PATTERNS IN SCIENCE AND SOCIETY IN TRANSITION

Douglas K. R. Robinson (TEQNODE & IFRIS)

1st PACITA project conference
Technology Assessment and Policy Areas of Great Transitions
Czech Republic, March 13 – 15, 2013
TEQNODE Limited, a Paris-based consultancy and contract research org. founded by Dr. Douglas K. R. Robinson and Prof. Arie Rip

TEQNODE provides strategically useful technology intelligence on emerging research and development and the transformation of R&D into products and into society. It augments traditional market analysis by providing insight into emerging situations (where there is no clear market in place).

IFRIS is a new public research center in Paris-Est University specialised in social studies on innovation: www.ifris.org

IFRIS has about 180 members (of which 100 permanent researchers) From different disciplinary fields (sociology, history, economics, management, political sciences).
Positioning of this presentation

• For this presentation, I speak from the position of the production of new scientific knowledge & technologies
  (In my presentation tomorrow I will speak from the position of industrial innovation activities and user/society interactions)

• This brief presentation on recontextualisation links to a project in which TEQNODE participated for a governmental organisation interested in Valorisation of Science and Technology for Society (TA) with a view to potential Policy interventions (Governance).

• We saw that across Europe a recontextualisation of Science and Society was visible and manifesting in different ways.

• I close (if I have time) with a small description of Construtive Technology Assessment as a support system within this

• I have 12 minutes left so LETS GET MOVING!
OUTLINE

• Why Sci-Soc links are important
  – I zoom out and look at the value-chains transforming Sci Knowledge into technologies in society
  – Key point: A variety of arenas of assessment are involved in this process, shaping the trajectory of technology development and societal embedment

• Recontextualisation of science and society
  – Society (in many guises) is getting more involved at early stages

• TA and Governance implications for S&T knowledge production
  – This translates into specific pressures on research scientists and technology developers.
  – An opportunity for TA professional support?

• A close on Constructive Technology Assessment (if time allows)
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Why are patterns of science and society important?

Value is created in the various interactions and co-evolutions!
Emerging Value Chains

Packaging R&D
- Packaging areas
  - Material Science
  - FCM studies
  - Fabrication eng.
  - Research Community
    - University
    - Institutes
    - Firms
  - Research fields (excerpts)
    - Biopolymers, Polymer, Chemistry, Material Processing

Packaging Manuf.
- Specialised Manufacturers
- Smaller players
- University foundries
- Research Institutes

Packaging meets food
- Types of food
  - Drinks
  - Processed foods
  - Fresh food

- Types of containments
  - Bottle/flask
  - Container
  - Films

- Integration locations
  - Large food production firms

In the shops
- Retailers
- Retail Associations
- Consumers
- Consumer Groups

Look at the current industrial value chain (here for food packaging)

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Disposal
- Tips
- Incineration
- Composting
- Recycling

Nanomaterials research areas
- Edible films
- Nanofibres
- Nanocomposites

Research Community
- Large Material firms
- Universities
- Start-Ups

Adapted from: Douglas Robinson, Lu Huang, Ying Guo & Alan Porter (2010)
Forecasting Innovation Pathways (FIP) for New & Emerging Science & Technologies.
ARENAS of ASSESSMENT and SHAPING

Linear Model of Innovation places User/Society role HERE

Bioplastics R&D funding
Funding calls for bioplastic innovations are increasing, with some linked to nanomaterials. This provides resources but little guidance in R&D planners.

Diffuse Societal Demand
A broader more diffuse notion of sustainability and environmentally friendly, affecting consumer choices and increasing demand for alternatives.

Packaging Material R&D
Research (universities, private & public labs) into new lines of packaging materials and fabrication processes, creating new knowledge. This arena includes traditional incremental improvements of materials (wood, glass, cardboard) as well as novel materials (nanocomposites, ceramics, bioresorbable, etc.). Involves research and development, material science and fabrication processes.

Up-valuing new material S&T
Conversion of new research results into something which can be taken further along the value chain (a possible product). For food packaging this includes large firms, small technology-based companies and SMEs.

Packaging Manufacture
Production of food packaging with the traditional or novel material. Specialty and packaging manufacturers populate this area (either in types of packaging: films, bottles or in types of product: fruit juice, dairy products etc.). Issues revolve around fabrication of the packaging and the relationship between packaging and food safety.

Niche Markets
This arena represents the first contacts of a new material into specific markets. Certain niches will be more open to novel materials than others. Particularly where there is a strong economic driver or incentive, for example, antimicrobial packaging to combat E.coli or Salmonella.

Wider embedment
Product entry into markets. Uptake or rejection by consumers. Consumer culture plays a role here, along with safety perceptions, trust etc. Retailers and retail associations play a key role here, acting as gatekeepers between novel packaged foods and the consumers.

End of Product Life
Traditionally food packaging has been thrown into rubbish tips or incinerated. Over the past decades recycling has become socially and economically desirable for certain materials, but this remains a very small amount of the total of food packaging. Recycling, and varieties of biodegradable materials are envisioned within this arena as well as societal embedment of culture.
RECONTEXTUALISATION

Let’s get back to S&T Production
Recent re-contextualization of science

**Patient associations** influence research agendas and engage in research themselves, undermining the exclusive rights of scientists.

**Technology Assessment**, Ethical, Legal & Social Aspects surround ongoing science and technology (Human Genome Project initiated this).

**Outreach, public engagement** – feedback into research agendas? (ex. interactive TA of GM vines)

Also **consultancies (and NGOs)** bridging science and the economy, science and the community.

Authority over science (knowledge production) is also claimed by non-scientists (from USA Congressmen to patients and indigenous people).
This shift is visible in science – society interactions
Schéma 1 : modèle britannique de communication scientifique (Science et Technologie au Royaume-Uni Numéro spécial 1Septembre-Octobre 2011) Crédit : Service pour la Science et la Technologie- Ambassade de France à Londres

Science and Society Interaction in the UK visualised in spciela issue produced by the French Embassy in the UK.

Is a reasonable picture as far as it goes (it is an interesting special issue by the way by the Service for Sci and Tech in the French Embassy in Lodnon, but integrating less traditional forms of interaction:

IS ONLY PART OF THE PICTURE
We see a number of different types even within this focused area of science and society interaction.
Preliminary findings: 
Recontextualisation is happening in a number of ways

- **Increase in Science Communication in National Science Strategies**

- **Interactive/Constructive Technology Assessment** organised by Parliamentary TA organisations (Rathenau, Danish Parl. TA) or social scientists (TA-NanoNed, INRA-iTA) bring Specific Publics into science and technology options assessment.

- **Social Scientists playing a role** in Ethics, Social and Legal Aspects (programmes in UK, DE, CH, NL and FR).

- **Social Media** and unique methods for discussing and promoting science becomes a dialogic space plus a mechanism of transparency

- **Science Media orgs.** And consultancies play a strong role.

- **Citizen Science** (biodiversity case AND protein modelling case (through computer game)

- **Museums as actors** rather than just mediators shaping and creating spaces for engagement (Biodiversity)
Occasions of recontextualisation are entwined with shifts in S&T governance

For example see Responsible Research and Innovation
Responsible Research and Innovation

Stages of emergence and societal embedment (or rejection) of a technological innovation:

- Research
- Prototype and further dev.
- Large scale Manufacture
- First entry into society (niches)
- Uptake in society

Relative presence in the enactment and selection of new technological options:

- Upstream Public Engagement
- Outreach
- Constructive TA and ELSA
- Soft Law / Codes of Conduct
- Regulation
- Acceptance / Rejection
ARENAS of ASSESSMENT and SHAPING

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Bioplastics R&D funding
Funding calls for bioplastic innovations are increasing, with some linked to nanomaterials. This provides resources but little guidance in R&D circles.

Diffuse Societal Demand
A broader more diffuse notion of sustainability and environmentally friendliness. Affecting consumer choices and increasing demand for alternatives.
ARENAS of ASSESSMENT and SHAPING

The situation is changing with society (in many guises) being involved (or influencing) other arenas of assessment.
So a challenge for TA generally

Has to be distributed or at least sensitive to the different contexts of many (and varied) assessment arenas

Governance is distributed (unevenly, with different power relations)
So what does this mean for TA and Governance of S&T PRODUCTION?

(IN BRIEF)
Distribution of Technology Assessment Labour

For new technologies (like nanotechnology) the situation changes – the societal side is becoming involved at earliest stages thru anticipation.

Concerns  Promises solutions  lucrative  Consumers

Research  Product  Time

a pressure to translate research into applications

a pressure to be strategic, (roadmapping & agenda building)

a pressure to be transparent & pay attention to various publics

a pressure to engage with ELSA and TA (responsible R&D)

Under New Pressures
Support Systems for Anticipatory TA is needed

This conference reveals a number of elements for this. Things like Constructive Technology Assessment and FTA can help here.

Support system for connecting (or bridging) the worlds of societal aspects, innovation and research related to nanotechnologies.

And to do so in a future-oriented way that anticipates/speculates in a controlled way how developments may unfold.
An opportunity for TA practitioners!
An approach I have been involved in is CTA

(present if time allows)
Constructive Technology Assessment

Embedded in ongoing dynamics and influencing design processes.

Aware of context and interacting with context.

Technology as evolving socio-technical networks.

Aware of socio-technical dynamics, such as co-evolution, sociology of expectations, entanglements.

Broadening design processes based on knowledge of ST dynamics including actor dynamics.

Understanding of actors assessment worlds and their link with (a) each other (b) with the technology and (c) the broader context of science, technology and society.

Embedment of STI insights into ongoing dynamics.

**INSERTION**

**CONSTRUCTION**

**TECHNIQUES**

Context relevant dynamics. For NANO:

**EMERGING IRREVERSIBILITIES**

**MULTI-LEVEL ENTANGLEMENTS**

Models and mechanisms for understanding and revealing assessment worlds and value structures.

**ENACTOR/SELECTION ARENAS FOR PROBING & LEARNING**

FUNCTIONS

CHARACTERISTICS

SOME ELEMENTS
Constructive Technology Assessment

- Embedded in ongoing dynamics and influencing design processes
- Technology as evolving socio-technical networks
- Broadening design processes based on knowledge of ST dynamics including actor dynamics
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INNOVATION CHAIN+ APPROACH FOR THE NANO-ENABLED AGRIFOOD SECTOR

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Packaging Material R&D

1. Material science
   - Fabrication processes
   - Food contact science

2. Novel material or fab. process

3. Standard process or material

4. Target niche Fresh Fruit
   - Target niche Meat
   - Target niche Beverages

5. Approved packaging
   - Embedment in normal practice
   - Acceptance by retailers & associations
   - Acceptance by consumers

6. End of product life
   - Passive compost
   - Incineration
   - Recycle

Issues and dynamics effecting potential packaging innovation journeys through the IC+

- Bioplastics R&D funding
  - Funding calls for bioplastic innovations are increasing, with some linked to nanomaterials. This provides resources but little guidance in R&D clusters.

- Novel food regulation
  - The recent collapse of the Novel Food Regulations in March 2011 means that nano-foods remain unregulated and are not subject to European labeling requirements.

- Food Contact Regulation
  - Plastic Implementation Measure (PIM) - 14262/07. The regulation on plastic materials and articles intended to come into contact with food, comes into force May 2011.

- Nanomaterial toxicity?
  - Limited knowledge of fate of nanomaterials in the body and environment, including toxicity.
  - Some guidance exists (EFSA, 2011).

- Specific Economic Challenge
  - As the cost of fossil fuels rises, so does the production of petrochemical based plastic packaging. In addition, fines and penalties on food packaging waste in various counties.

- Diffuse Societal Demand
  - A broader more diffuse notion of sustainability and environmentally friendly food. Affecting consumer choices and increasing demand for alternatives.
CTA Projects, located in world of S&T production, anticipating on how technologies will co-evolve with different arenas of assessment (at different stages of development)

Van Merkerk & Robinson 2006 Technology Analysis and Strategic Management
LAB-ON-A-CHIP


Robinson & Propp 2006 2nd FTA conf.
2008 TF&SC on multipath mapping
LAB-ON-A-CHIP

Robinson 2010 PhD Thesis SIRNA DELIVERY

Te Kulve 2011 PhD Thesis FOOD AND PHARMA

Robinson 2008 3rd FTA Seminar
2009 TF&SC

CO-EVOLUTIONARY SCENARIOS FOR NANO GOVERNANCE


DEEP BRAIN IMPLANTS

Elwyn et al 2011 Journal of Evaluation in Clinical Practice MEDICAL INFORMATICS FOR HEART DISEASE

Parandian PhD Thesis forthcoming 2011

LARGE AREA ELECTRONICS

BODY AREA NETWORKS

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DEVELOPMENT AND DEPLOYMENT AGENDA

**SOME ELEMENTS**

- Embedment of STI insights into ongoing dynamics
  - Insertion
  - CTA Workshop Techniques

Research into OPERATIONALISING CTA-type activities AND linking it up to actual decision making that shapes development (some progress already visible)

Context aware application of insights into science and technology dynamics

Improved models and tools to explore valorisation processes of various actors (Assessment worlds, values and routines)

Context relevant dynamics. For NANO:
- Emerging Irreversibilities
- Multi-Level Entanglements

Models and mechanisms for understanding and revealing assessment worlds and value structures
- Enactor/Selector
- Arenas for Probing & Learning