Finnish Experiences in Technology Foresight

Eija Ahola, Tekes

- Technology foresight within the Finnish innovation system
- “Embedded foresight”: integration of evaluation, assessment and foresight
- Tekes perspective: technology strategy and technology programmes
- Technology foresight for innovations within industrial clusters: project cases
Key actors of the Finnish innovation system

- Finnish Industry Investment Ltd
- Sitra
- Investors
- Business Angels
- Associations
- Inventions
- Companies
- Research institutes
- Universities
- Academy of Finland
- Ministry of Education
- Ministry of Trade and Industry
- The Science and Technology Policy Council

EU structural funds for innovation

- Finnvera
- Regional Councils
- Regional TE-Centres
- Polytechnics
- Centres of Expertise
- Technology Centres
- Tekes

Investments in different sectors like environment, health and traffic

National public investment in innovation and know-how

Invest in Finland
Innovation system
Resources and funding in 2000

- **R&D at companies**
  - 3,100

- **Public**
  - **VTT**
    - From abroad
    - 210 (60)
  - **From abroad**
    - 120
  - **Academy of Finland**
    - 160
  - **Universities**
    - 790 (350)
  - **Ministries, TE-Centres and sectoral research**
    - 290 (210)

- **Private**
  - **Venture Capitalists**
    - Private 350
    - Tesi 45 (80)
    - Sitra 100 (2)
  - **Finnvera**
    - 320 (50)
  - **Finnpro**
    - 60 (30)
  - **Tesi**
    - 45 (80)
  - **Found. Innov. 5**
  - **Sitra**
    - 100 (2)
  - **Private**
    - 350
  - **Tesi**
    - 45 (80)
  - **Tekes**
    - 380
  - **VTT**
    - 210 (60)

- **Business development**
  - Marketing
  - Internationalisation

- **Million euros**
Technology foresight within the innovation system

PARLIAMENT: Committee for the future

GOVERNMENT

Science and Technology Policy Council

Ministry of Education

Academy of Finland
  “science watch for programme strategy”

Universities

Ministry of Trade and Industry
  “TF-coordination”

Tekes
  “technology strategy, programme strategy”

VTT
  “research strategy”

Regional TE-Centres
  “regional development”

Other ministries and their institutes
  “resource strategy”

Sitra
  “structural challenges”

Industrial Associations
  ”R&D and education policies”
“Embedded foresight”: integrating evaluation, technology assessment and technology foresight

Ruud Smits: Technology assessment and user oriented impact evaluation, EU DG Research and Tekes – workshop on Impact evaluation, 1999 Helsinki
“Embedded foresight”: integrating evaluation, technology assessment and technology foresight

National technology foresight networks, cooperation and coordination:

- Parliamentary Committee for the Future has established an expert-network to support their goals and projects; TA
- Ministry of Trade and Industry has established several networks within TF; between ministries, between MTI, Tekes, VTT and Academy of Finland, network of TF experts
- The two key processes of Tekes (competitive selection of funding, technology programmes) rely on technology strategy which is based on technology foresight
- Industrial cluster strategy is typically made within a technology foresight project
- Evaluation of technology programmes include integration of TF and TA into evaluations
- (“embedded” and integrated approach is still conceptual; methodologies, methods and processes need to be developed)
Assessment of technology foresight within the Finnish innovation system

### SOCIAL & HUMAN CAPITAL in TF

<table>
<thead>
<tr>
<th><strong>SUPPLY</strong></th>
<th><strong>USERS</strong></th>
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<tbody>
<tr>
<td>- foreign TF reports</td>
<td>- dispersed IS</td>
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<tr>
<td>- technology push-based</td>
<td>- individual goals</td>
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<tr>
<td>- projects</td>
<td>- little experience</td>
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<tr>
<td>- industrial clusters</td>
<td>and expertise in TF</td>
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<th><strong>CREATORS</strong></th>
<th><strong>DEMAND</strong></th>
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<td>- emerging research field</td>
<td>- increasing</td>
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<tr>
<td>- small groups, dispersed</td>
<td>- cooperation</td>
</tr>
<tr>
<td>- little links with technology</td>
<td>- “policy towards</td>
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<tr>
<td>experts and policy</td>
<td>innovations”</td>
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**TECHNOLOGY & INNOVATION POLICY PERFORMANCE**

- The Finnish Parliament Committee for the future
- Regional technology foresight activities
- The key role of Tekes in the innovation system
Benefits and challenges of Finnish technology foresight practices

Strengths
- Exploitation orientation
- Effective; minimum effort, resources and organisation
- Ongoing objective-oriented and strategic process
- Directly implemented on technology policy level
- Based on expertise and technology push
- Problem-orientation, strongly focused, on-demand

Challenges:
- New knowledge creation?
- Systematic analysis and data coverage?
- Cooperation on national level, common visions?
- New markets and new ideas for technology and innovations?
- Broader views; consumers, citizens?
“After an in-depth investigation of the national organisation of foresight and relevant needs, it is evident that it is time to proceed to more extensive and concrete projects.

Finland has the prerequisites for a national foresight exercise. Network-building and the monitoring of foresight methods and needs are not enough to keep up interest in the futures outlook among researchers, business enterprises and other players and to encourage them to contribute to foresight.”

**Tekes, the National Technology Agency**

The main public financer for applied and industrial R&D

| Key Functions | Technology Programmes | Selective Project Funding | Activation for Innovation | Development of the Innovation Environment | International Technological Cooperation and Internationalisation of Companies |
|---------------|-----------------------|---------------------------|---------------------------|------------------------------------------|

These key functions of Tekes provide for technology foresight:

1. **Sources of visions, goals and demand for technologies**
2. **Operative measures to implement technology strategy**
3. **Cooperation and links within the innovation system**
   (domestic and international, companies, universities, CROs, ministries, other actors in the innovation system)
Tekes Technology Strategy process

- Critical technologies
- Core competences

**Technology strategy**

**International contacts:**
- IFTF, NISTEP, EU, IAF, Social Sciences etc.

**Values and goals of the society**

**Global megatrends**

**Regional strategies/regional technology strategies**

**Industrial associations**

**Companies**

**Universities, Research institutes**

**The Academy of Finland**

**International contacts:**
- IPTS etc.

**Societal foresight studies**
Dynamics of Finnish Industrial Clusters

Technology and competence are sources of renewal

The future is in knowledge and competence
Technology strategy – a review of choices
Market drivers and technology drivers

General trends:
- globalisation, knowledge and competence, digital era,
- networked economy, sustainable development, social development, technological trends

Development of industrial clusters:
- competitiveness and renewal of existing industries,
- birth and growth of new businesses
- Welfare in line with sustainable development

Intelligent products, processes and systems
Information and communications technology
Material technology
Bio-technology
Knowledge-intensive services
Welfare
Sustainable development
Business competence in the networked economy
Potential applications

Key Areas of Industrial Renewal and Welfare-promotion

- **Intelligent products, processes and systems**
  - adaptive and intelligent products, materials and systems
  - navigation and identification
  - virtual models

- **Sustainable development**
  - future energy solutions
  - environmental technologies
  - ecological effectiveness and low-emission processes
  - life-cycle solutions

- **Business competence in the networked economy**
  - networks with new value
  - cluster cooperation
  - fast commercialisation of ideas
  - digital economy

- **Welfare**
  - information and communications technology for health care
  - functional foods
  - targeted pharmaceuticals and diagnostics
  - healthy and safe living environment

- **Knowledge-intensive services**
  - knowledge-intensive business services
  - product-integrated services
  - new technology-related services

- **Material technology**

- **Biotechnology**

- **Information and communications technology**
Tekes Technology Programmes
- the main tool to implement technology strategy on technology policy level

- extensive programmes initiated by Tekes and consisting of numerous projects
- focused on a key technology sector
- implemented in cooperation by companies and research units

- 43 on-going programmes in 2002 with a total extent of 1.5 billion euros
- Tekes participates in five programmes started by the Academy of Finland
- c. half of Tekes funding goes through technology programmes
- Tekes usually finances half of programme costs
- annually 2000 company and 800 research unit participations
Technology foresight studies for cluster dynamics

ICT cluster

- Software business
- Communications services
- Instrumentation and automation

Total cluster

Forest cluster

- Forest chemicals
- Pulp and paper
- Harvesting and logistics
- Wood products

Total cluster

Food cluster

- Functional foods
- Basic foods

Total cluster

Content business

- Electrotechnical products
- Communications equipment

Total cluster

Electrotechnical products

- Functional foods
- Basic foods

Total cluster

Wood products

- Functional foods
- Basic foods

Total cluster

Forest chemicals

- Functional foods
- Basic foods

Total cluster

Harvesting and logistics

- Functional foods
- Basic foods

Total cluster

Pulp and paper

- Functional foods
- Basic foods

Total cluster

Increasing

Decreasing

Growth of global markets

Finnish share of global markets

Fast

Slow

Decreasing

Increasing
Cluster-based technology foresights:
- three cases of micro-level technology foresight

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<tr>
<th>Industrial cluster</th>
<th>Goals of the project</th>
<th>Methodology</th>
<th>Main “systemic” results (impacts)</th>
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</thead>
</table>
| **Food cluster**  
*Gaia Group*                                          | - Potential technologies  
- Innovation processes                                                        | Mix: interviews, workshops, international benchmarking; over 100 participants from many sectors | New ideas for industrial and technology strategy  
Wider networks                                         |
| **Media and communications**  
*VTT Mediatech*                                         | - Potential innovations  
- Possibilities for Finland                                                     | Expert study: mediaholes, weak signals, scenarios, technology screening     | New innovation processes  
New ideas for industrial and CRO strategy               |
| **Forest, pulp and paper**  
*System analysis at the University of Technology* | - Evaluation of programme, relevance of research and impacts on clustering   | ICT aided embedded in-house: internet-survey, internet-voting, workshops, scoring; programme participants | New R&D programme strategy  
Wider exploring of R&D results                         |