Technology Dynamics and Transition Management in China

Technology Assessment

http://surf.to/comet
photo credit: British Airways

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Technology Assessment
Katrina Disaster

Causes?

Natural or human?

http://rescuetac.com/images/katrina1.jpg

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Technology Assessment
Katrina Disaster Causes

A combination of natural and human causes: "altered hydrology" (26%), shoreline erosion (25%)

The 1928 Flood Control Act gave rise to a 3500 km levee system, containing the river, preventing sediments from sustaining and enforcing the delta wetlands

Could such have been foreseen?
            Technology Assessment (TA) aims to do that!

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Technology Assessment

A sub-discipline of Technology Dynamics 1

Technology Dynamics (TD): study of technology development from a societal perspective and the (im)possibilities to steer

Technology Assessment: study of impact of new technology and steering possibilities (TD applied for social purposes; external control by social actors)

Technology Forecasting: study of what the future will bring us (socio-technical processes with a high measure of autonomy or self-organization; chances and constraints; auxiliary science in TD)

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Technology Assessment
A sub-discipline of Technology Dynamics 2

Technology Development: determinants and mechanisms (actors and factors; main subject of TD)

Economic Approaches: economic determinants and mechanisms (e.g. self-interest, market mechanism; subject of TD)

Management of Technology: how to steer technology development? (TD applied for social purposes; internal control by technologists)

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Technology Assessment
What is Technology

Key characteristics:

Artefacts / complex artefacts / technical systems
        [sluice, sluice complex, irrigation system]

Knowledge: technical know-how / natural sciences   [irrigation science]

Actors: organized groups involved in technology or technology development [management, users, companies, education, agencies]

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Technology Assessment
What is technology?

Combination of hardware, software and orgware

Effects resulting from technology in use; effects on society and its environment, including (public) health situation

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Technology Assessment

What is Society?

Structure: groups and organizations (actors) + relationships (hierarchy) + rules (institutions) = social order

(NL: mixed economy of market and state, democracy, welfare state)

Culture: values + world vision + knowledge in general

(NL: freedom, equality and brotherhood + mixed scientific and Christian worldview + science and "hidden knowledge")

Natural environment: geographical and climatological factors influencing society

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Technology and Society

Hardware/orgware+structure+nature = sociotechnical system

> E.g. cars & roads/petrol stations, dealers, Ministry of Transport and communications, ANWB etc.

> + involved social order elements (e.g. free market economy)

> + involved geographical characteristics = road system

System borders: what is being controlled by central actors?

Software+general knowledge & values = technological regime

> E.g. irrigation science + exploitation/development = irrigation regimes

Regime borders: what influences technology development?

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Technology Assessment

What is Technology Assessment about?

In general: about technology and its effects on society

In particular:

Concepts, models and theories

- about the relationship of technology and society
- about technology development, i.e. the development of technologuy and society (e.g. relationships between regimes and systems)

Concepts, tools and methods

- for foresighting and for impact assessment
- for steering technology development

Why is this important ?

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Technology Assessment
Technological Failure

Identify technological failures and discuss why these failed

10 minutes in small groups of 3

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Thomas Midgley jr, CFC's

Developed tetra-ethyl lead (TEL)

Additive to gasoline and chlorofluorocarbons (CFCs)

1921, Ethyl Gasoline Corporation, 1923 → health problems

CFC (Chlorofluorocarbons): increased safety in cooling,

since 1932 → damages ozon layer, stimulates global warming

http://www.dartmouth.edu/~toxmetal/images/Midgley.gif

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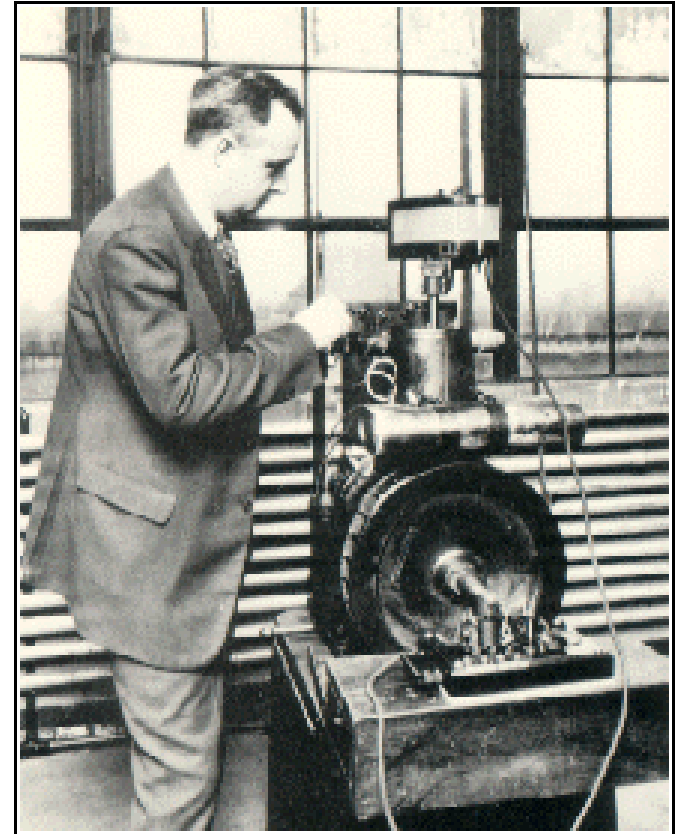
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Paul Hermann Muller, DDT

Invented DDT in 1939

> Against, insects and diseases such as malaria and typhus

Won the 1948 Nobel Prize in Medicine

Accumulation in the environment and in organisms, threatened bird species etc.

> This lead to the banning of DDT in the 70's and 80's in western countries

http://sandwalk.blogspot.com/2007/03/nobel-laureate-paul-hermann-mller.html

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Havilland Comet

First commercial jet airliner first flight in 1952

Early crashes due to metal fatigue

2 comets crashed in 1954

Aircraft was withdrawn and had to be redesigned

http://surf.to/comet   Photo credit: British Airways

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Technology Assessment

Bridges

Erasmusbridge, Rotterdam

Bridge 'swings'

Wind induced resonance in cables

http://en.wikipedia.org/wiki/Image:Erasmusbrug.jpg

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Technology Assessment
Bridges

Millenium Bridge, London

Horizontal resonance

Caused by pedestrians

www.morgenthal.org

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Wadden area, Netherlands

Sluice complex, built around 1970, for draining and shipping canal that was never built; cleared away in the 1980s

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Aswan Dams

In Egypt

1899, 1912, 1933 and 1970 (Nasser Lake)

http://rst.gsfc.nasa.gov/Sect6/
Aswan_High_Dam.jpg

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Technology Assessment
Aswan Dams

carbon.cudenver.edu

The Nile has sustained agriculture for thousands of years; empires rose and fell as a consequence of discharge variations

Colonial cotton growing caused salinity (soils becoming salty)

Aswan dams prevented silt transportation and created a need for artificial fertilizer

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Technology Assessment
Solo River Debacle

1872

Technology Assessment
Solo River Debacle

Development project in East Java

Too expensive

Unprofitable / social considerations too weak

Technically not feasible

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Technology Assessment
Solo River Debacle

Solo debacle + Consequences for Ethical Policy =

      Small works in connection with Javanese irrigation

      Irrigation management

      Directed at population agriculture

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Technology Assessment
Solo River Debacle

Indonesia:

"Java will become a desert within one hundred years"

Dutch East Indian irrigation engineer, ca. 1925

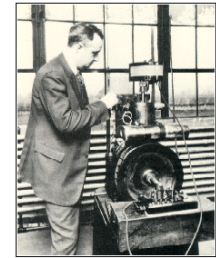# Technology Assessment
Where do things go wrong?

Technology
- It did not work at all
- Unexpected issues (bridges, Comet)
- It did much more (CFC, DDT, lead-additive)
- High volumes cause negative impacts (cars, lead-additive)

Societal demand changed or was misjudged
- E.g. Concorde, Infrastructure (Betuwe-railtrack), East-Groningen

Problem: impacts and changes in demands – or perceptions – were only discovered in practice

http://www.mind fully.org/Pesticide

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First and higher order effects

First order

expected effects

Second order effects

unexpected and sometimes undesired cultural or behavioural changes, like:

> telephone for social communication
>
> new roads attracting more cars
>
> supply creating demand

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Technology Assessment

Where do things go wrong?

Concern about side-effects of industrialisation and technology

Society should be better involved in decision-making in technology development

Usually all relevant requirements are discovered in practice:

Rachel Carson's Silent Spring, 1962

http://en.wikipedia.org/wiki/Rachel_carson

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Technology Assessment

What is it about?

Concepts, models and theories

    about the relationships, mutual influence and improved attunement of technology and society

    for technology development

    social theories, economic theories, linear models

Concepts, tools and methods

    for technology foresighting and technological impact assessment

    for (societal) steering, technology development

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Technology Assessment
Technological models and theories (visions)

Technological Determinism (1950s-1960s)

    Technology structures and shapes society

    Autonomous technology development

Social constructivism (1970s, 1980s)

    Society and societal choices shape technology

    Malleability of technology

Co-evolution and mutual influence of technology and society

    Mutual influence, user initiatives, path dependencies

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Technology Assessment
Technology Assessment Defined (early view)

Technology Assessment is:

the systematic identification, analysis and evaluation of the potential **secondary consequences** (whether beneficial or detrimental) of technology in terms of its impacts on social, cultural, political,

Technology Assessment is intended to provide a neutral, factual input into the **decision-making process.**

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Technology Assessment
Technology Assessment Defined (early view)

Technology Assessment is an attempt to establish an **early warning system** to detect, control, and direct technological changes and developments so as to **maximize the public good while minimizing the public risk**

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Technology Assessment
Office of Technology Assessment

1972 USA: Office of Technology Assessment

- 'Strictly neutral', walking on a tight rope between Democrats and Republicans in US Congress
- Expression of a powerful parliament and it supporting its power position

Technology Assessment offices followed in European countries, e.g. Rathenau Institute in the Netherlands

http://en.wikipedia.org/
wiki/Image:OTA_seal.png

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Technology Assessment

Problems in Technology Assessment

Objectivity and single-best outcome/solution **not possible**

No contribution to **democracy** in technology development

Technology development can be **unpredictable** and problems/impacts are often seen **too late**

Technology **negatively** approached: Technology Arrestment or Technology Harrashment

Expert driven, little concern about **value driven** opinions and differing **mental frameworks**

Limited use of outcomes in **decision-making**

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Technology Assessment
Control Dilemma

*….*attempting to **control** a technology is **difficult**, and not rarely impossible, **because during its early stages, when it can be controlled**, not enough can be known about its harmful **social consequences** to warrant controlling its development; **but by the time these consequences are apparent, control has become costly and slow**.

Collingridge (1980)

knowledge effects

adaptability

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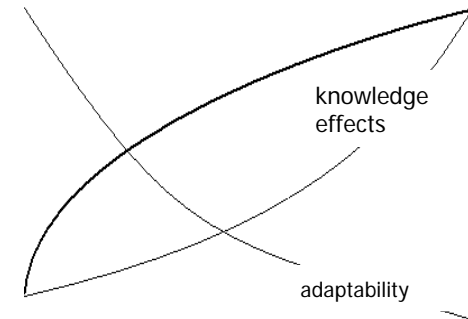
Technology Assessment
Early and New Technology Assessment

EARLY TA	NEW TA
Science is dominant (Analyst)	Analyst and users are equal
High expectations	Modest expectations
Output TA = report	TA-Output = report + discussion
Little attention for problem definition	Problem definition plays major role
One TA organisation	Several TA organisations
Instrumental use of TA-information in a rational decision-making process	Conceptual use of TA-information by (all) actors
TA results automatically used in decision-making	High level of attention to incorporate TA in decision-making
Technology is autonomous	Technology is man-made

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What can TA do?

1. **Reinforcement** of stakeholders in decision-making
2. Providing support for the **actual policy**
3. Initiation and development of **future policy**
4. Providing **early warning** (for negative consequences)
5. **Broadening of decision-making** concerning stakeholders (involving more people and more actors)
6. Development of **desirable** technological **adjustments**
7. Promoting the **acceptance** of technology **by the public**
8. Promoting **societal responsibility** of **scientists/engineers**

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Technology Assessment
Three approaches in TA

Awareness TA

foresighting/exploring of possible societal consequences, opportunities and choices of technology and raising awareness to make government or the public aware of opportunities and threats.

Strategic TA

meant to inform a specific stakeholder or sector on his strategic options with respect to technological possibilities, their limitations and effects (From Awareness to Strategy).

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Three approaches in TA

Constructive TA

enhancing interaction between developers of technology and other stakeholders/actors, broadening technology development with social aspects and actors

Novel varities

include **Interactive TA** and **Participatory Backcasting**, related to Constructive TA

Source: Smits and Leyten, 1991

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Different forms of TA in the Netherlands

Parliamentary TA Rathenau Institute organising public debates and reporting to the Dutch Parliament

Governmental TA WRR (Council for Governmental Policy), min of Agriculture (new technologies in agriculture), Sustainable Technology Development programme

Business TA broadening strategy and technology development, preventing market failures and side-effects

Academic TA developing and testing new methods and tools for TA

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Technology Assessment
Rathenau Institute: New projects

Nanotechnology

Military Technology

Technology, Poverty and Development
Co-operation

Renewed Nuclear Energy Debate

Science and Spatial Planning

Intelligent Interaction between Man
and Machine

Anti-ageing Technology

Reproductive Cloning of Humans

Rathenau Instituut

www.rathenau.nl

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Group Assignment

Which solutions can be designed?

Which aspects/effects would you take into account?

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