



EU-SPRI PhD Spring School

Anticipation in the Governance of Innovation:
Expectations, Foresight and Technology Assessment

Anticipation in the Governance of Innovation: Notions, Modes – and New Horizons?

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1. Notions of anticipation

- Opposing notions:
 - Anticipation vs. prediction:
 - . Obtain idea of what future might be vs.
 - . Extrapolation of past / present toward future state
 - Anticipation vs. utopia:
 - . Orientation toward possible realities / future spaces vs.
 - . Orientation toward negated reality / imagined non-space

- Anticipation in the governance of innovation – what is at stake?
 - Keep pace with dynamics of S&T
 - Ability to foresee – and shape – technological and social change
 - Future quality of S&T and society
- Underlying uncertainties, indeterminacies, and ambiguities:
 - *Temporal*: time horizons; significance of developments in S&T
 - *Material*: realization of potentials of S&T; context-specific usefulness; intended and unintended consequences
 - *Social*: divergent interests and preferences; multiple institutional and organizational contexts

- Approaches to dealing with challenges of incertitude, e.g.:
 - Foresight
 - Technology Assessment (TA)
 - Participation (as expectation management)
- Limits, e.g.:
 - Non-linearity of technological and social change
 - Plasticity of technological applications and institutions
 - Divergent user preferences and concerns

2. Modes of anticipation I: Foresight

- Diverging modes: “informal” vs. “formal” (“implicit” vs. “explicit”)
 - In innovation governance:
 - . Attention given mostly to formalized modes, such as
 - . Foresight in governmental S&T policy (e.g., Delphi), to identify
 - . future areas of innovation
 - . future challenges to innovativeness
 - . future societal challenges
 - relationship between these dimensions as area of conflicting expectation building
 - . Foresight in corporate strategic planning and technology management

- But, there are informal ways of foresight, such as
 - . Forward looking observations by researchers / research organizations / companies, e.g., to identify
 - . „hot“ areas of future research and development
 - . „hot spots“ / „top heads“ of promising research developments
 - . „hot issues“ in regulation of S&T
- Of course, informal foresight can be formalized, see for example
 - . Corporate foresight, e.g., Shell, Siemens, Daimler
 - . Max-Planck-Society: 2010+, Research Perspectives of the Max-Planck-Society (Oct. 2010)
- Conclusion: difference in foresight modes (formal / informal) relates to
 - Role of organizations in configuration of S&T&I in society
 - Self-positioning of organizations in environment of change

- Foresight in / for other governmental domains, e.g. to identify
 - Future issues to take into account
 - Future effects of past / current decisions
- Policy fields, e.g.
 - Finance: budget, taxes, debt
 - Interior and Justice: legal order, immigration, criminal law
 - Labor: employment, social security, pensions
 - Exterior and Defense: trade, issues in diplomacy, war & peace
 - Plus: health, education, agriculture, environment & consumers
- Conclusion: to put on STS / social science research agenda
 - Foresight epistemologies: e.g., predictions, forecasts, expectations
 - Interfaces of foresight with planning and decision-making

Modes of anticipation II: Technology Assessment

- Early institutionalization in 1970s:
 - Multiple approaches in various contexts (e.g., parliaments, companies, academia)
 - Often conceptualized as “early warning systems”
- Core ideas of parliamentary TA:
 - Should be conducted as early – and as comprehensive – as possible
 - Inform decision-making in/on S&T, e.g., funding and regulation
 - Provide multiple perspectives
- Problem:
 - Early warning system = anticipation from outside
 - Thus gap between TA and R&D enterprise

- Conceptual innovations since 1990s / 2000s:
 - Genomics & life sciences:
 - . TA efforts to close / narrow gap to S&T, e.g.
 - . through research on ethical, legal, and social issues (ELSI)
 - . In question: success, failure?
 - Nanotechnologies:
 - . Experiments to integrate TA into R&D enterprise:
 - . Constructive TA (CTA)
 - . Real-Time TA (RTTA)
 - . Upstream Engagement (UE)

- CTA, RTTA, and UE: modes of anticipatory governance
 - Embody different combinations of
 - . Foresight
 - . TA
 - . Participation
 - Constructive TA, e.g.,
 - . Scenario work, reflexive development, inclusion of diverse actors
 - Real-Time TA, e.g.,
 - . Foresight, integration, public engagement
 - Upstream Engagement, e.g.,
 - . Ethical & social issues, integration, experiments in deliberation

3. TA as anticipatory governance in innovation

- RTTA at Center for Nanotechnology in Society, Arizona State University
 - Organizational features:
 - Funded by U.S. National Science Foundation
 - Based on political mandate, i.e., 21st Century Nanotechnology R&D Act of 2003 (Public Law 108-153)
 - Operating as inter-university network (with distributed expertise)
 - Organized in RTTA areas and thematic research clusters, plus teaching and outreach: e.g.,
 - . RTTA 1: Research and Innovation System Analysis
 - . RTTA 2: Public Opinion and Values
 - . RTTA 3: Deliberation and Participation
 - . RTTA 4: Reflexivity, Assessment and Evaluation

- Core elements of capacity building for anticipatory governance:
 - *Foresight*: generating anticipatory knowledge (i.e., not predictions)
 - *Integration* of knowledge: across academic cultures, i.e., science and engineering, humanities and social sciences
 - *Engagement*: participatory exercises providing input by citizens and publics (face-to-face and online)
- Promises of anticipatory governance:
 - Improved technologies (e.g., development, outcomes)
 - Improved societal embedding (e.g., regarding user preferences)

[on “Anticipatory Governance,” see Barben, Fisher, Selin & Guston 2008, in *Handbook of Science & Technology Studies, Third Edition*, MIT Press, Cambridge MA, pp. 979-1000]

- Strengths:
 - In addition to strategic design and elaboration of anticipatory governance,
 - Operating mode of CNS-ASU:
 - Key role of scientists and engineers: e.g.,
 - *Collaboration* (research, teaching)
 - *Advising and consulting* (e.g., issues requiring S&T expertise)
 - *Serving as research subjects* (e.g., discussing research-related decisions and potential impacts of nanotechnology)
 - Partial reconfiguration of social relationships:
 - In particular, in academic research and development
 - To a lesser extent, between technology development and society

- Limitations in the reach of RTTA-based anticipatory governance:
 - Capacities to shape later stages of technology development
 - Capacities to shape regulatory frameworks of S&T
- Extending the reach of anticipatory governance is both needed and challenging because of
 - Configuration of innovation regime in
 - “Horizontal” differentiation of society
 - “Vertical” differentiation of society
 - Thus, anticipatory governance
 - Has been limited to publicly funded academic settings of S&T-related research, education & outreach
 - Has not been linked to other sites where innovations are generated, regulated, and appropriated

4. New horizons?

- Anticipation in governance ↔ anticipatory governance
 - Anticipatory capacities embedded in modes of governing S&T, e.g.,
 - . *Research & innovation policy*: foresight, roadmapping, scenario-building (by government, industry, academia, think tanks, etc.)
 - . *Risk management*: prevention and precaution as regulatory principles (institutional procedures, moratoria, international agreements, etc.)
 - . *Patenting*: legal entitlements granted to inventors with regard to future exploitation, while securing systemic innovativeness
 - . *Ethics*: norms and principles to guide decision-making, and impose sanctions, in case of morally sensitive or dubious options of S&T (in the form of laws, guidelines, declarations, etc.)
 - . *Acceptance politics*: strategies aiming at shaping contemporary perceptions and expectations of future possibilities of S&T

- Strategies to expand anticipatory governance at local, national, and international levels require
 - Institutional change that allows for better taking into account future uncertainties and outcomes, across social domains and policy fields
 - Future-oriented transformation of infrastructures (e.g., energy, building, mobility, water, waste, urban & spatial development)
 - Prior deliberations about global/grand challenges and adequate strategies to meet them (e.g., regarding particular fields of S&T, climate change, sustainability)
 - Future-oriented adaptation of democratic institutions, including expansion of direct democracy (e.g., in light of emerging approaches to geo/climate engineering)