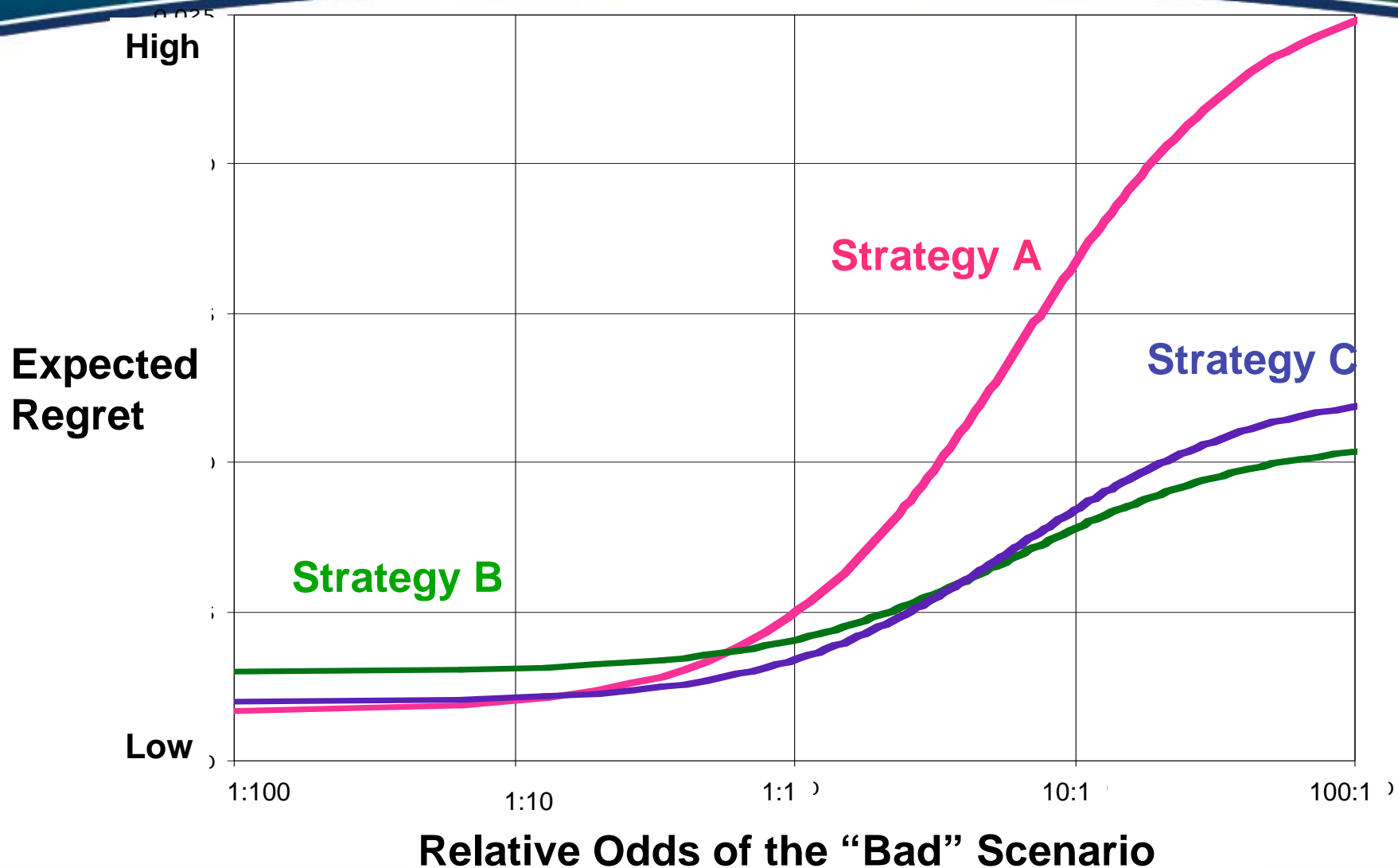
- “Data-mining” method reduces many (in this case 41) dimensions of uncertainties to
 - an easy-to-interpret “Bad” scenario
 - where strategy performs poorly



Lempert, Popper, and Bankes, 2003: *Shaping the Next One Hundred Years: New Methods for Quantitative, Long-Term Policy Analysis*, RAND, MR-1626-CR



What the Decision Maker Sees: The Choice Among Small Number of Key Tradeoffs



Our Art is to Use Modern Means to Apply Insights from the Past

“If we begin with certainties, we shall end in doubts; but if we begin with doubts, and are patient in them, we shall end in certainties.”



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Novum Organum
--Francis Bacon.



World Health
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Second Annual

Triple Helix Summit

February 2 – 5, 2008

Sheraton Waikiki Hotel
Honolulu, Hawaii