Foresight methodology

Practice, trends & challenges

HSE - ISSEK

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Contents

- Foresight: evolution of the practice
- Foresight practice around the world
- Foresight process and new trends
- Challenges in Foresight
- Future life sections

Some ‘drivers of change’

- Printing, gunpowder and the compass have changed the whole face and state of things throughout the world... (Francis Bacon, 1620).
- Improvements in machinery go hand in hand with the division of labor, and very pretty machines ... facilitate and quicken production... (Adam Smith, 1776).
- The bourgeoisie cannot exist without constantly revolutionizing the means of production! (Karl Marx, 1848).
- Knowledge is the chief engine of progress in the economy (Alfred Marshall, 1897).
- The entrepreneur and his search for new combinations is the driving force in all economic development... (Joseph Schumpeter, 1911).
- Science and basic research are incredibly powerful sources of future economic and societal development... (Vannevar Bush, 1945).

Evolution of Foresight

- **Early Foresight:** The existence of human on the earth surface - the act of anticipation as an unavoidable human characteristic
- **1950s:** The principles of trend extrapolation and social indicators, and the methods of expert analysis (e.g. Delphi & cross-impact). First computer simulations become well-known
- **1960s:** Narrowly focused technology-oriented forecasting activities – the probabilistic assessment of what is likely to happen in the future
- **1970s:** Change in the understanding of forecasting due to increasing complexity and uncertainty of societies and economies (e.g. unpredicted oil shocks in the '70s)
- **1980s:** Multiple futures thinking, participatory activities, where both processes (i.e. networks, tacit outcomes) and products (i.e. codified outputs) were given emphasis
- **1990s:** Foresight for **S&T policy making** by government, industry and other organisations
- **2000s:** Recognition of the close relationship between S&T and society

Foresight

- "the application of
  - *'**systematic**'*,
  - *'**participatory**'*,
  - *'**future-intelligence-gathering and medium-to-long-term vision building process**'* to
  - *'**informing present-day decisions*** and ***mobilising joint actions**'"*

Forecasting vs. Foresight

- Single vs. Multiple futures thinking
- Nature of situations : Simple, Complicated & Complex
- Nature of systems: Technological, Economic, Social and Human systems
- Nature of problems & approaches (Positivist, Constructivist, Critical)
- Level of participation: Expert driven to participative and inclusive
- Level of uncertainty & Time horizons
- Taking into account of Wild Cards / Surprises / Shocks
- Use of techniques: Qualitative, Quantitative or a suitable mixture

The uses of Foresight

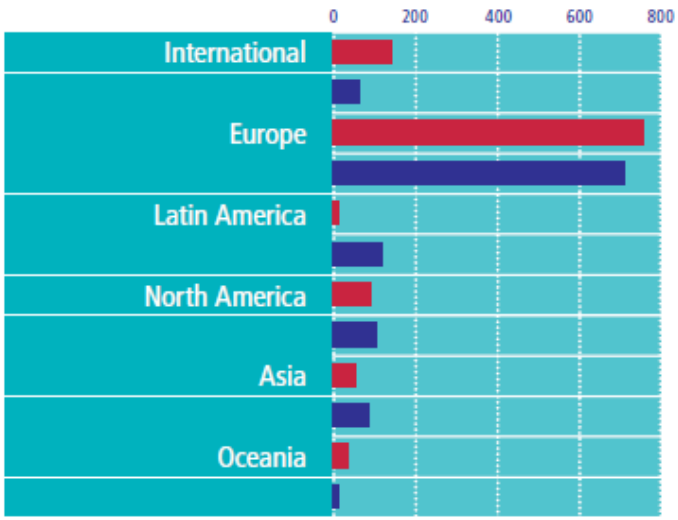
Products

- Build visions of the future
- Provide anticipatory intelligence to system actors
- Set general research directions
- Inform policy and public debates
- Inform funding and investment priorities

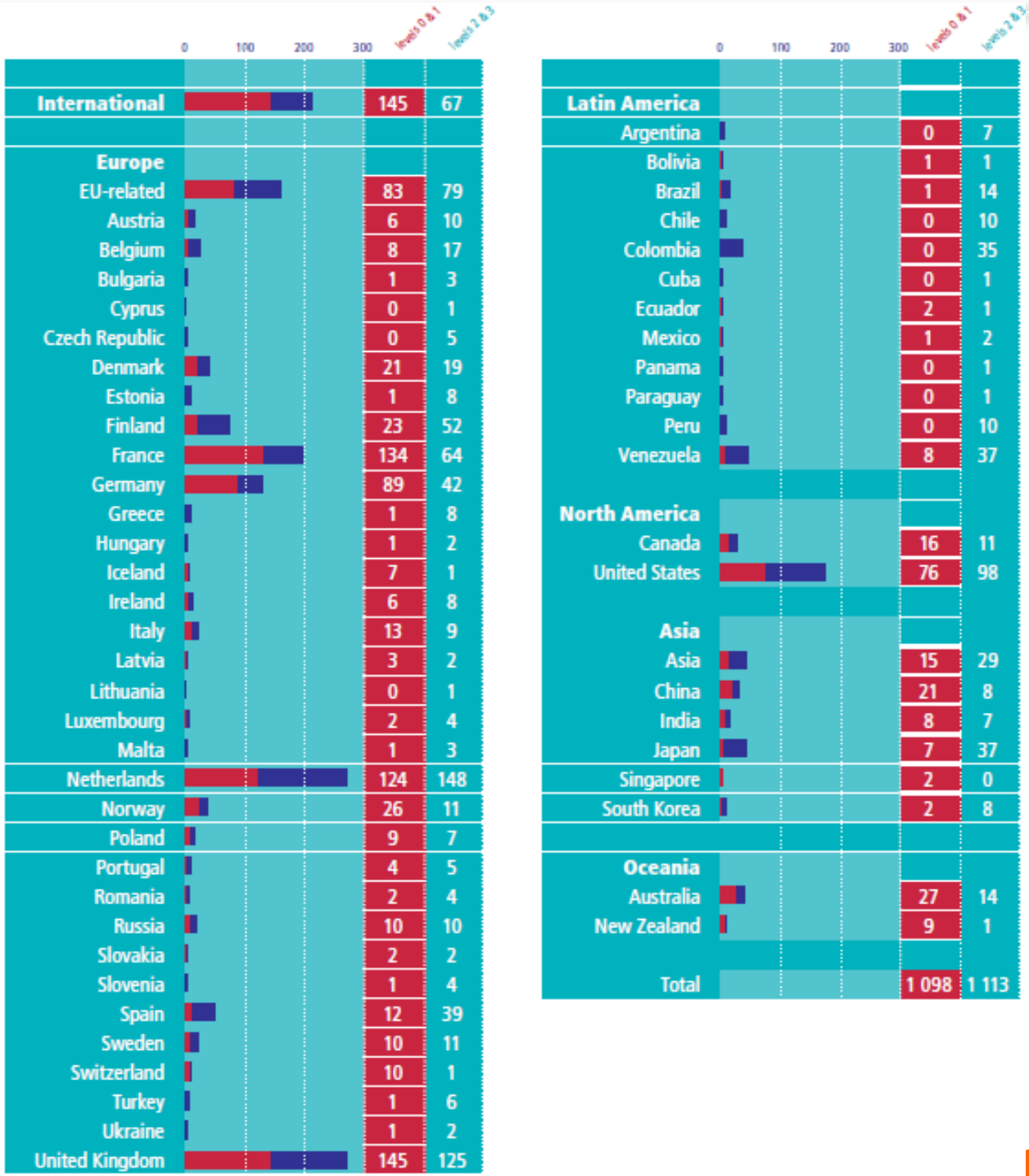
Process

- Increase involvement of system actors in decision making
- Increase understanding and change mindsets
- Build trust between participants
- Aid collaboration and highlight interdisciplinary opportunities
- Build networks and strengthen communities

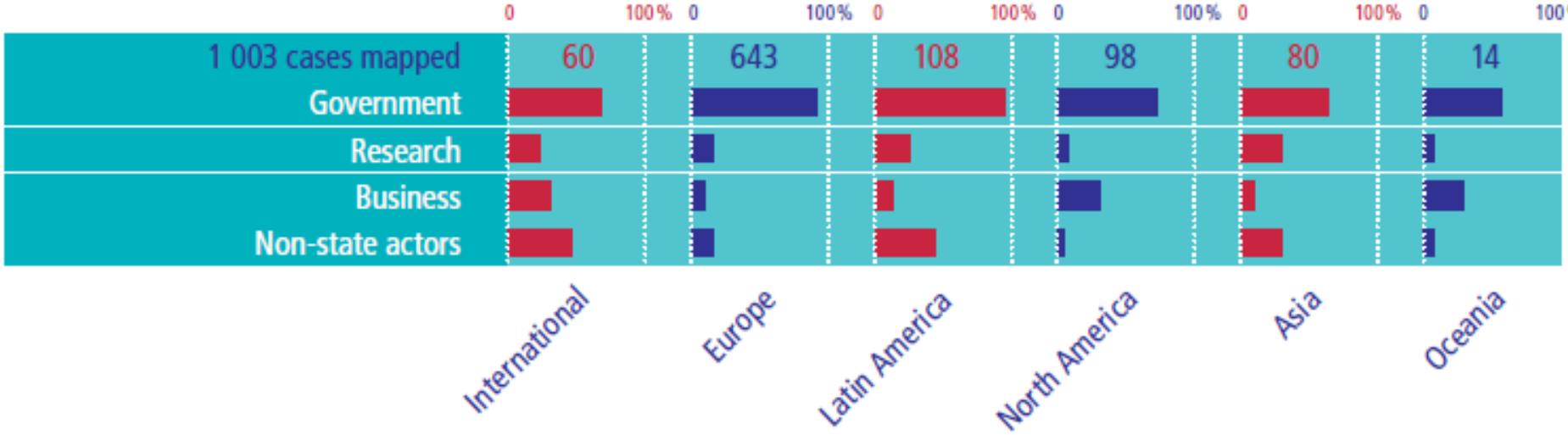
EFMN mapped Foresight exercises per region

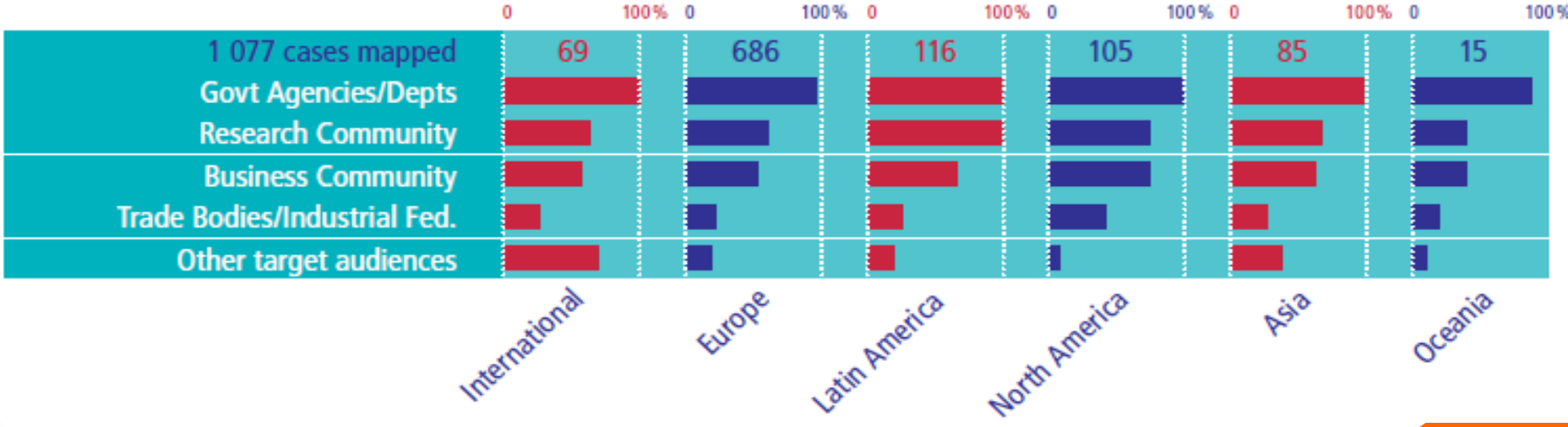


Mapping of Foresight activities

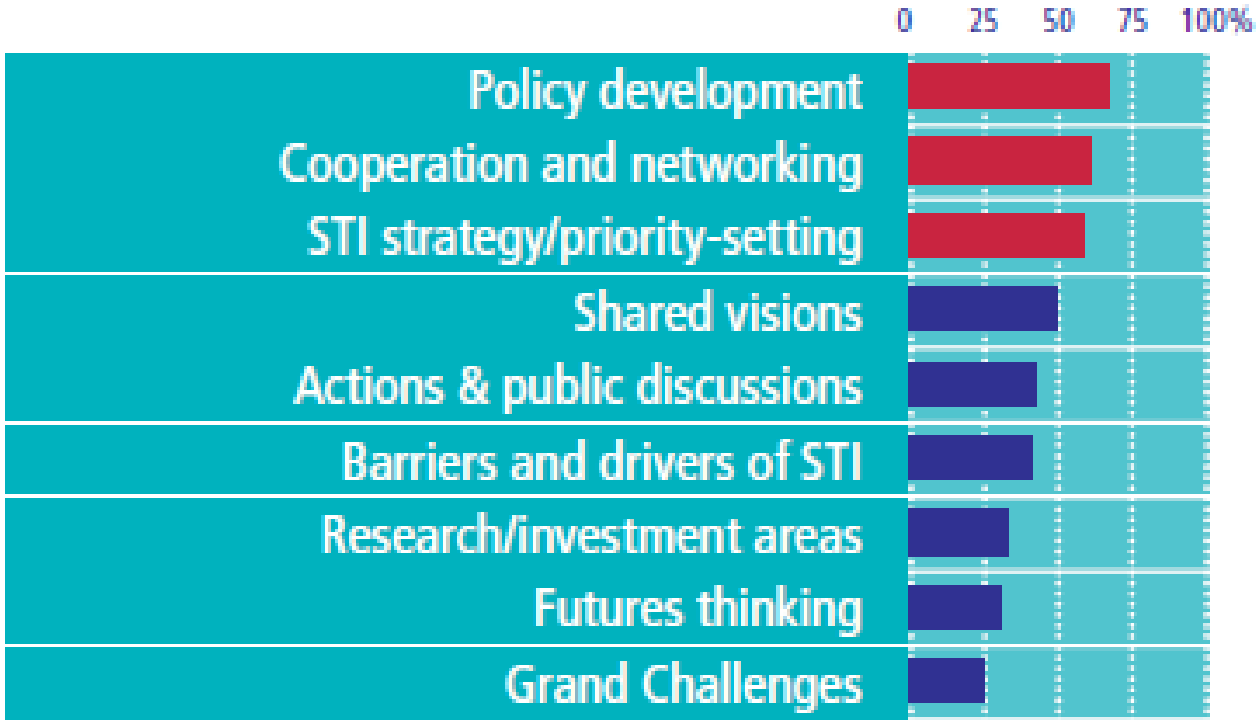


Sponsors & target audiences of Foresight



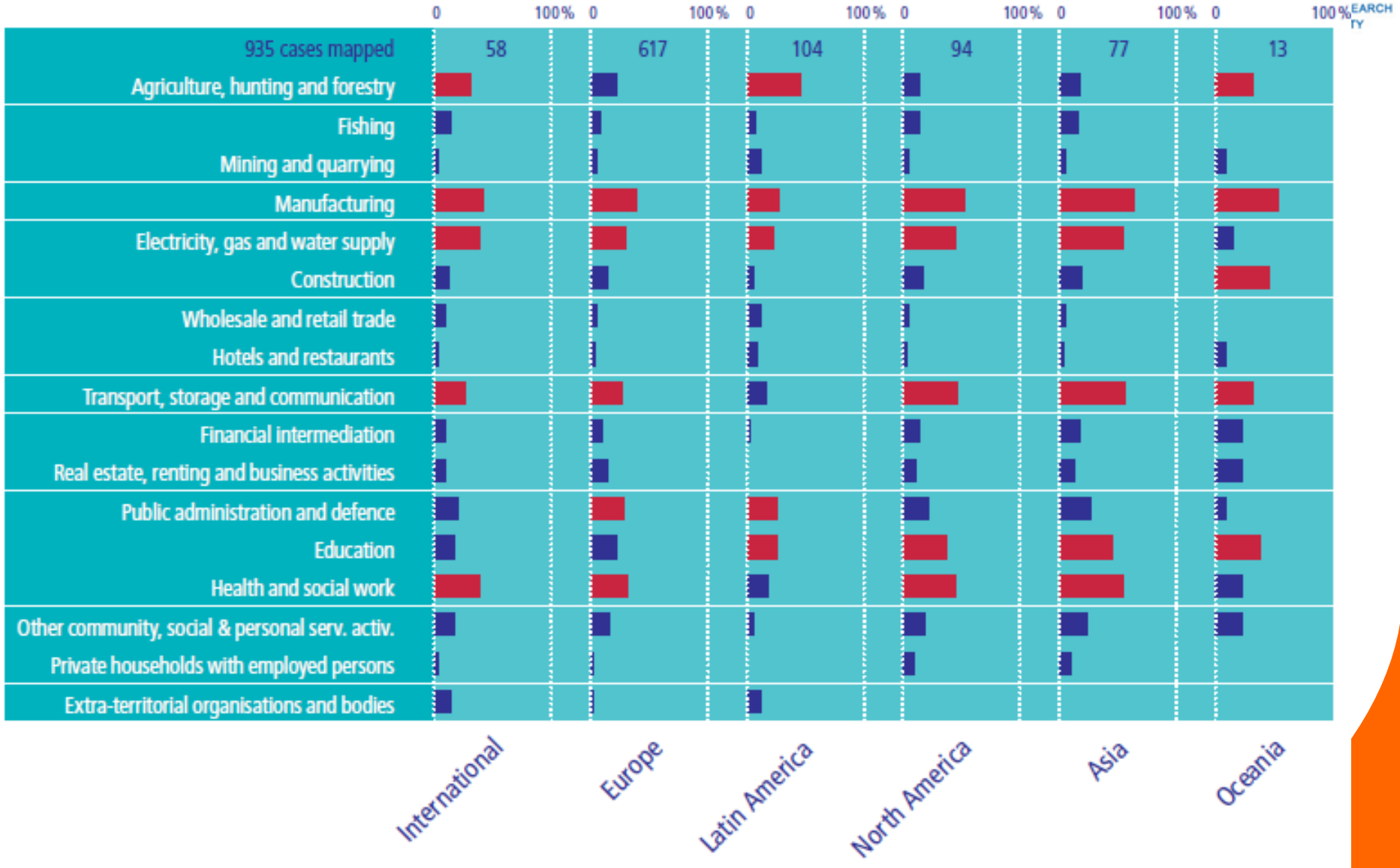


Objectives of Foresight

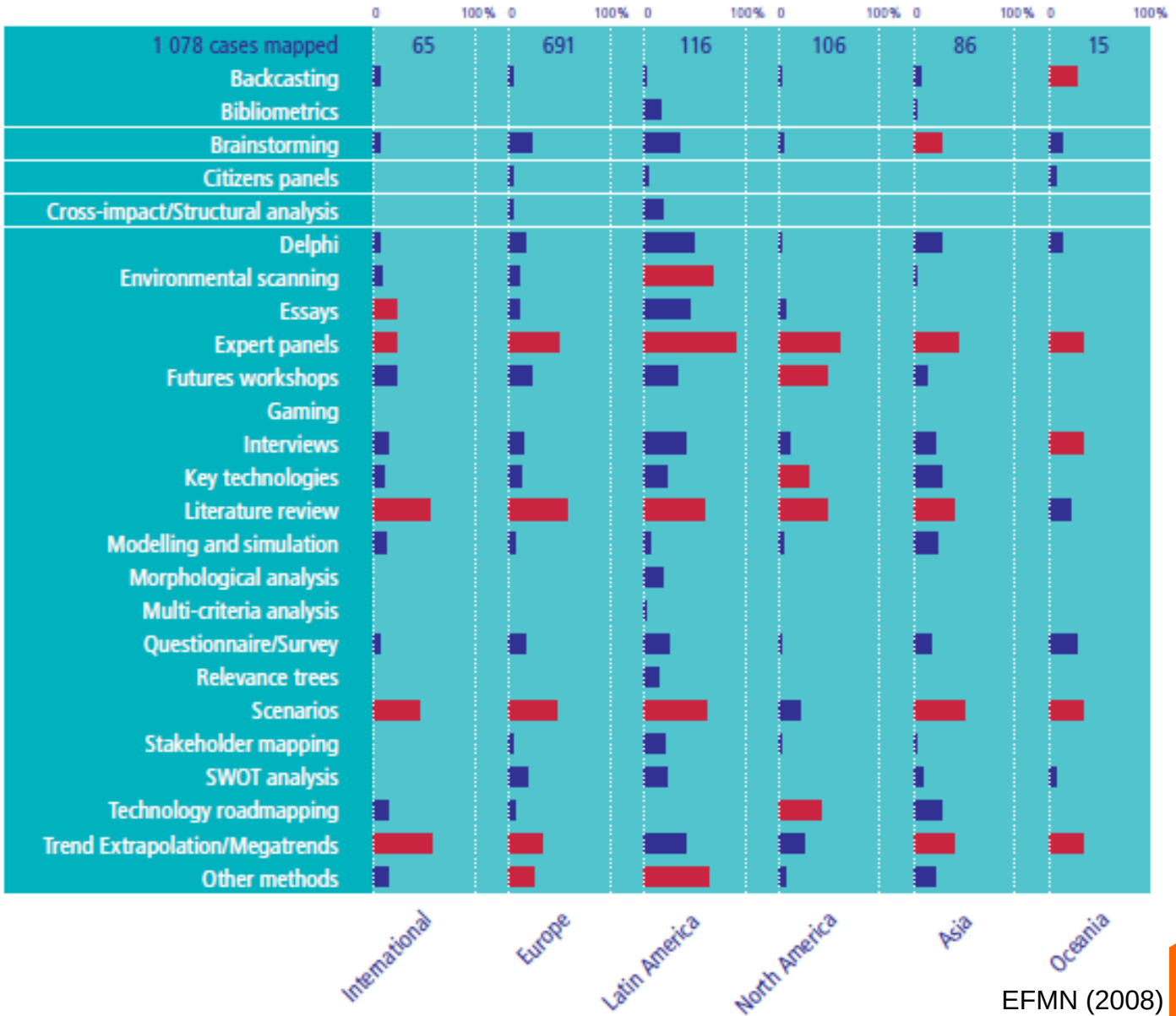


EFMN (2008)

Sectors focused

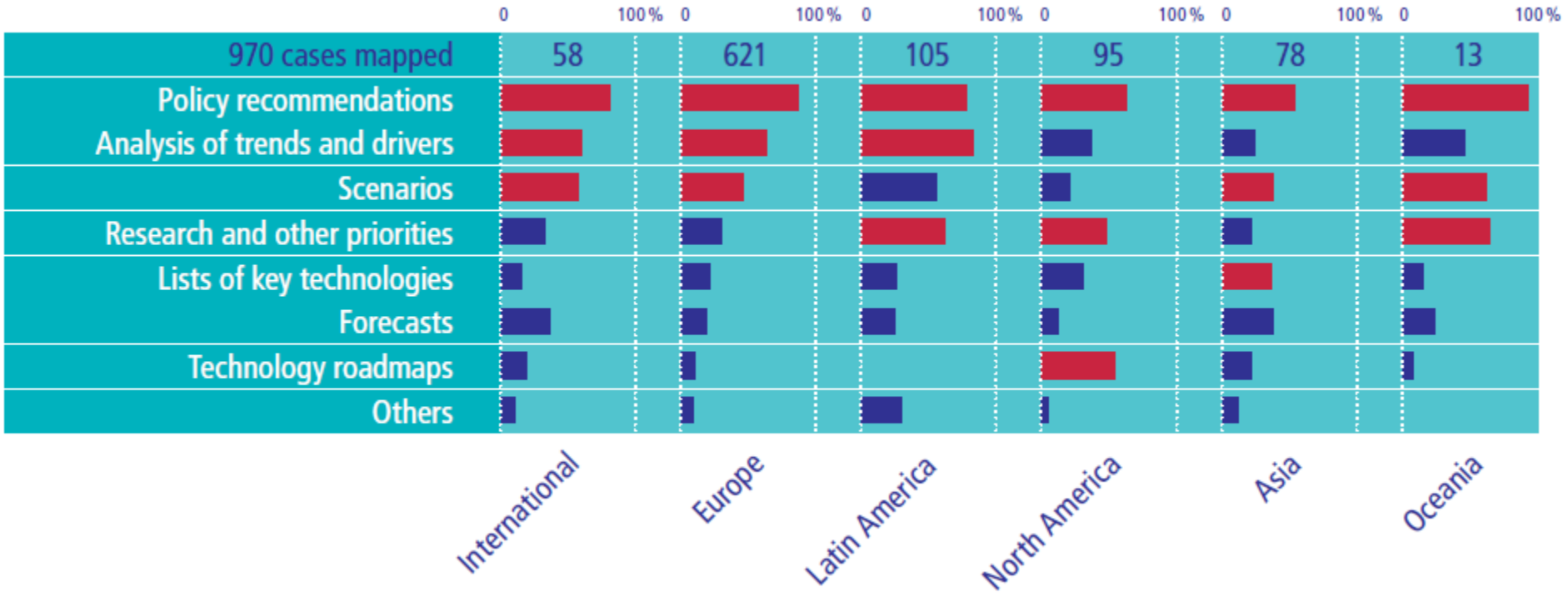


Foresight methods used



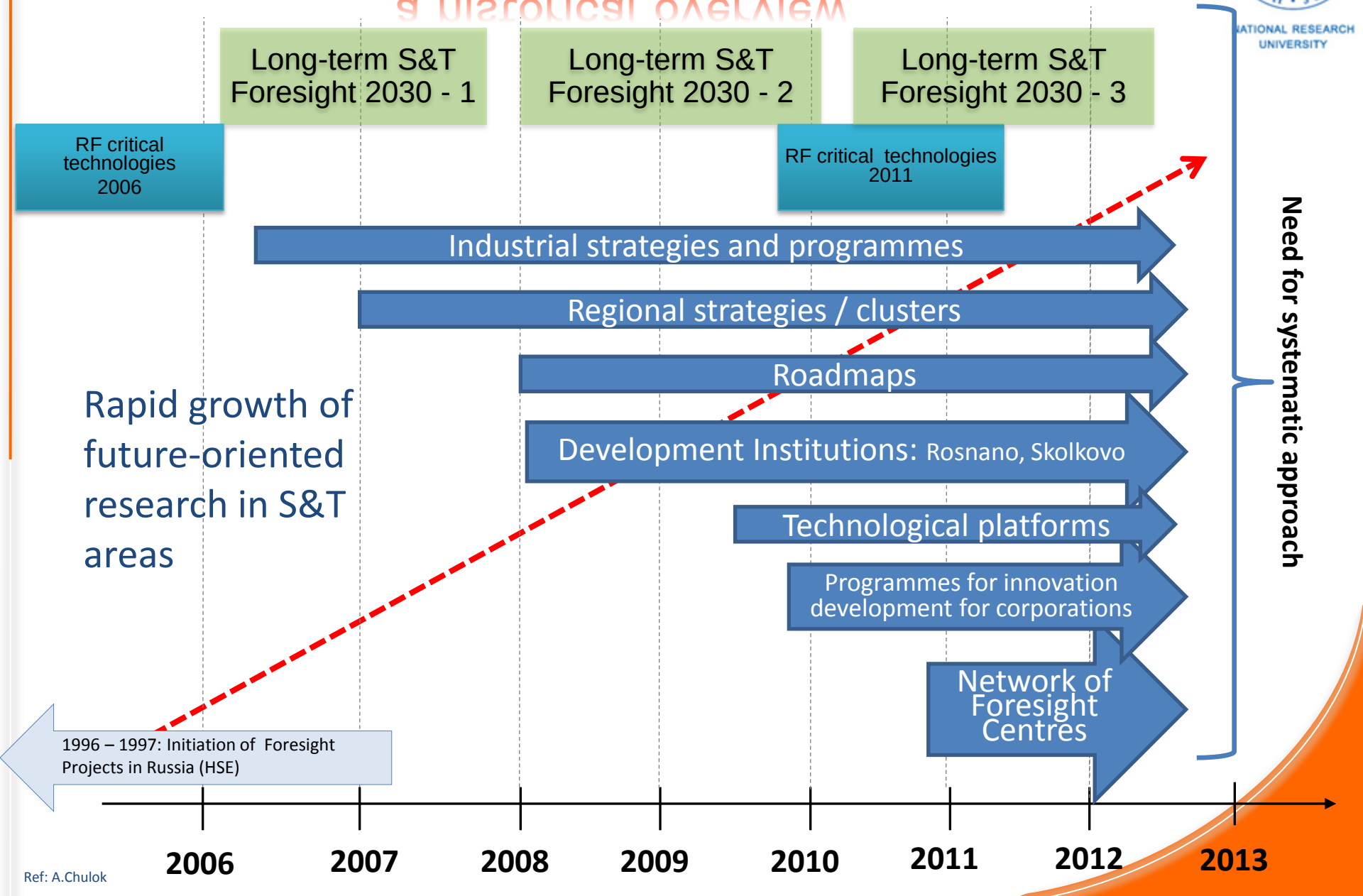
EFMN (2008)

Foresight outputs



EFMN (2008)

S&T Foresight in Russian S&T and Innovation policy: a historical overview



Ref: A.Chulok

Foresight in the 2010s

- New global context and new drivers of change
  - **The increasing importance of innovation** (both technological and organisational)
  - **The development of service economies.** Considerable portions of economic activity, employment and output have started taking place in service sectors of the economy
  - Rapid and accelerating technological progress; ICTs, biotechnology, fuel cells, nanotechnologies
  - **Other developments** including globalisation, changes in demographic structures and in cultural practices, and environmental affairs

Drivers of change

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Wild cards

Weak signals

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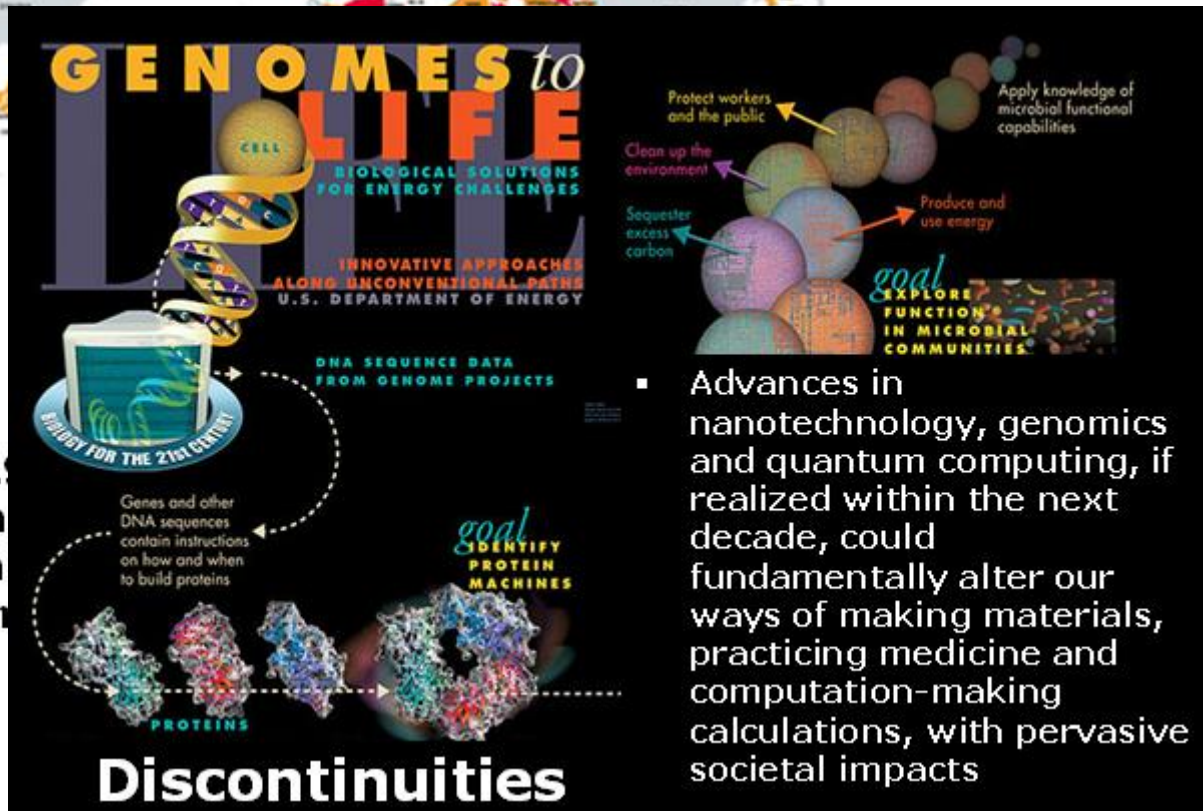
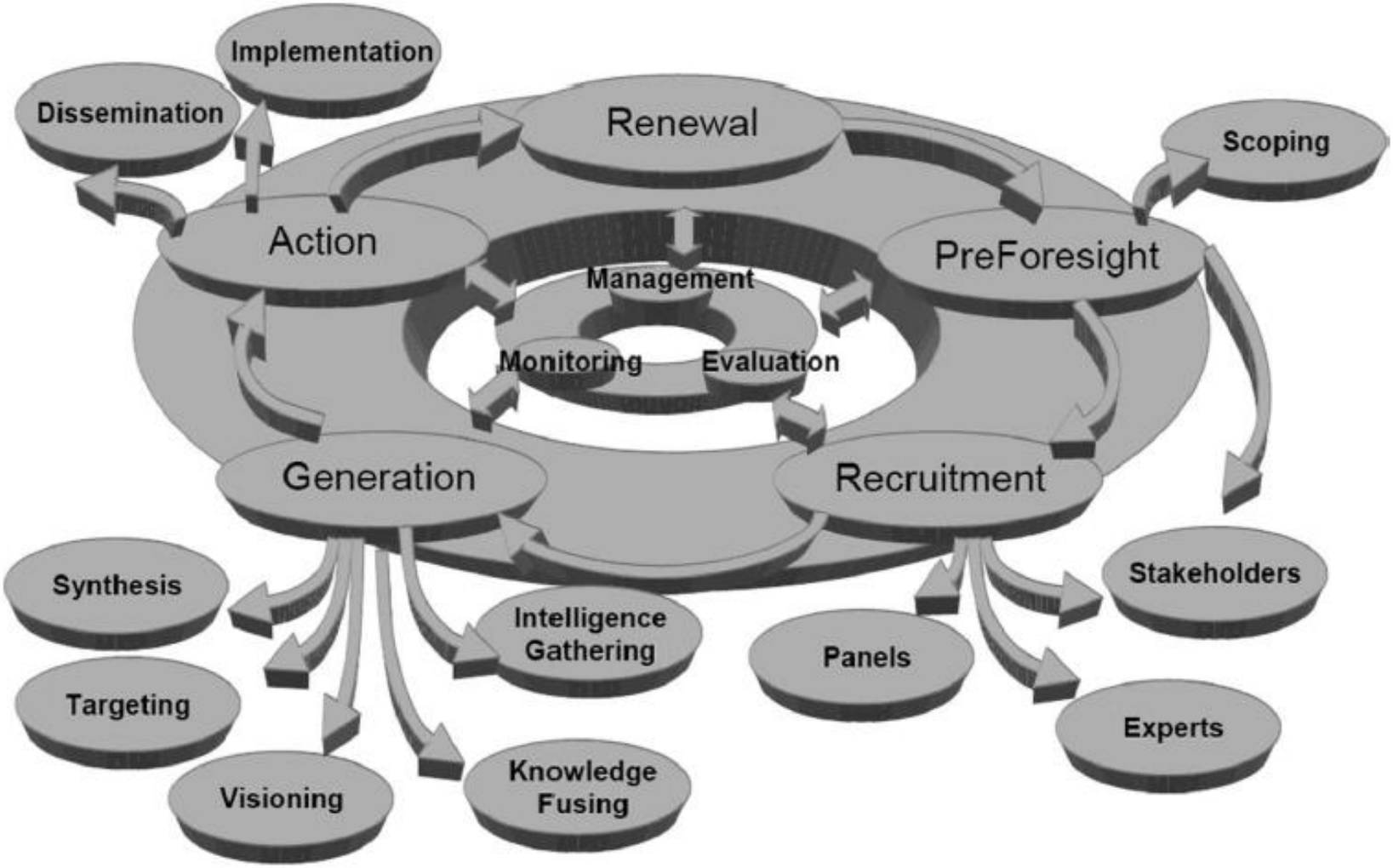


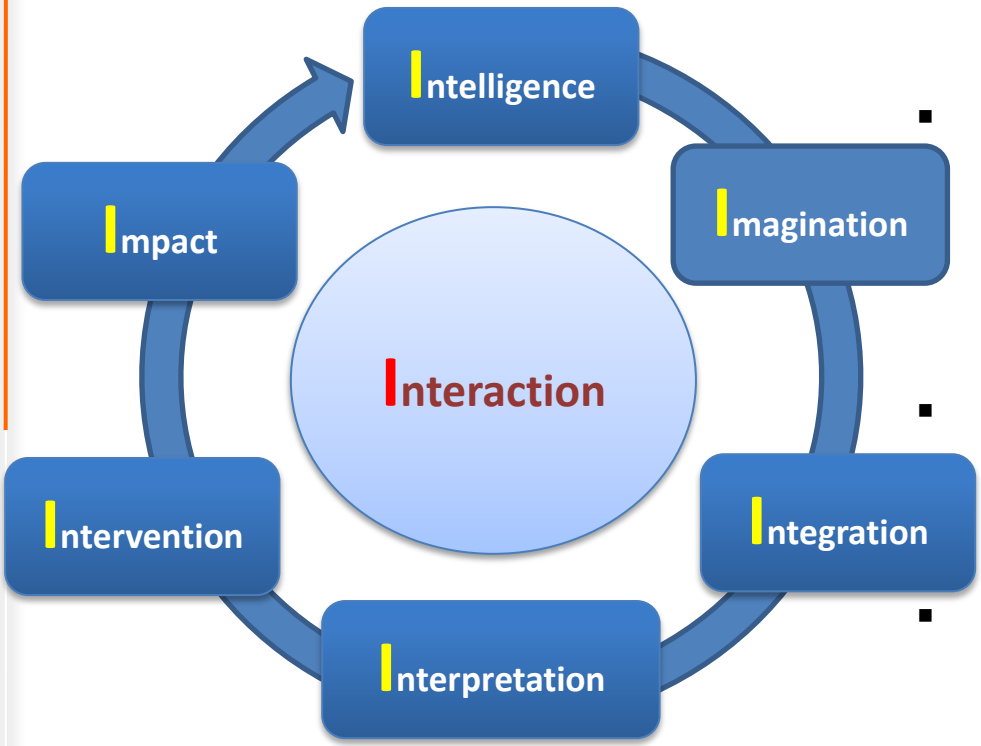
Discontinuities

- Advances in nanotechnology, genomics and quantum computing, if realized within the next decade, could fundamentally alter our ways of making materials, practicing medicine and computation-making calculations, with pervasive societal impacts

Organising a Foresight exercise



Phases of Foresight



- ***Intelligence***
  - Creates shared understanding and mutual appreciation of issues at hand
- ***Imagination***
  - The input from scanning is synthesised into conceptual models of the situations involved in the real world
- ***Integration***
  - Analyses the alternative models of the future and 'prioritises' them, through intensive negotiations among system actors and stakeholders, to create an agreed model of the future
- ***Interpretation***
  - Translates future visions into long-, medium-, and short-term actions for a successful change programme
- ***Intervention***
  - Creates plans to inform present day decisions for immediate change to provide structural and behavioural transformations
- ***Impact***
  - Assesses the results and impacts of Foresight exercise, learns from experience and provides input for next round

SFM: Methods & Tools

	SCOPE / SURVEY PHASE	CREATIVE PHASE	ORDERING PHASE	STRATEGY PHASE	ACTION PHASE	
	INTELLIGENCE	*IMAGINATION*	*INTEGRATION*	*INTER PRETATION*	*INTER VENTION*	
	Survey, scan, evidence	*Concept model, visions, scenarios*	*Priorities, analysis, negotiations*	*agendas & strategies*	*Plans, policies, actions*	
"Divergent" methods *(more open, creative)*	Horizon scanning Weak signals Trend analysis Social Network analysis Knowledge / research map Literature review STI policy analysis	Visioning / social priority choice Scenario stories / images Policy scenarios Scenario analysis Agent based modelling Scenario modelling	Backcasting Wild card study Success scenarios Risk assessment Delphi / online Delphi Multi-criteria Social cost benefit	SWOT analysis Scenario planning Roadmapping Cross impact analysis Logic framework Linear programming	Strategic planning Critical / key technologies Operational research Policy impact assessment	
"Convergent methods" *(more specific, quantitative)*	Bibliometrics Patent analysis	System dynamics	Cost benefit analysis			

Challenges for Foresight

1. Understanding the complex and systemic nature of the future
2. Known unknowns, unkown knowns and unknown unknowns
3. Combining Quantitative and Qualitative methods
4. Vision and consensus-building under
5. Systemic policy responses to systemic challenges

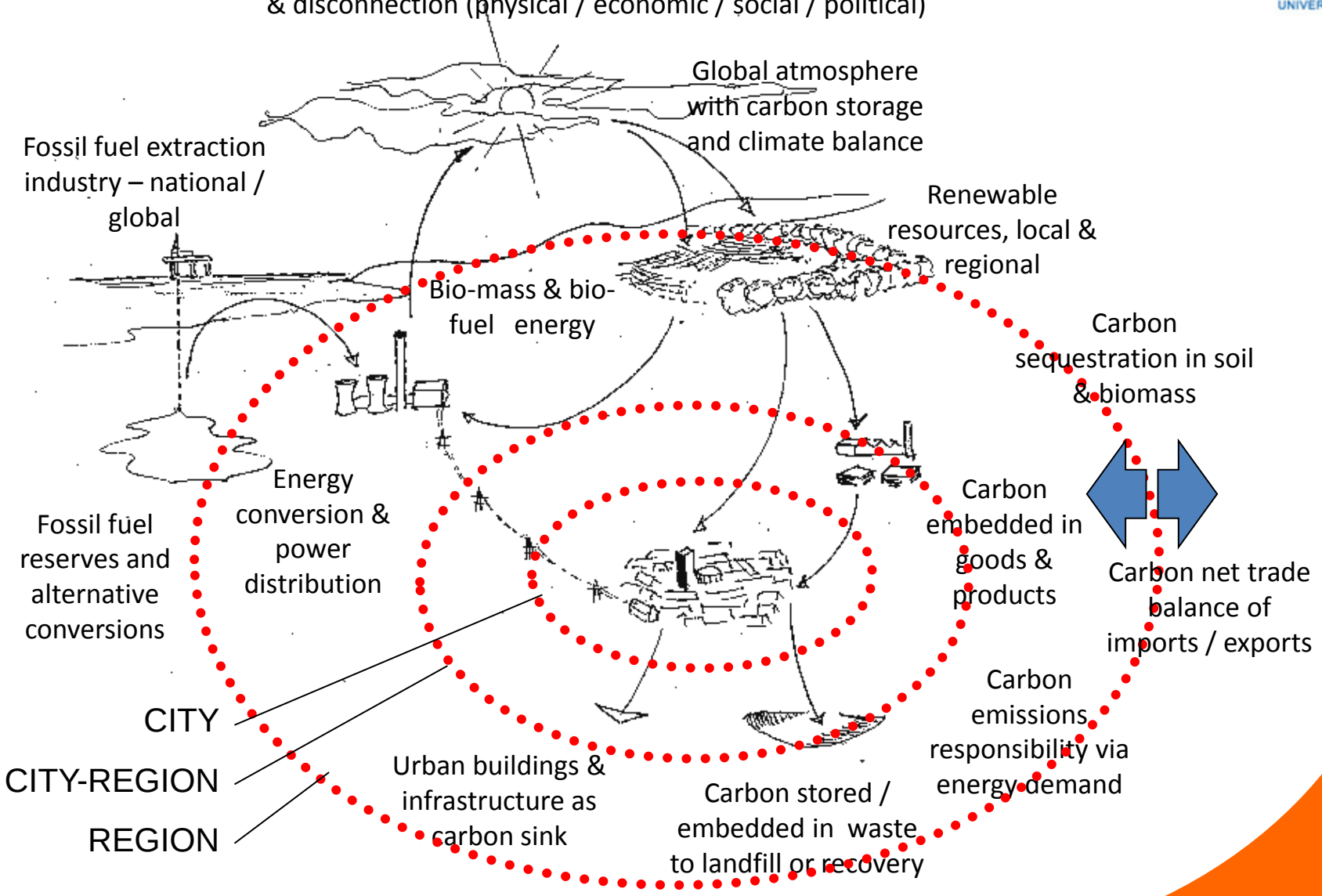
1. Understanding the complex and systemic nature of the future

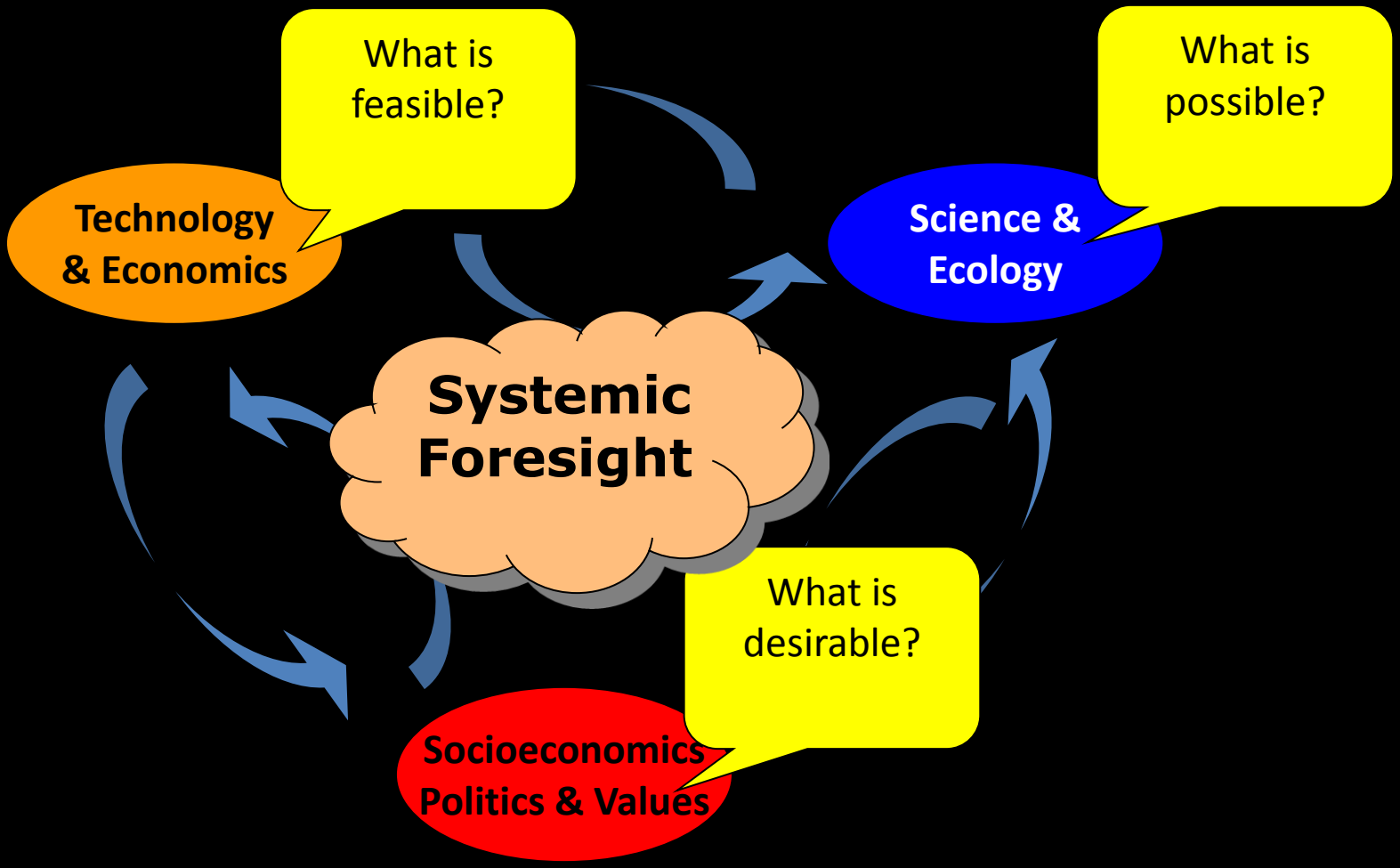
Future challenges

- are very large topics with their interdisciplinary nature and fuzzy boundaries
- typically involve complex and systemic relationships within and between STEEPV systems
- may not fit with the existing thematic and disciplinary structures of research, policy making and funding agencies.

Complex and systemic nature of situations

Mapping patterns of conflict / competition (political / economic / ideological): in typical situations of displacement & disconnection (physical / economic / social / political)




What is feasible?
What is possible?
Technology & Economics
Science & Ecology
Systemic Foresight
What is desirable?
Socioeconomics Politics & Values

2. Known unknowns, unknown knowns, unknown unknowns

- Pronounced by Herman Kahn in the 60's and reminded by Rumsfeld in 2002
- Used by Loveridge and Saritas (2012) to explain three levels of ignorance involved in Foresight and policy making
- Considering that Foresight, scanning and intelligence are imaginative projections of current knowledge, the practical outcomes of the process are characterised by human behaviour under subjective opinion
- The subjectivity and associated ignorance due to the choices and decisions made will increase as policies begin to deal with more complex and uncertain issues

The case of Fukushima nuclear disaster exemplifies the levels of ignorance

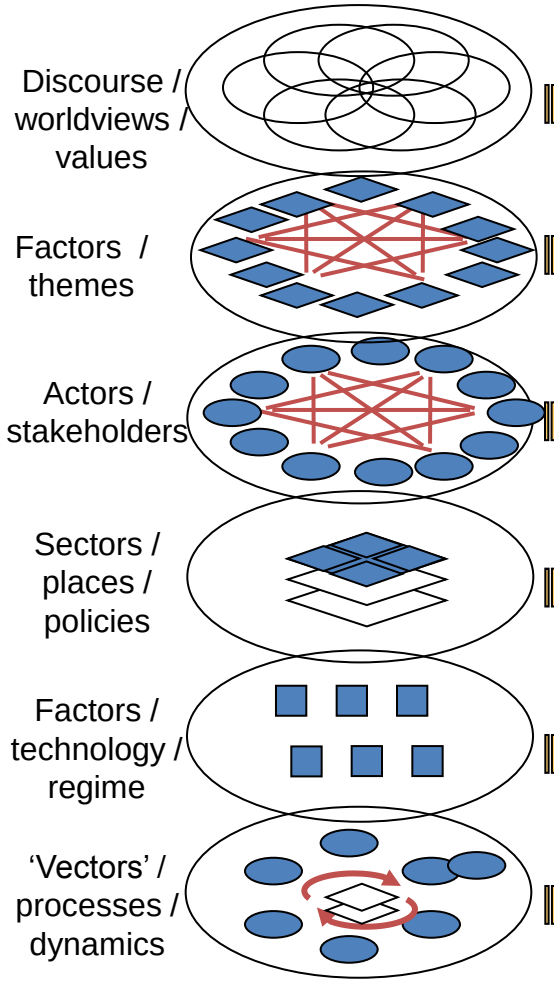
- The timing and likelihood of an earthquake
- The magnitude of the earthquake (very rare earthquakes of 9 magnitude)
- Enormous amounts of energy released and consequent tsunami with an eventual devastation

3. Combining quantitative & qualitative

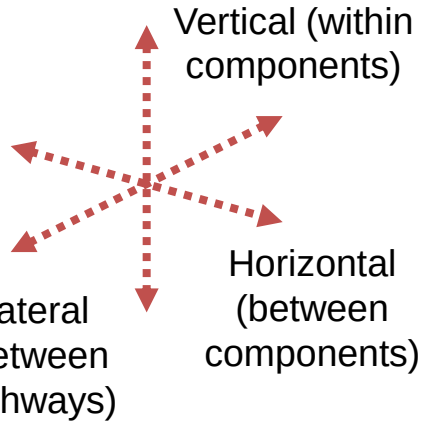
- Wide variety of methods are used in Foresight
- This offers an opportunity for more tailored design of Foresight process to address a variety of issues, which may involve quantitative and qualitative judgement, and usually a combination of them
- The challenge for Foresight is the selection and combination of methods, which can be done in a number of ways as there is no single way to address the GCs, neither single point in time
- Aforementioned challenge of subjectivity also applies in the selection methods and their use. The critical issue here is the balance between reliability and external validity

Systemic & Synergistic view of situations

Relational view	Emergence view
Discourse / worldviews / values	Explore multiple worldviews & looking for shared values, goals
Factors / themes	Explore causal links & loops between themes & sectors
Actors / stakeholders	Explore relations between actors & look for synergies & shared interests
Sectors / places / policies	Focus on the sector/ place / situation, with internal & external relations / impacts
Factors / technology / regime	Focus on the system / technology / engineering & the opportunities
'Vectors' / processes / dynamics	Explore the proceses / metabolism & dynamics of change & transition



Shared intelligence mapping

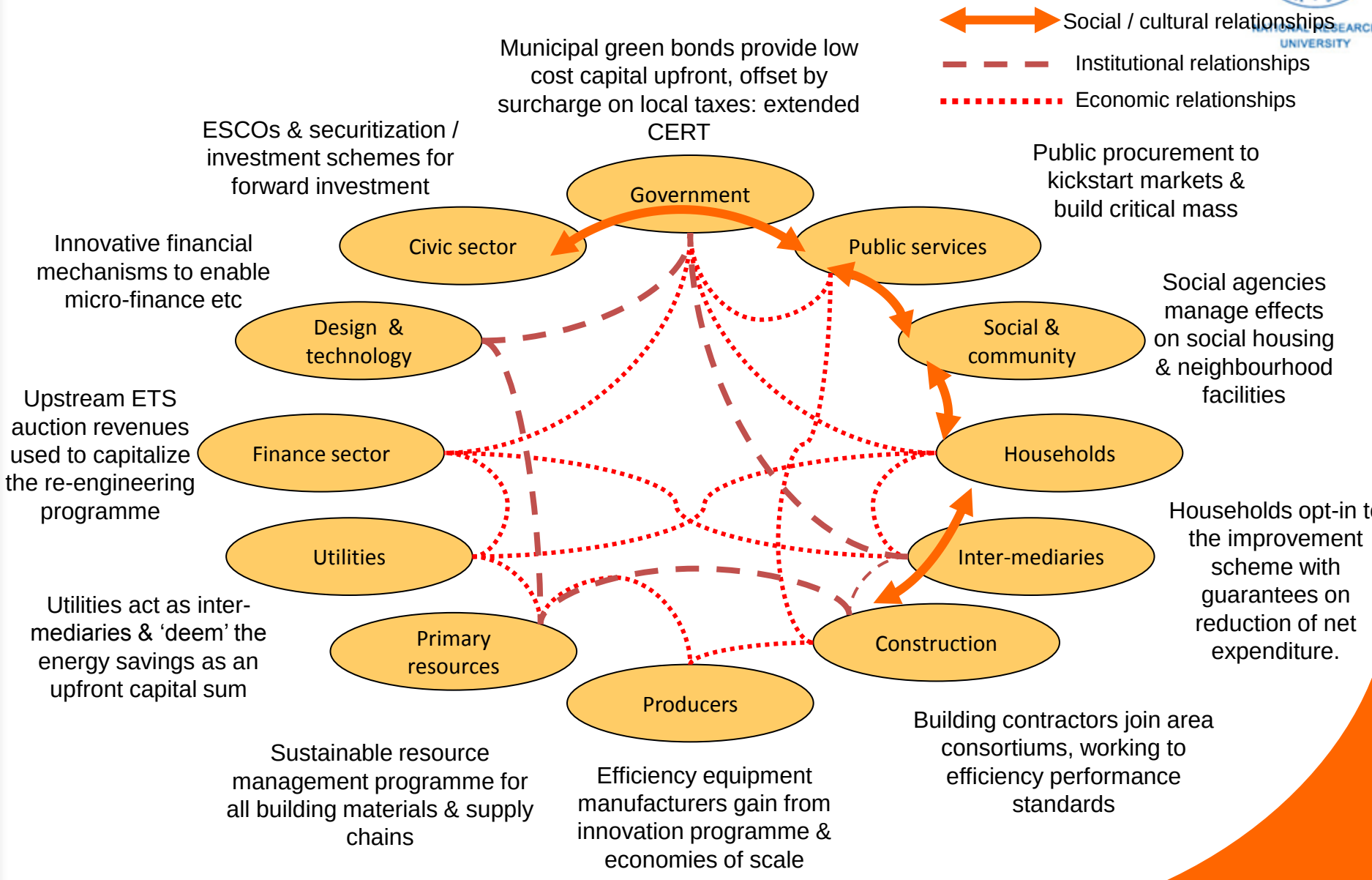


The shared intelligence mapping explores the potential for learning / innovation which links between different component / stakeholders / synergies

4. Vision and consensus-building

- Foresight requires long term commitment, consensus and concerted action by a number of actors around a common vision
- Due to its long term and uncertain nature, Foresight faces the challenge of justifying futures thinking for policy makers, who are commonly concerned commonly with next few years, rather than next decades
- Issues like GCs are not bounded at the city or national level, they are mostly transnational and in a number of cases global
- All these increase the costs of intervention, which require considerable amount of resources and transformations
- Risk of investments in research and innovation in such uncertain and complex issues brings additional challenges for policy to provide consensus for intervention

Vision & consensus building on policies

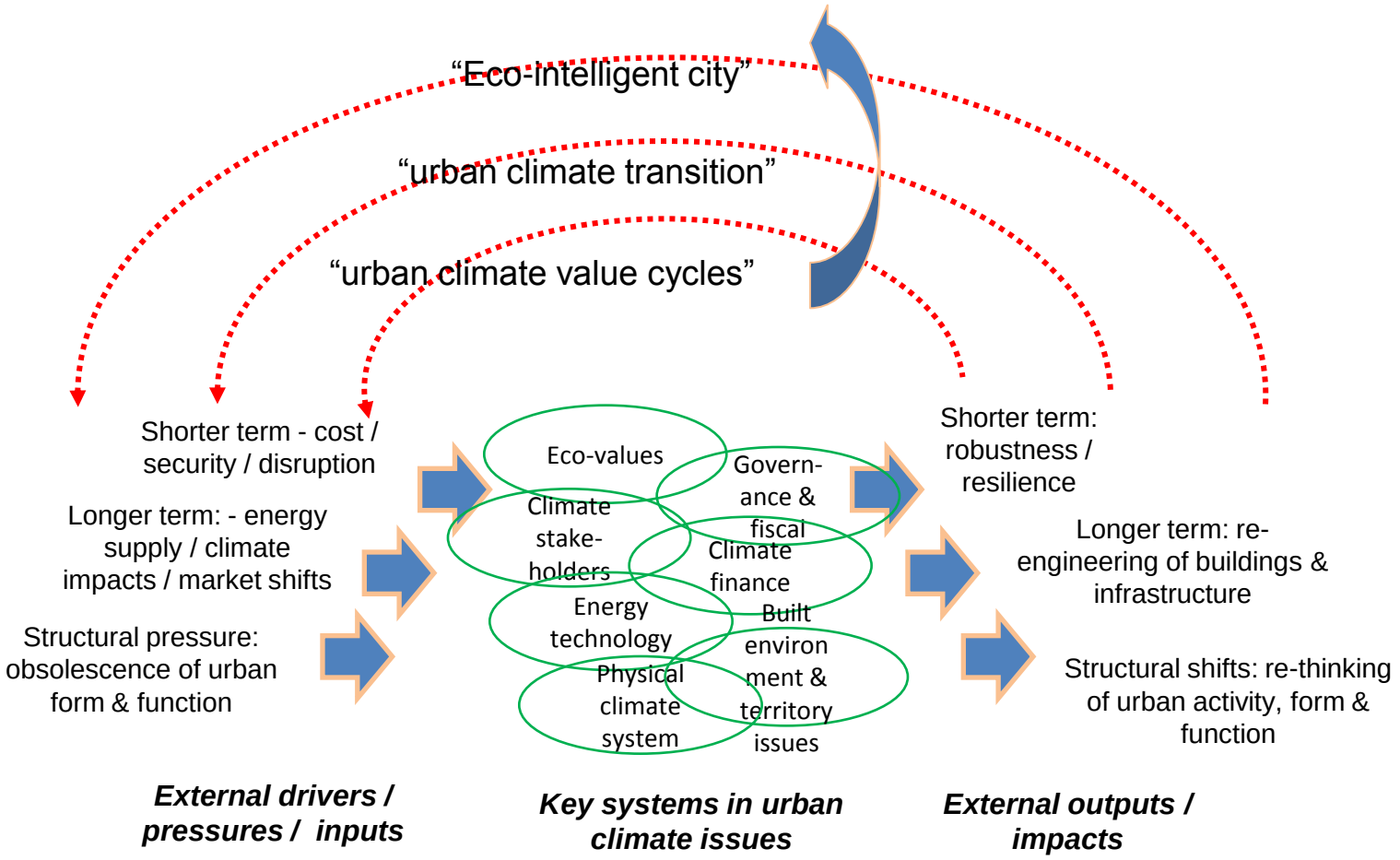


Strategic policy responses

- Even if the required consensus generated and resources allocated for intervention, strategic policy intelligence still needs to develop mechanisms for integrated innovation and collective action
- Strong need for building and strengthening the community of innovators, which are collaborative, interdisciplinary and global
- Systemic action is required for a collective transformation through the coordinated application of scientific/technological, social and business innovation simultaneously supported by political will

Systemic responses

Climate Synergicity – emergence of creative climate action, strategic climate thinking & urban eco-intelligence



HSE Responses

1. Scope and Coverage of Foresight

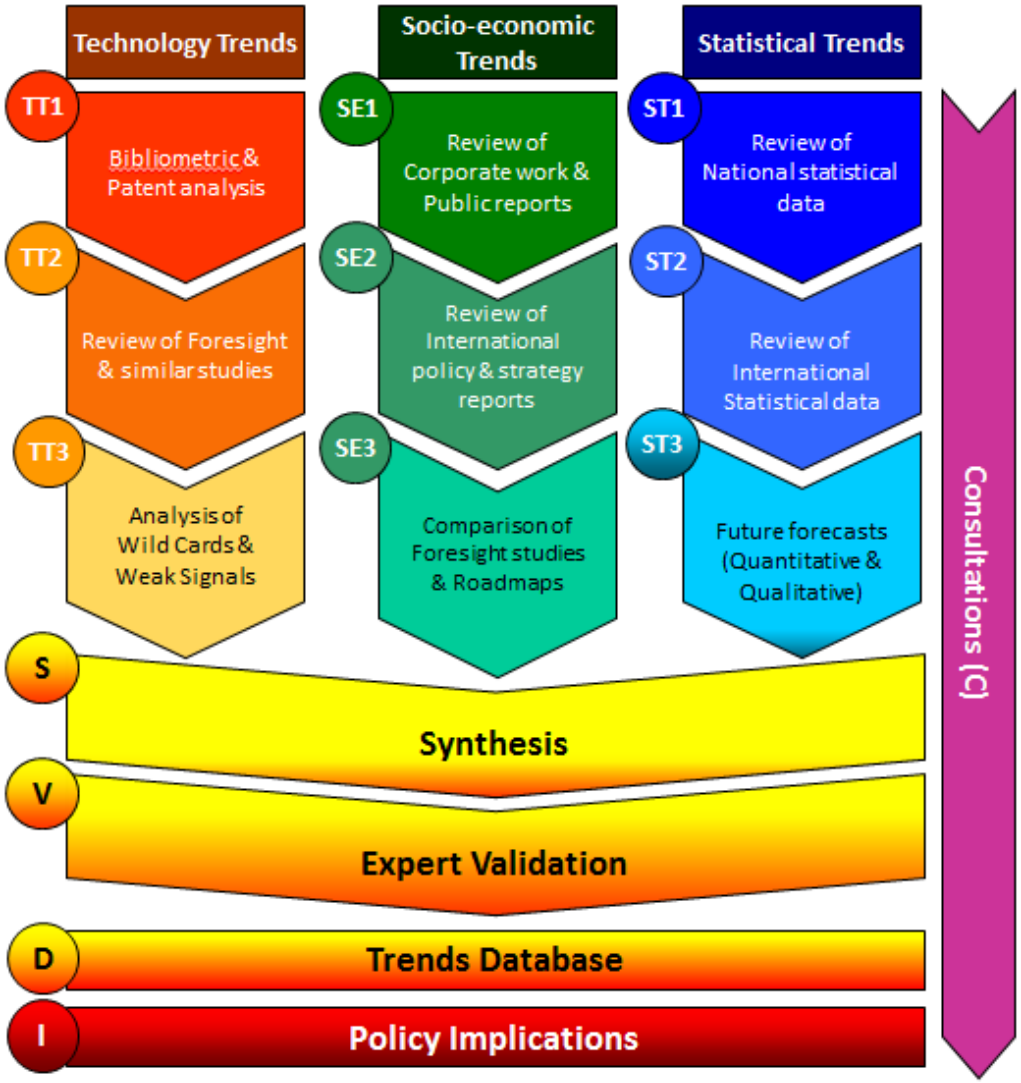
- **Widened scope and coverage of Foresight:** A wide variety of issues in Social, Technological, Economic, Environmental, Political, Value/Cultural systems are focused to inform national, regional and corporate policies

- **Focus on Grand Challenges and Strategic Responses.** Grand Challenges are those challenges, which are “wicked problems” concerning the whole or large parts of societies and require multidisciplinary and collective action including energy, water, ageing population, cities and urban development, education, health and others.

- **Scanning Horizons:** To explore novel and unexpected issues, as well as persistent problems or trends. The process involves the identification of Trends, Drivers of Change, Weak Signals, Wild Cards/Shocks/Surprises and Discontinuities. Horizon scanning helps to identify emerging future opportunities and threats, align actors around those and propose disruptive transformations in response to them

HSE Responses

2. Global Technology Trend Monitoring



HSE Responses

3. Networks and collaborations

- **Networked and distributed policy making.** HSE considers Foresight as an integral element of networked and distributed policy-making by providing three crucial functions
  - *policy informing* by generating consolidated findings concerning the dynamics of change, future challenges and options and transmitting it to policy-makers as an input into policy conceptualisation and design
  - *policy strategic counselling* by transferring and translating the insights generated in the context of policy informing
  - *policy facilitating* by building a common awareness of current dynamics and future developments as well as new networks and visions among stakeholders.
- **Building new networks and linkages across fields, sectors & markets or around problems**
- ***Bringing new actors into the strategic debate.***
- ***Demonstrating the vitality of the Science, Technology and Innovation System*.**

Technological advancements

In the future, your clothes will be a power plant

A startup in Corvallis, Oregon, has developed a small chip that can turn body heat into electric energy, using the same technology found in solar panels. The result: a single, square-inch TEGwear chip generates enough power to power anything from the accelerometer in your pedometer to the wireless headset for your smartphone.

Reign of Robots May Be Closer Than You Think

The futurist Ray Kurzweil has famously predicted that humanity is approaching a "singularity," a fateful moment when our technology becomes smarter than us and able to learn faster than we can, when it becomes the principal creator of new technologies and machines race far ahead of us. Humans may effectively fall out of the loop -- a species demoted, if not eliminated

3D printing with metal: The final frontier of additive manufacturing

The real breakthrough that has enabled 3D printing for the masses has been the laser. Spray welding is a technique that has been used for decades to build up worn motor shafts, but it is far too crude for controlled additive printing. Spray welding uses a gravity-fed powdered metal dispenser integrated into a special oxygen-acetylene torch head which melts the powder as it is dispensed. Swapping the torch for a laser gave the powerful construction tool we have today.

More Robots, Less Farmers – Company Installs 12,500th Robotic Cow Milking System

From GPS-guided tractors to fleets of weed-clearing robots, technology continues to change the meaning of a day's work on the farm. The hands off milking system that the Astronaut A4 provides allows farmers to spend less time milking and more time managing the health of their herd as a whole from their smartphone

China Shops More Frequently Online Than The US And UK

More than one in five netizens are Chinese and spend on average as much time online per week as Americans. will there be any need for shopping malls?

Report raises ethical concerns about human enhancement technologies

Drugs and digital technologies that will allow people to work harder, longer and smarter are coming soon, say scientists and ethicists, so we need to decide now how best to ensure they are used properly

Perpetually connected: are wearable computers and bio-implants the future of mobile?

We are entering a pivotal era in which we will become inextricably intertwined with computational technology that will become part of our everyday lives in a much more immediate and intimate way than in the past

“Techno-school”

- Teaching how to learn
- Avatar teachers, assistants
- Virtual reality supported classes
- Learning by doing
- Assessment of the “whole life experience” without exams
- Career guidance based on data analysis

“3-D shop”

- Create, scan, print technology
- 3-D metal and plastic printing
- Distributed, just-in-time and clean production
- Minimum storage and logistics
- Energy efficient, clean working and living environment

“Eco-farm”

- High technology “precision farming”
- Remotely operated GPS-enabled vehicles / equipments
- Plant and soil sensors
- Automated watering and fertilizing
- Enhanced food with increased productivity and increased nutrition
- Consumer oriented transparent production

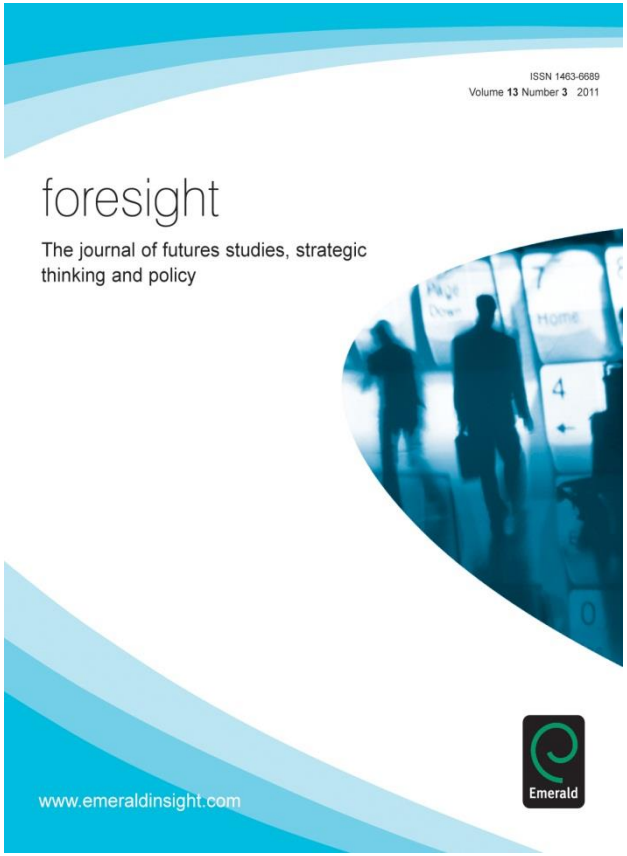
“Future-office”

- Foresight and creative uncertainty management
- Real time information collection and decision-making technologies
- Enhanced machines and human
- Pro-Technology vs. Anti-Technology movements
- Socio-technological studies
- Digital arts and creativity

“Personal healthcare” practice

- Personal Health Systems (medicine, electronics & ICTs)
- Wearable technologies
- Real time monitoring systems with body sensors
- Automated prescription systems
- Healthy people, low health expenditures

Foresight Journals



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