Methods for extracting & compiling knowledge in Foresight

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Characteristics of Foresight as an umbrella activity

- The role of Foresight in addressing disruptive transformations in response to grand societal challenges
- The role of Foresight in ‘managing the Earth’
- The use of techniques: Search for techniques to fit perceptions of the work in hand. Has it always been successful?
- ‘Methods pass the problem by’ (Wittgenstein)
- Subjectivity: The influence of personal behavioural patterns

Claims to Foresight knowledge benefits in policy context

- FTA knowledge allows:
  - To explore possible futures and develop a vision on such futures
  - To identify impacts on society and implications for policy and particular stakeholders and or sectors of society
  - To guide and support the policy process
  - To timely mitigate negative impacts or adapt to new situations and exploit positive outcomes
  - To deepen dialogue with society
  - To improve governance

Von Schomberg et al, 2005

Distinction of normal science and Foresight

In distinction to normal science, foresight knowledge

- is non-verifiable in nature since it does not give a representation of an empirical reality. It can, therefore, also not be related to the normal use "predictability" of events. The quality of foresight knowledge is discussed in terms of its plausibility rather than in terms how accurate it is in terms of the predictability of certain events. FTA is therefore often characterized as "explorative" (or "normative") in nature and not meant to produce predictions
- has a high degree of uncertainty and complexity
- has an action-oriented perspective (identification of 'threats / challenges / opportunities and the relevance of knowledge for a particular issue) whereby normal scientific knowledge lacks such an orientation
- is more than future-oriented research: it combines normative targets with socio-economic feasibility and scientific plausibility
- is by definition multi-disciplinary in nature and even very often combines the insights of the social and natural sciences

von Schomberg et al, 2005

Comparing Foresight knowledge to normal science

SCIENTIFIC KNOWLEDGE BASE	Argumentation Forms based on knowledge input	Argumentation/ Problem focus	Policy Discourse
FORESIGHT KNOWLEDGE	PLAUSIBILITY CLAIMS (such as arguments by analogy and counterfactuals)	PROBLEM DEFINING/EXPLORING	POLICY DEFINING
NORMAL SCIENCE	PREDICTABILITY CLAIMS	PROBLEM SOLVING	POLICY EVALUATING

Von Schomberg et al, 2006

Foresight and subjective behaviour

- Three interpretations of probability (Savage, 1954)
  - Objectivist (frequentist)
  - Personalistic (with regards to propositions expressing opinion)
  - Necessary (measurement of the extent that a set of propositions ‘of necessity’ confirms the truth of another)
- Uncertainties of quantitative information due to expert opinion and interpretation
- Subjectivity in eliciting expert opinion and mental ‘handshaking’

Considerations in method selection

Ten typical selection criteria for methods:

1. Proof of concept – learning from other sites of application
2. Available- accessible resources, cost (information-knowledge, time, money, facilities, skills)
3. Level of participation desired
4. Stakeholder expectations , designations etc.
5. Urgency - time constraints
6. Suitability for combination with other methods
7. Prior experience and familiarity
8. Objectives, desired outputs of Foresight exercises (mix of product and process orientation)
9. Quantitative and Qualitative data requirements and availability of expertise, right of use etc.
10. Methodological competence of practitioners

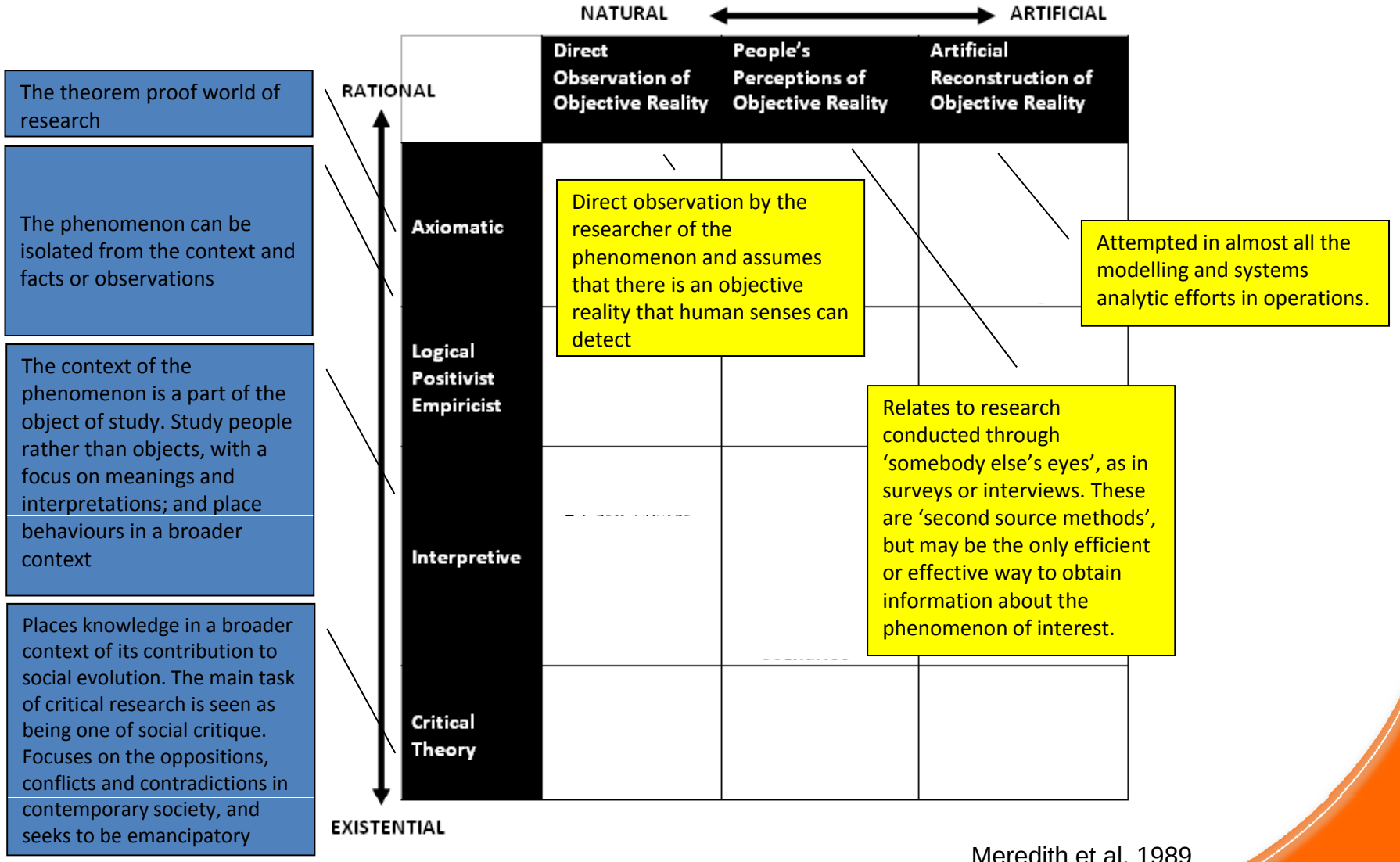
Methodological principles

- Future-oriented
- Participative
- Evidence-based
- Multidisciplinary
- Coordinating
- Action oriented

Positioning Foresight methods

- How to fit perceptions and techniques?

- Meredith *et al.* (1989) suggest a two dimensional framework that shapes the philosophical basis for a research activity:
  - **Rational/existential dimension:** concerns the nature of truth
    - Rationalism - purely logical and independent of man: uses a formal structure and pure logic as the ultimate measure of truth
    - Existentialism - can only be defined relative to individual experience: knowledge is acquired through the human process of interacting with the environment
  - **Natural/artificial dimension:** concerns the source and kind of information used in the research.
    - Natural dimension - empiricism (deriving explanation from concrete, objective data)
    - Artificial dimension - subjectivism (deriving explanation from interpretation and artificial reconstruction of reality).



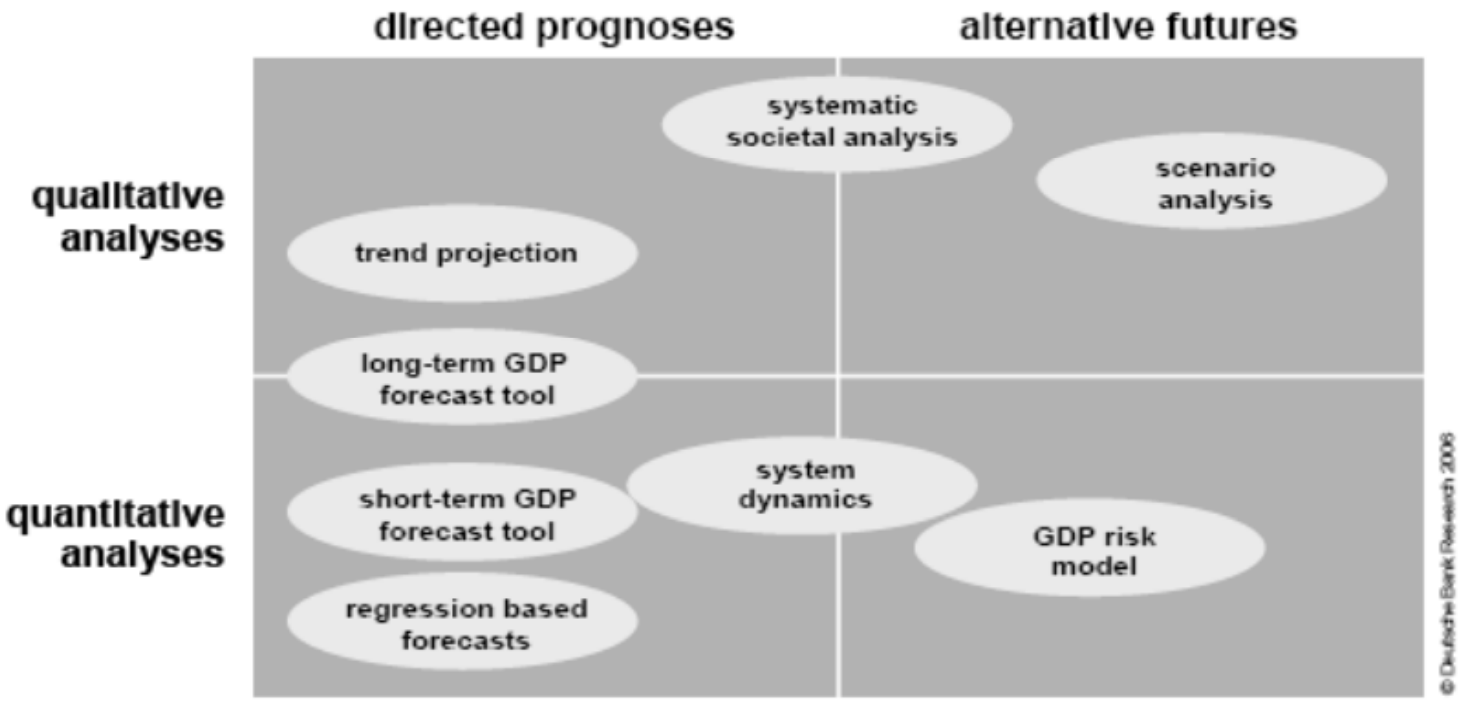
Meredith et al, 1989

NATURAL ⟷ ARTIFICIAL

RATIONAL ↕ EXISTENTIAL

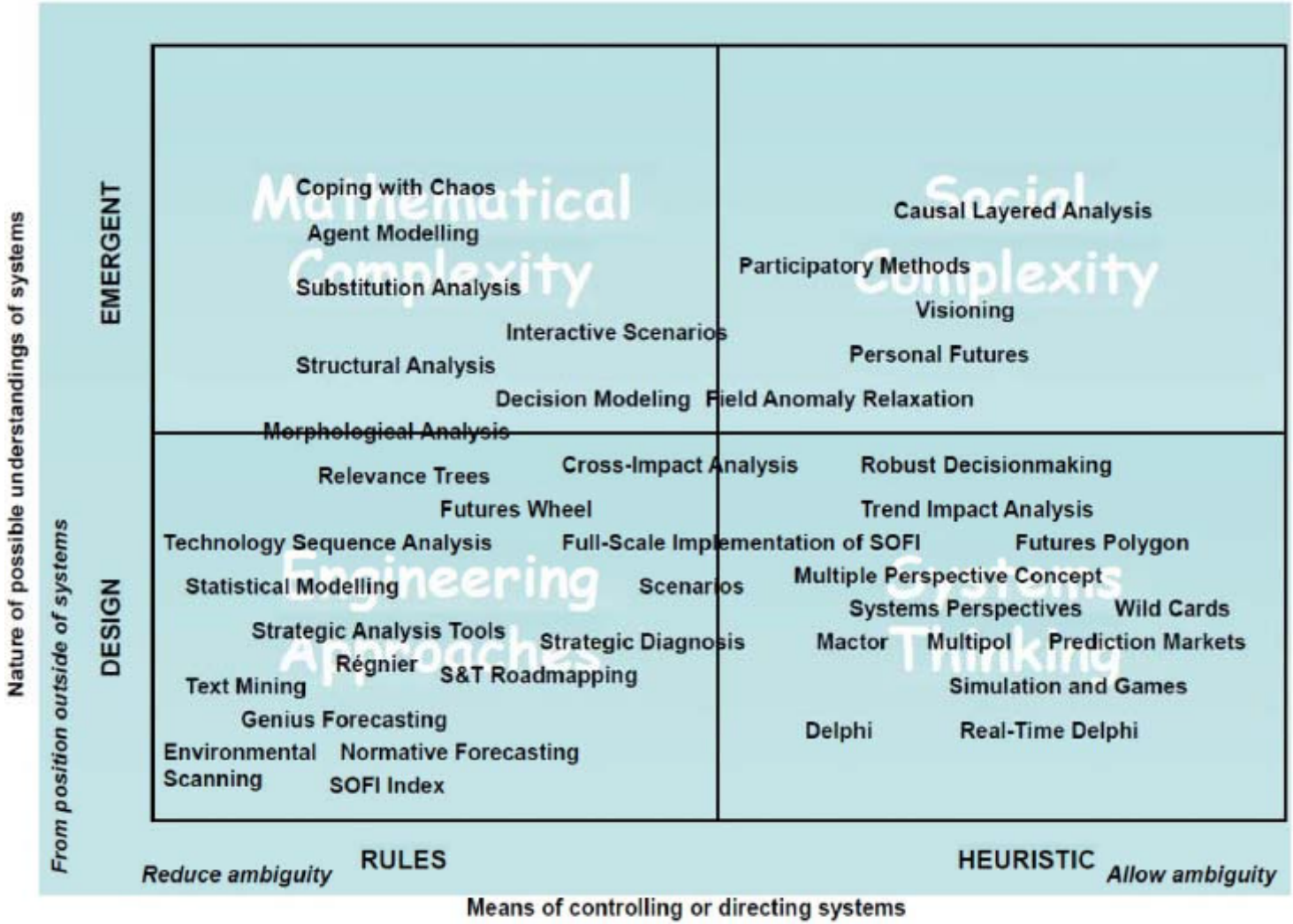
	Direct Observation of Objective Reality	People's Perceptions of Objective Reality	Artificial Reconstruction of Objective Reality
Axiomatic			• Reason/Logic/ Theorems • Normative Modelling • Descriptive Modelling
Logical Positivist Empiricist	• Field Studies • Field Experiments	• Structured Interviewing • Survey Research	• Prototyping • Physical Modelling • Laboratory Experimentation
Interpretive	• Action Research • Case Studies	• Historical Analysis • Delphi • Intensive Interviewing • Expert Panels • **Futures/ Scenarios**	• Conceptual Modelling • Hermeneutics
Critical Theory		• Introspective Reflection	

Mapping methods for Corporate Foresight



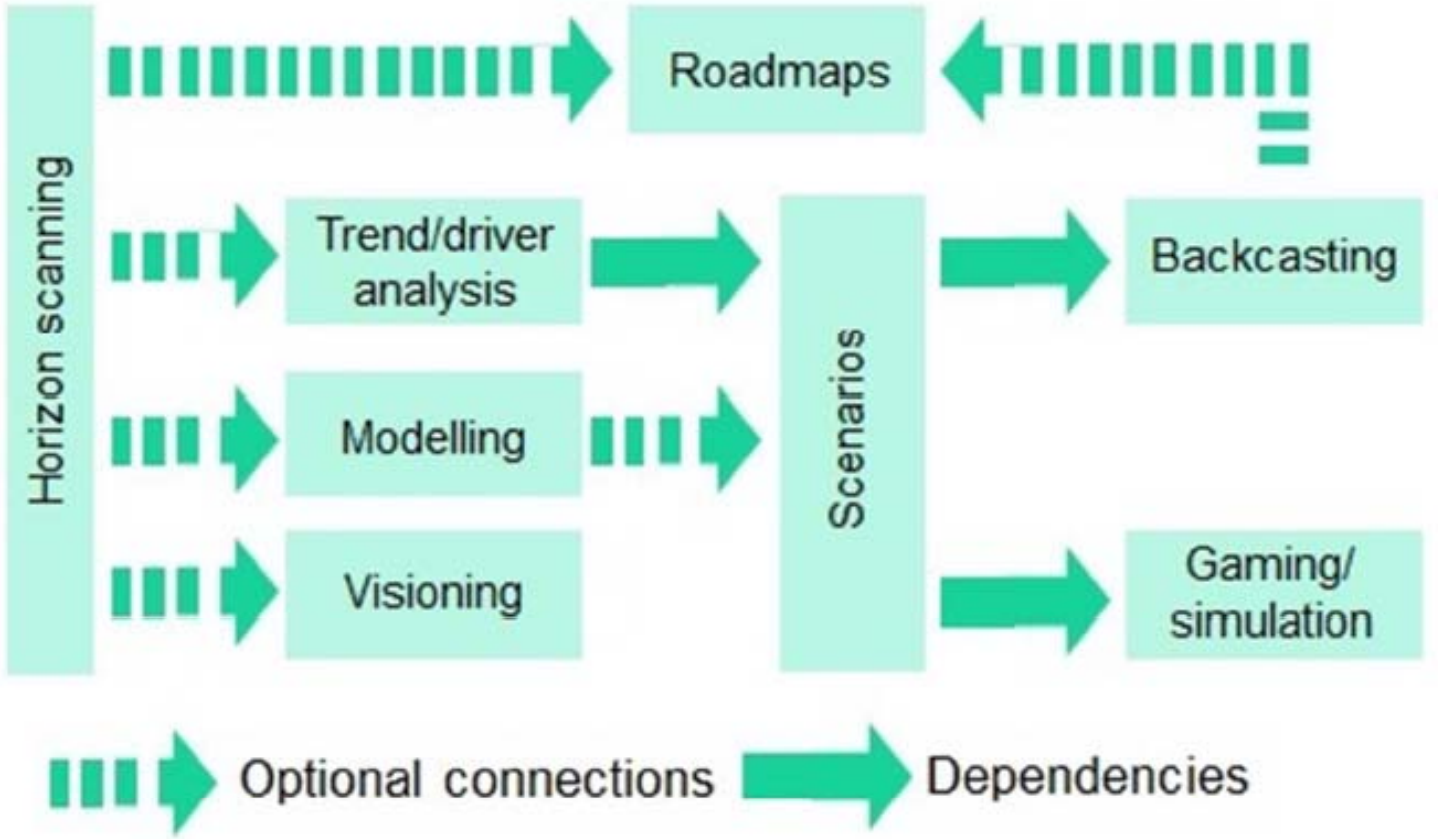
Deutsche Bank (2006)

Mapping methods: Futures Research Methodology



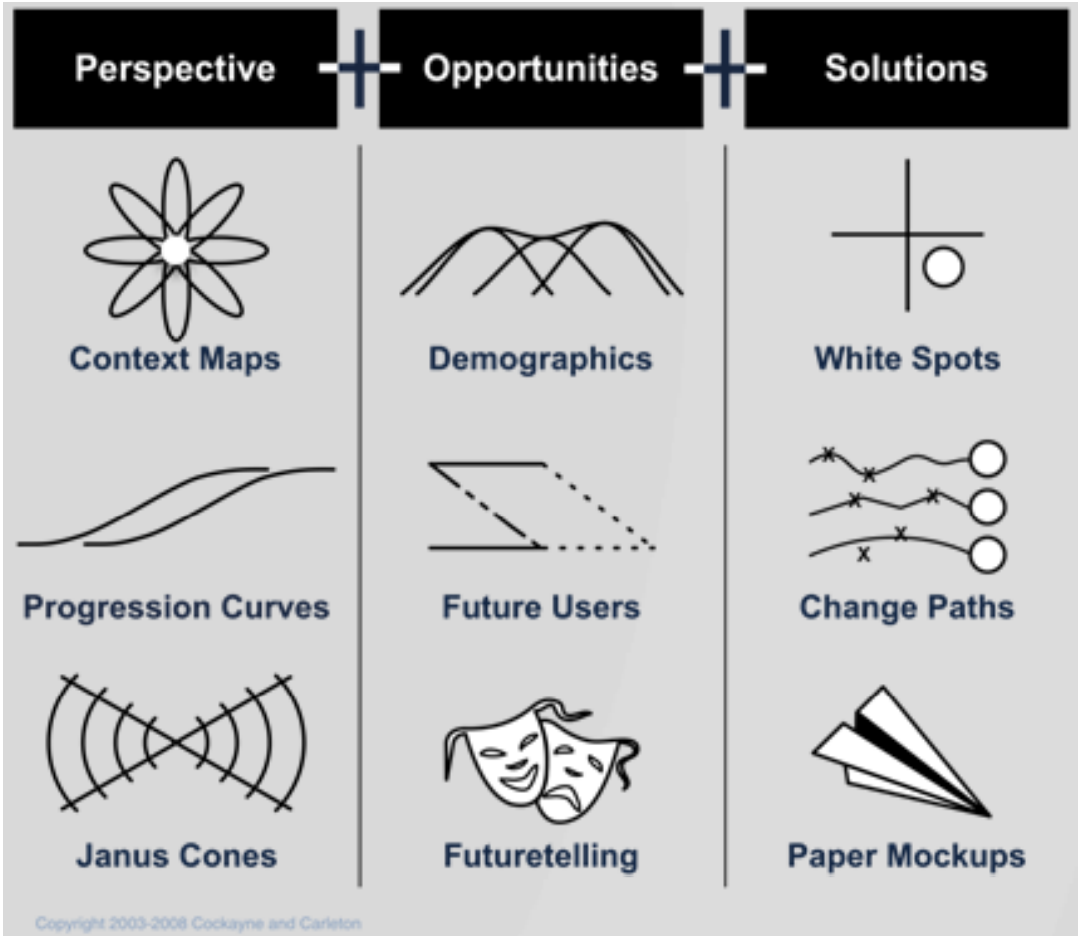
Aaltonen (2010)

Ordering and combining methods



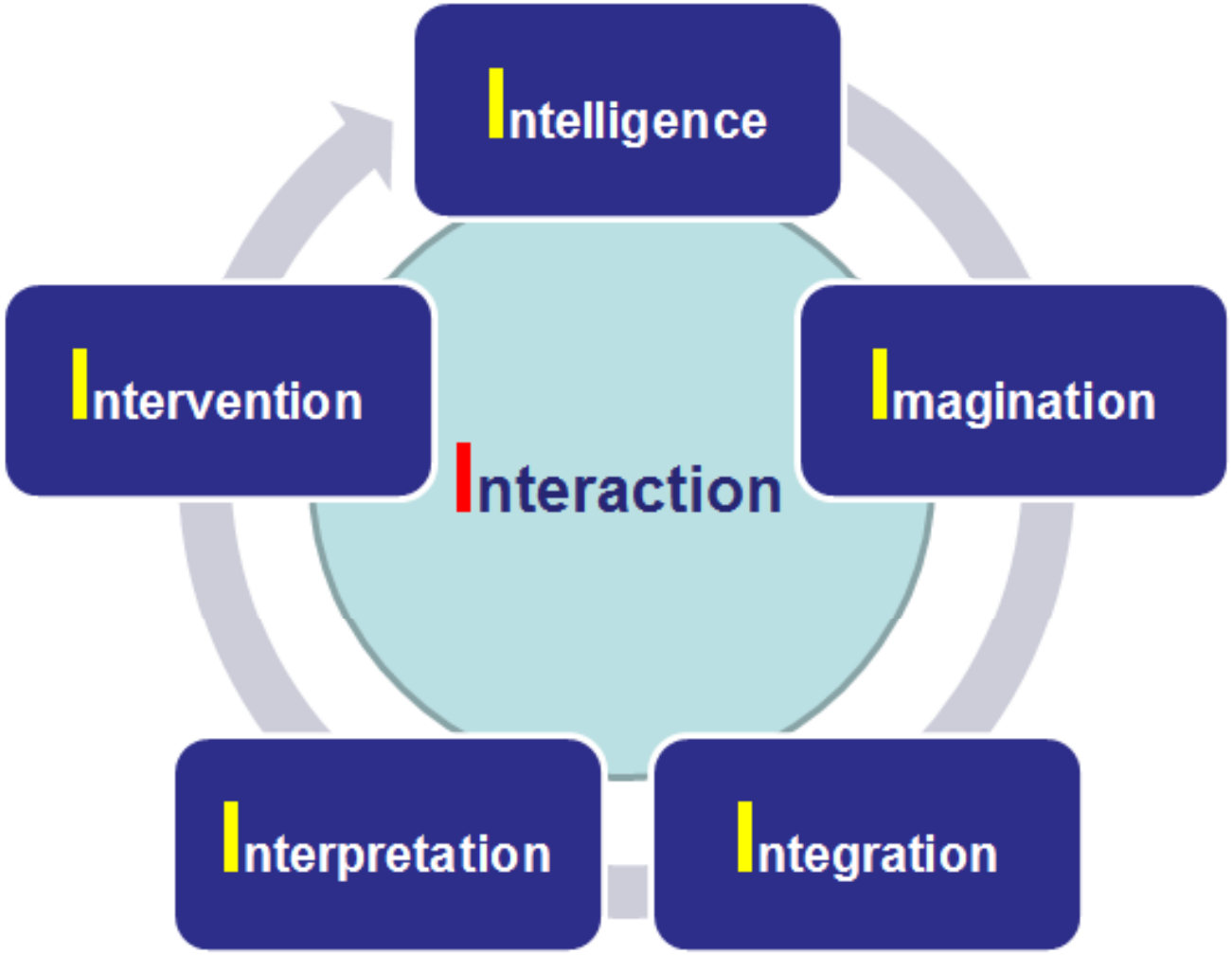
Strategic Futures Planning – Andrew Jackson.
(www.foresight.gov.uk)

Ordering and combining methods

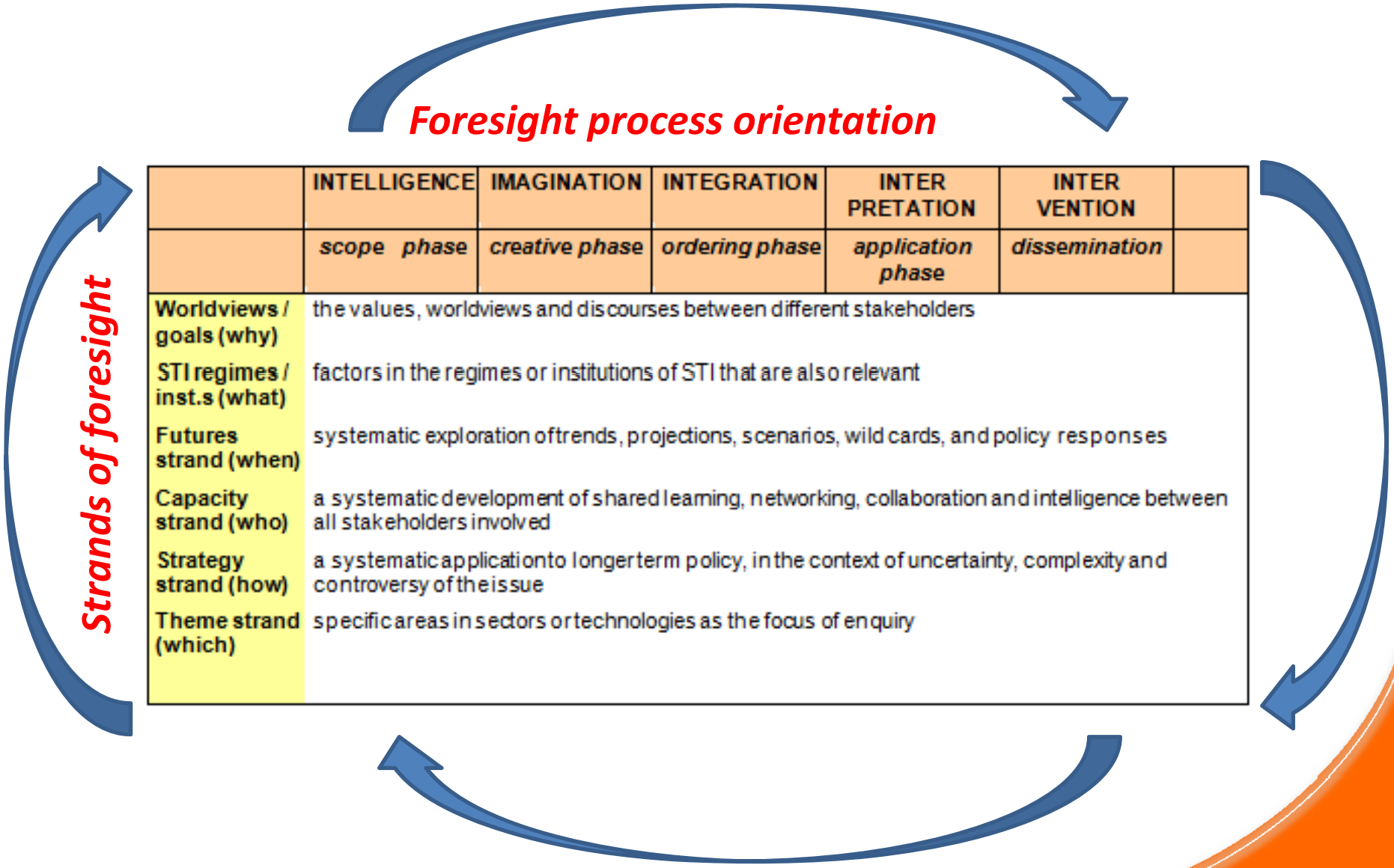


Stanford Foresight and Innovation Approach (http://foresight.stanford.edu/about.html)

Systemic Foresight Methodology: Phases



Systemic Foresight Exercise: Architecture



	INTELLIGENCE	IMAGINATION	INTEGRATION	INTER PRETATION	INTER VENTION	
	scope phase	*creative phase*	*ordering phase*	*application phase*	*dissemination*	
Worldviews / goals (why)	the values, worldviews and discourses between different stakeholders					
STI regimes / inst.s (what)	factors in the regimes or institutions of STI that are also relevant					
Futures strand (when)	systematic exploration of trends, projections, scenarios, wild cards, and policy responses					
Capacity strand (who)	a systematic development of shared learning, networking, collaboration and intelligence between all stakeholders involved					
Strategy strand (how)	a systematic application to longer term policy, in the context of uncertainty, complexity and controversy of the issue					
Theme strand (which)	specific areas in sectors or technologies as the focus of enquiry					

SFM: Methods & Tools

PHASES	INTELLIGENCE	IMAGINATION	INTEGRATION	INTERPRETATION	INTERVENTION
FUNCTIONS	*Scoping / surveying phase*	*Creative phase*	*Ordering phase*	*Strategy phase*	*Action phase*
ACTIVITIES	*Survey, scan, evidence*	*Concept model, visions, scenarios*	*Priorities, analysis, negotiations*	*Agendas, strategies*	*Plans, policies, actions*
Divergent Methods *(more open, creative)*	Horizon scanning	Scenario stories / images	Backcasting	SWOT analysis	R&D planning
	Social Network Analysis	Gaming	Delphi	Strategic planning	Operational research
	Knowledge / research map	Visioning	Success scenarios	Roadmapping	Action planning
	Literature review	Agent –based modelling	Multi-criteria analysis	Cross-impact analysis	Policy impact assessment
Convergent methods *(more specific, quantitative)*	STI policy analysis	Scenario modelling	Risk assessment	Logic framework	Priority lists
	Bibliometric / patent analysis	System dynamics	Cost-benefit analysis	Linear programming	Critical / key technologies

SFM: Example methods

Phases	INTELLIGENCE	IMAGINATION	INTEGRATION	INTERPRETATION	INTERVENTION
Functions	Scoping / surveying phase	Creative phase	Ordering phase	Strategy phase	Action phase
Activities	Survey, scan, evidence	Concept model, visions, scenarios	Priorities, analysis, negotiations	Agendas, strategies	Plans, policies, actions
Divergent Methods (more open, creative)	EHS – Environmental Horizon Scanning	SFV – Societal Future Visions	STH – Six Thinking Hats	FPE – Forward Policy Engagement	RBD – Robust Decision Making
	SOP – State of the Play in the futures field	ISF – Interactive Scenarios Formulation	EPS – Expert Panel Synthesis	FDM – Foresight Decision Models	ARI – Accelerating Radical Innovation
	SFI – State of the Future Index	CSA – Casual Layered Analysis	SBC – Situational Back Casting	CIA – Cross Impact Analysis	THI – Triple Helix Integration
	CTI – Competitive Technical Intelligence	ABM – Agent Based Modelling	CSF – Critical Success Factors	TRM – Technology Road mapping	TIA – Trend Impact Analysis
	STM – Statistical Trend Modelling	SAG – Simulation and Games	RTD – Real Time Delphi	TSA – Technology Sequence Analysis	APM – Action Priority Matrix
Convergent methods (more specific, quantitative)	TDM – Technology Data Mining	GFI – Genius Forecasting and Intuition	CSC – Computerised Scenario Comparisons	FRT – Factor Relevance Trees	CKT – Critical & Key Technologies

Objectives and paths

- **Research path** - where foresight is applied to determine next stage or longer term research priorities;
- **Technology path** – where foresight is applied to ascetrtain prospective shifts andnew types of te chnologies and the implications related to thir potential adoption;
- **Structural path** - where foresight is applied to envisioning how key structures – systems, organizations, funding procedures etc. could change and what implications might follow;
- Policy path – where foresight is applied to provide insights, multiple options and guidance to governance stakeholders, policy planners and decision makers;
- **Strategy path** - where foresight is used to develop strategies for individuals and organizations to be agile, adaptive, anticipatory and effective in terms of preparedness, readiness and capacity for action to avoid surprise and be positioned for coping or prospering from change;
- **Business / Market path –** where foresight is applied to anticipate potential shifts and changes in business conditions, market constraints and opportunities, including weak signals about new, emergent and prospective future markets;
- **Vision path –** where foresight is applied to create, validate or change the future vision guiding a set of stakehoders, clients and participants;

A Case: Methodology for a Regional Foresight exercise

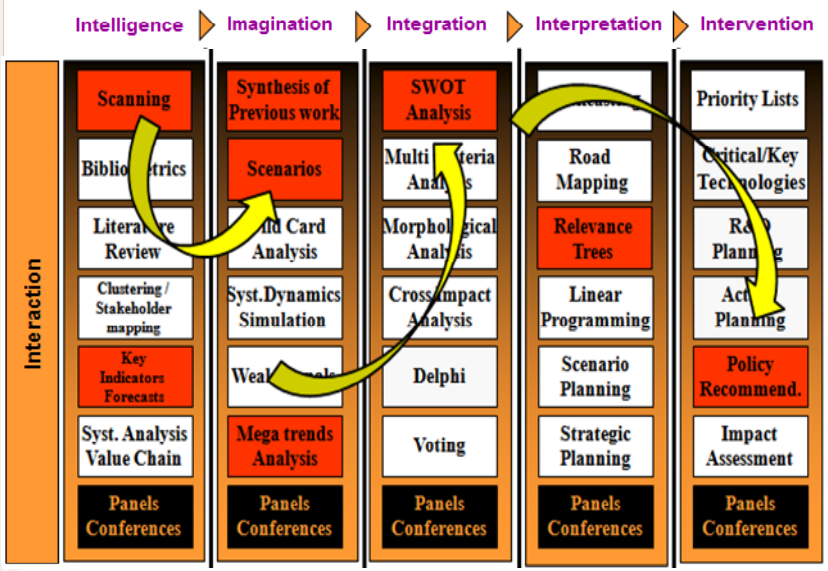
Objectives of the Regional Foresight exercise:

- Policies and strategies for the Renewable Energies sector (e.g. improve competitiveness of companies, scientific organizations and intermediaries; establish the capital region as relevant and attractive location; improve services; and exploit a large market in the region and beyond)

- Identification of key technologies (e.g. identify key technologies for the next 10-20 years; promote technology learning; strengthen technology transfer; utilize existing technologies; and involve in the development, shaping and expert technologies)

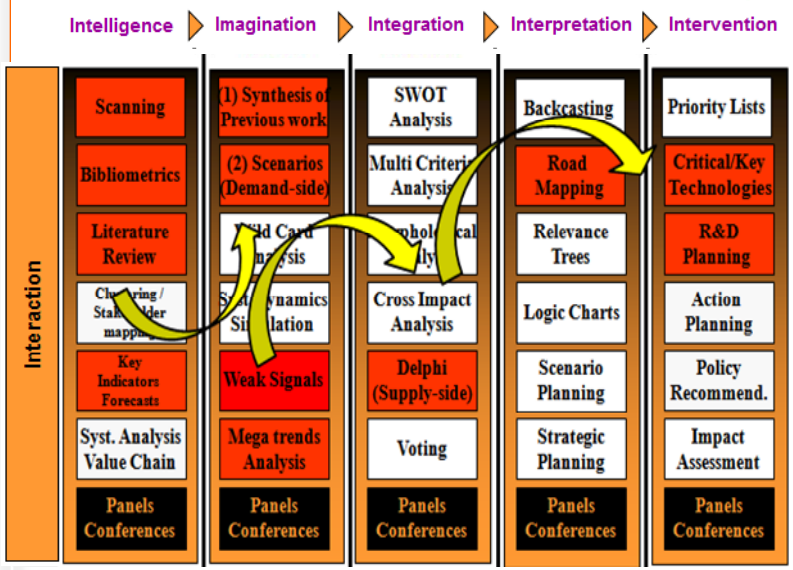
- Structural and organizational improvement of the sector (e.g. improve collaboration among actors; improve supplier / value chains; initiate new partnerships and investments; establish state-wide SME network; and establish international activities)

Policy path



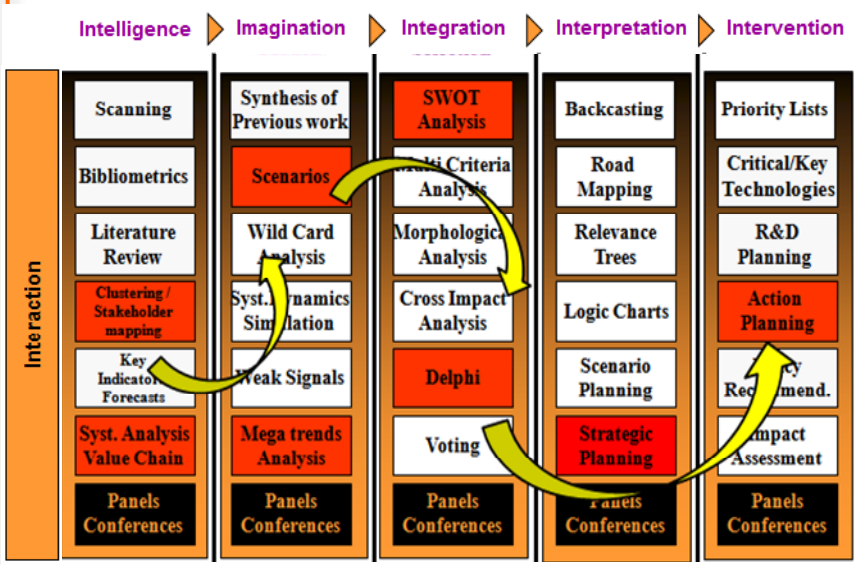
- **Scanning:** For the analysis of STEEPV systems to understand what type of energies will be needed and what kind of demand will come out
- **Key Indicators / Forecasting:** For the analysis of sectoral forecasts and long term projections
- **Mega trend analysis:** To understand the broad policy tendencies at the Global/European/National levels
- **Synthesis of previous work:** Large amount of the work on energy futures exists including plenty of scenario work (reviewing those scenarios would be useful to suggest a set of “synthesis scenarios”)
- **Scenarios:** To discover alternative futures on policy developments
- **SWOT analysis** of the regional capabilities against the visionary scenario
- **Roadmapping:** Illustrating the priority areas, the actions to be taken in long, medium and short terms and the distribution of initiatives among the actors in the sector
- **Policy Recommendations:** Policy actions to be taken in the short term

Technological path



- **Scanning:** For the analysis of STEEPV systems and discuss their implications on technologies
- **Bibliometrics/Literature Review:** For the review the technologies to generate energy and discuss in panels which are relevant and promising for the region
- **Key Indicators/Forecasts:** Analysis of sectoral forecasts and long term projections on technologies
- **Synthesis:** For the review and synthesis of the previous Foresight work
- **Scenarios** with wide participation (including citizens) identify the 'demands of society' from the technology
- **Delphi:** Represents the 'supply' side – whether the demands in the scenarios are possible and feasible or not. Helps to define time of realisation for selected technologies and technology areas. Also helps to identify priority technologies
- **Roadmaps:** For the development of Technology Roadmaps for prioritised technologies at different levels such as Technology – Product / Capability / Development / Research
- Produce a list of **critical technologies**
- Suggest **R&D projects** and plan R&D activities and resources

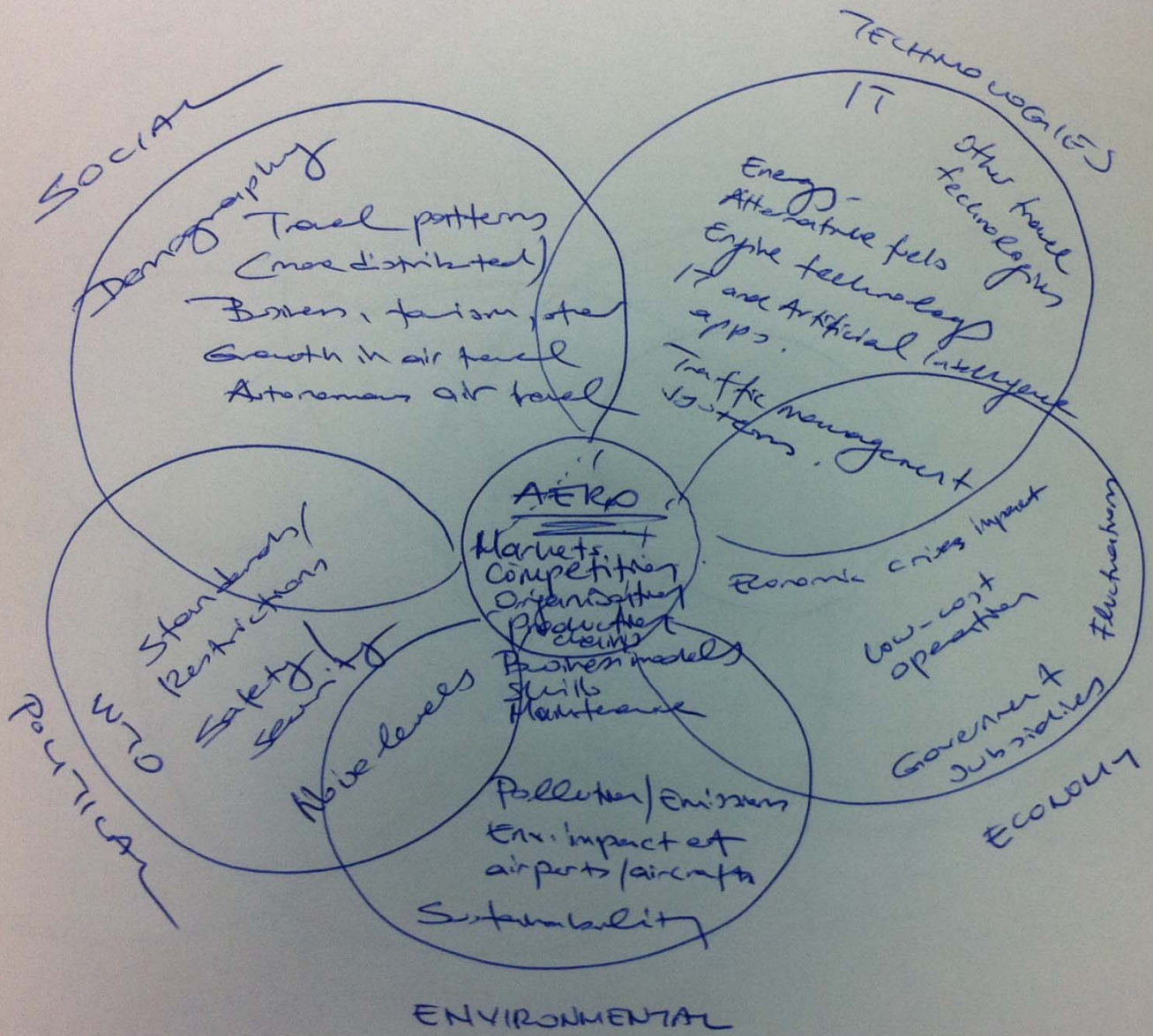
Structural path



- **System Analysis:** Analysis of the value chain helps to come to a better understanding of how the sector works and what the actors / stakeholders are
- **Clustering** by stakeholder mapping helps to map the actors in the sector and to indicate 'who is doing what'
- **Mega trend analysis:** Sectoral megatrends will give clues on changing roles in the sectors and inclusion of new actors / stakeholders in the process in the future
- **Scenarios:** Various scenarios around Input-Output relationships illustrate the future organisation of the sector
- **SWOT analysis** of the existing structures against the structures suggested in the visionary / most desirable scenario
- **Delphi:** To identify types of collaborations needed among stakeholders in order to establish new links in the system
- **Strategic plans:** for the restructuring of the sector in the medium term
- **Action planning:** To suggest immediate actions to change / improve structures and organisations and to introduce new rules and regulations

METHODS	Policy Path	Tech Path	Structural Path
Scanning	★	★	
Bibliometrics		★	
Literature Review		★	
Key Indicators	★	★	
Stakeholder Mapping			★
System Analysis			★
Megatrend Analysis	★	★	★
Scenarios	★	★	★
Weak Signals		★	
SWOT Analysis	★	☆	★
Delphi Survey	☆	★	★
Roadmapping		★	
Relevance Trees	★		
Strategic Planning			★
Critical / Key Techs		★	
R&D Planning		★	
Policy Recommendations	★		
Action Planning	☆		★

SYSTEMS MAP FOR AIRCRAFT ENGINEERING



*ACTORS?

*INTERNATIONAL COLLABORATION

*INCREMENTAL INNOVATION (long technology and product development times)

- Need for time horizons?
  - 2030!
  - 2050.

Future influences on Foresight

- Increasing complexity, political interventions and implications
  - The misleading anti-nuclear lobby
- Increasing computer power will require unconventional influences on Foresight
  - “Computers ‘and’ you” vs. “Computers ‘or’ you” (Loveridge, 1983)
  - Kurzweil’s singularity
  - Getting nearer to unknown unknowns
- New skills and understanding
  - The role of computation and algorithms
- Grand challenges
  - Existence and nature of global situations
  - Continual introduction of ideas and artefacts in NBIC
  - Social control of technology

Epilogue

- Foresight's greatest obstacle is ignorance – going beyond known knowns and known unknowns to unknown unknowns
- The need for Foresight to be framed in its perceived context, which is bounded by fuzzy boundaries
- The practical outcomes of Foresight are underlain by complex matters relating to human behaviour, uncertainty and ignorance
- Emphasis on behavioural and cognitive sciences, and the need for understanding the nature of individual expertise
- The influence of behavioural matters on quantitative data
- Computational power will take Foresight into a Kurzwellian era

End of presentation

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