Overview

- Approaches to third mission and consequences for indicators
  - Systems approach
  - Supply and demand sides
    - Universities vs firms
    - Higher education vs innovation

- Examples on indicators
  - From the universities’ point of view
  - From business point of view

- Availability of comparable data

- Conclusions
**Approach**

- Third mission: Universities playing a variable set of roles in interaction with industry and business.
  - A strategic choice or
  - The sum of independent actions
- Excludes:
  - Dissemination activities and lectures to the general public
  - Specialised courses for the business community
  - Second-order spill-over effects
- Third mission is the university taking part in the innovation system
  - Executed in the interplay between firms and other specialised knowledge providers
  - Role dependent on characteristics of whole system
  - Can be analysed from supply and demand side

**Approach**

- System characteristics are important
  - Industrial structure and specialisation
  - R&D and innovation capacity of industry
  - Other knowledge providers available
    - Public laboratories and institutes
    - Private labs and consultancies
  - Traditional roles and path dependency
  - Policies and incentives
- System knowledge is essential for interpretation of indicators
Available indicators

- **Indicators of user-directed commercialisation:**
  1. Revenues from contract research for industry
  2. Co-authorship academia – industry
  3. Consultancy and expert advice to industry
  4. Grey literature or confidential reports to industry
  5. Exchange of graduates with industry

- **Indicators of both user-directed and science-directed commercialisation:**
  6. Research results cited in patent applications
  7. Publications in scientific fields of interest for business
  8. Engagement in fields of science with a potential for commercialisation
  9. Mobility of personnel between research institutions and industry

- **Indicators of science-directed commercialisation:**
  10. Patents applied for by the institution or its academic personnel
  11. Patents granted to institutions or academic personnel
  12. Revenues from licensing
  13. The establishment of spin-offs owned by institutions or academic personnel
  14. Existence of a support organisation for commercial activities (TTOs, experts in patents etc)
  15. Existence of formalised rules for redistribution of revenues from commercialisation of research results (e.g. the Stanford model)
  16. Existence of courses in entrepreneurship (with hands-on experience learning and at different levels, e.g. including PhD degrees)
### Summary of Aquameth survey on data availability 2006 (1)

<table>
<thead>
<tr>
<th>Data / Indicator</th>
<th>France</th>
<th>Spain</th>
<th>Hungary</th>
<th>Italy</th>
<th>Norway</th>
<th>Switzerland</th>
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<td>1. Revenues from contract research for industry</td>
<td>A</td>
<td>A</td>
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<td>A from 1994</td>
<td>A from 2001</td>
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<td>2. Co-authorship academia – industry</td>
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<td>3. Consultancy and expert advice to industry</td>
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<td>4. Grey literature or confidential reports to industry</td>
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<td>NA</td>
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<td>5. Exchange of graduates with industry</td>
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<td>6. Research results cited in patent applications</td>
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<td>7. Publications in scientific fields of interest for business</td>
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<td>8. Engagement in fields of science with a potential for commercialisation</td>
<td>Not in survey</td>
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<td>9. Mobility of personnel between research institutions and industry</td>
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<td>10a Patents applied for by the university</td>
<td>A</td>
<td>A from 2000</td>
<td>A from 1994</td>
<td>A but problems</td>
<td>Not relevant</td>
<td>A but problems</td>
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<td>10b Patents applied for by academic personnel (university employees)</td>
<td>Not relevant</td>
<td>Not relevant</td>
<td>A</td>
<td>A but problems</td>
<td>A 1998 – 2003</td>
<td>NA</td>
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<td>11a Patents granted to the university (institutional ownership)</td>
<td>A 2004</td>
<td>A from 2000</td>
<td>A from 1994</td>
<td>A but problems</td>
<td>Not yet relevant</td>
<td>A but problems</td>
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<tr>
<td>11b Patents granted to academic personnel (university employees)</td>
<td>A 2004</td>
<td>Not relevant</td>
<td>A</td>
<td>A but problems</td>
<td>A 1998 – 2003</td>
<td>A but problems</td>
</tr>
<tr>
<td>12 Revenues from licensing</td>
<td>A</td>
<td>A from 2000</td>
<td>A but problems</td>
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<tr>
<td>13a Number of spin-offs established by the university (institutional ownership)</td>
<td>A but problems</td>
<td>A but problems</td>
<td>A from 2006</td>
<td>A for some</td>
<td>Not relevant</td>
<td>A but problems</td>
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<tr>
<td>13b Number of spin-offs established by academic personnel (university employees)</td>
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<td>NA</td>
<td>A</td>
<td>NA</td>
<td>A</td>
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<td>14 Existence of a support organisation for commercial activities (TTO or other)</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
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<tr>
<td>15 Existence of formalised rules for redistribution of revenues from commercialisation of research results</td>
<td>A</td>
<td>Not relevant</td>
<td>Possible in future</td>
<td>NA</td>
<td>Possible in future</td>
<td>A</td>
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<td>16 Courses in entrepreneurship</td>
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<tr>
<td>Effects of established spin-offs</td>
<td>NA</td>
<td>NA</td>
<td>A</td>
<td>A but problems</td>
<td>A</td>
<td>A but problems</td>
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Available indicators and their usefulness

- **Contract funding from industry**
  - Available from 2001 onwards
  - Some problems, but still probably the best indicator on industry relevance
  - But, often collaboration without funding

- **PhDs in industry/business**
  - Reflects industry relevance of educational programmes, not necessarily 3rd mission
  - Might vary according to industrial structure of country, traditions, variations in labour market

- **Patents and patents citations**
  - Possible for some countries and years, but not for time series
  - Citing of research publications and name of inventors provide a direct link to universities
  - Drawbacks: Possibilities yet to be explored, requires possibly much cleaning of data

- **Co-authorship university-industry**
  - Probably best indicator for collaboration
  - Pro: Available and updated
  - Con: Expensive and requires considerable data cleaning

- **Other: Spin-offs, TTOs, PhD supervision**
  - Some relevance, but data hardly available and not very useful

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### Logistic regression analyses of probabilities that faculty members report commercial outputs in terms of patents, commercial products, establishment of firms and consulting contracts. (N=1937).

<table>
<thead>
<tr>
<th></th>
<th>Patents</th>
<th>Commercial products</th>
<th>Firms</th>
<th>Consultant contracts</th>
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<tr>
<td></td>
<td>B</td>
<td>B</td>
<td>B</td>
<td>B</td>
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<tr>
<td><strong>Demographics:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full professor</td>
<td>0.558 *</td>
<td>-0.160</td>
<td>0.223</td>
<td>-0.096</td>
</tr>
<tr>
<td>Age</td>
<td>0.008</td>
<td>0.011</td>
<td>0.005</td>
<td>0.013</td>
</tr>
<tr>
<td>Female</td>
<td>-0.687</td>
<td>-0.321</td>
<td>-1.187 *</td>
<td>-0.208</td>
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<tr>
<td><strong>External funding:</strong></td>
<td></td>
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<tr>
<td>Funding from industry</td>
<td>1.703 ***</td>
<td>1.195 **</td>
<td>1.217 **</td>
<td>1.156 ***</td>
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<tr>
<td>Only other external funds</td>
<td>0.793</td>
<td>0.200</td>
<td>0.458</td>
<td>0.169</td>
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<tr>
<td><strong>Research collaboration:</strong></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Universities</td>
<td>0.047</td>
<td>0.308</td>
<td>0.340</td>
<td>0.320 *</td>
</tr>
<tr>
<td>Research</td>
<td>-0.435</td>
<td>-0.404 **</td>
<td>-0.227</td>
<td>0.417 ***</td>
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<tr>
<td>Institutes</td>
<td>1.293 ***</td>
<td>0.896 ***</td>
<td>1.218 ***</td>
<td>0.611 ***</td>
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<td>Industry</td>
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<td>-0.241</td>
<td>0.269</td>
<td>0.203</td>
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<td>Scientific publications:</td>
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<tr>
<td>Article equivalents</td>
<td>0.000</td>
<td>0.019 *</td>
<td>0.001</td>
<td>0.025 ***</td>
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<tr>
<td><strong>Academic field (natural science ref. group):</strong></td>
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<tr>
<td>Humanities</td>
<td>-2.163 **</td>
<td>0.160</td>
<td>-1.184 *</td>
<td>0.308</td>
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<tr>
<td>Social Sciences</td>
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<td>-0.257</td>
<td>-0.903 **</td>
<td>0.022 ***</td>
</tr>
<tr>
<td>Medicine</td>
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<td>-0.034</td>
<td>-0.302</td>
<td>-0.187</td>
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<tr>
<td>Technology</td>
<td>0.447</td>
<td>0.504 *</td>
<td>0.116</td>
<td>1.066 ***</td>
</tr>
<tr>
<td>Constant</td>
<td>-4.509 ***</td>
<td>-3.558 **</td>
<td>-4.197 ***</td>
<td>-2.896 ***</td>
</tr>
<tr>
<td><strong>-2 Log likelihood</strong></td>
<td>731.470</td>
<td>1120.83</td>
<td>759.048</td>
<td>2078.260</td>
</tr>
</tbody>
</table>

Available indicators on Providers of R&D, information and cooperation in CIS 4 survey

**Public R&D**
- R&D acquired from domestic public institutions
- R&D acquired from foreign public institutions
- Universities used as source of information
- Research institutes used as source of information
- Cooperation with universities
- Cooperation with research institutes

**Private R&D**
- R&D acquired from domestic firms
- R&D acquired from foreign firms
- R&D acquired as support to R&D activities of business association
- Consultancies used as source of information
- Commercial laboratories used as source of information
- Collaboration with consultancies
- Collaboration with commercial laboratories

**Market**
- Suppliers used as source of information
- Customers used as source of information
- Competitors used as source of information
- Industrial association used as source of information
- Collaboration with suppliers
- Collaboration with customers
- Collaboration with competitors

**Open sources**
- Conferences used as source of information
- Publications used as source of information
Relative importance of information sources for innovation activities. Average for selected sectors and full CIS sample. Per cent.

Relative importance of cooperation partners for innovation activities. Average for selected sectors and full CIS sample. Per cent.
Findings of Tether and Tajar for UK (Research Policy July 2008)

- Few firms have contact with specialised knowledge providers at all
  - Less than 10 per cent of total UK CIS3 sample
- Considerable variation between sectors of the economy at the general level
  - Most formal contact within Technical Service Providers (23 %) and High Tech Manufacturing (22 %)
  - Least contact within Transport Services (4 %) and Professional Services
- Same pattern for links with the public science base (universities and government research organisations).
- Positive effects for contacts of in-house absorptive capacity
- Interlinkages and networking effects are typical
- Specialised knowledge providers are complementary to in-house innovation, not a replacement
Some conclusions

- Some indicators based on comparable data are available
  - Efforts needed to expand number of useful indicators and quality
- Informal and indirect knowledge transfer are important parts of third mission, but indicators for such transfer are difficult
- Indirect links and networking relationships are important
  - Consequently: Measuring third mission by direct university-firm relationships might miss the target
- Innovation indicators are a useful supplement
  - Provides detailed data on firm behaviour
  - Relates to firm and sector characteristics
- Combined approaches are useful to capture the fact that third mission is very dependent upon the context and the dynamics of the business sectors it serves.