Construction R&D investments in Denmark

Kim Haugbølle, PhD, Senior Researcher
Aalborg University
Outline

• Background
• Research design
• Organisational structure
• Construction R&D investments
• Roadmap
• Results?
• Perspective

Photo: Kim Haugbølle
Background

• Policy reports
  • Resource area analysis of 1993 and 2000
  • Byggeriets Task Force in 2000
• Previous construction R&D studies
  • Indicative, but inconclusive due to small studies
• Construction R&D committee
Research design: Adapted Triple Helix

- Holistic approach: Resource area building/housing
  - Primary industries (raw materials like gravel etc.)
  - Manufacturing industries (building components like windows etc.)
  - Service industries (contractors, consultants etc.)
  - Supporting industries (technological service institutes etc.)
Organisational structure

• More than 200 knowledge institutions and brokers
• Five (six) core institutions
  • Danish Building Research Institute
  • Department of Building Technology, Aalborg University
  • BYG-DTU, Technical University of Denmark
  • The Royal Danish Academy of Fine Arts, School of Architecture
  • Aarhus School of Architecture
  • (Danish Technological Institute, Division Building Technology)
# Public R&D

<table>
<thead>
<tr>
<th></th>
<th>AAU Building Technology</th>
<th>DTU BYG•DTU</th>
<th>KARCH</th>
<th>AAA</th>
<th>SBi</th>
<th>DTI Building Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Basic public funding</strong></td>
<td>16.1 (66 %)</td>
<td>29 (66 %)</td>
<td>24 (89 %)</td>
<td>12.2 (70 %)</td>
<td>32.2 (54 %)</td>
<td>6.6 (12 %)</td>
</tr>
<tr>
<td><strong>Private foundations</strong></td>
<td>1.2 (5 %)</td>
<td>1 (2 %)</td>
<td>0.1 (0.3 %)</td>
<td>0.7 (4 %)</td>
<td>0.3 (0.5 %)</td>
<td></td>
</tr>
<tr>
<td><strong>Public programs</strong></td>
<td>3.4 (14 %)</td>
<td>2 (4.5 %)</td>
<td>0.1 (0.3 %)</td>
<td>3.4 (19 %)</td>
<td>3.8 (6 %)</td>
<td>6.6 (12 %)</td>
</tr>
<tr>
<td><strong>Public sources</strong></td>
<td>3.4 (14 %)</td>
<td>7 (16 %)</td>
<td>2.8 (10 %)</td>
<td>1.3 (7 %)</td>
<td>20.2 (34 %)</td>
<td></td>
</tr>
<tr>
<td><strong>Private firms</strong></td>
<td>0 (0 %)</td>
<td>2 (4.5 %)</td>
<td>0 (0 %)</td>
<td>0 (0 %)</td>
<td>2 (3 %)</td>
<td>39 (71 %)</td>
</tr>
<tr>
<td><strong>International sources</strong></td>
<td>0.2 (1 %)</td>
<td>3 (7 %)</td>
<td>0.1 (0.3 %)</td>
<td>0 (0 %)</td>
<td>0.9 (1.5 %)</td>
<td>2.8 (5 %)</td>
</tr>
<tr>
<td><strong>R&amp;D total</strong></td>
<td><strong>24.3 (100 %)</strong></td>
<td><strong>44 (100 %)</strong></td>
<td><strong>27 (100 %)</strong></td>
<td><strong>17.5 (100 %)</strong></td>
<td><strong>59.4 (100 %)</strong></td>
<td><strong>55 (100 %)</strong></td>
</tr>
</tbody>
</table>
Public R&D in sum

• Some 275-325 million DKK in total public R&D
  • Some 175 million DKK (EUR) in five core public institutions
  • Some 100-150 million DKK at all other public research institutions

• Technological service institute
  • Some 55 million DKK at DTI (by definition private institution)

• Some 3 % of total public R&D expenditure
## Private R&D

<table>
<thead>
<tr>
<th>Source of financing</th>
<th>R&amp;D income (mio. DKK)</th>
<th>Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public financing</td>
<td>128</td>
<td>7 %</td>
</tr>
<tr>
<td>Own financing</td>
<td>1,446</td>
<td>80 %</td>
</tr>
<tr>
<td>Other private companies</td>
<td>113</td>
<td>6 %</td>
</tr>
<tr>
<td>Other Danish financing</td>
<td>10</td>
<td>1 %</td>
</tr>
<tr>
<td>Foreign financing</td>
<td>101</td>
<td>6 %</td>
</tr>
<tr>
<td><strong>Sum</strong></td>
<td><strong>1,799</strong></td>
<td><strong>100 %</strong></td>
</tr>
</tbody>
</table>
## Resource areas compared

<table>
<thead>
<tr>
<th>Resource area</th>
<th>R&amp;D expenditure (million DKK)</th>
<th>Turnover (million DKK)</th>
<th>R&amp;D share of turnover</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medico/health</td>
<td>6,172</td>
<td>71,343</td>
<td>8.65%</td>
</tr>
<tr>
<td>IT/communication</td>
<td>5,046</td>
<td>281,974</td>
<td>1.79%</td>
</tr>
<tr>
<td>Other business</td>
<td>2,843</td>
<td>246,539</td>
<td>1.15%</td>
</tr>
<tr>
<td>Building/housing</td>
<td>1,799</td>
<td>329,028</td>
<td>0.55%</td>
</tr>
<tr>
<td>Energy/environment</td>
<td>902</td>
<td>177,683</td>
<td>0.51%</td>
</tr>
<tr>
<td>Transport</td>
<td>641</td>
<td>224,357</td>
<td>0.29%</td>
</tr>
<tr>
<td>Food</td>
<td>1,128</td>
<td>488,882</td>
<td>0.23%</td>
</tr>
<tr>
<td>Furniture/clothing</td>
<td>143</td>
<td>94,060</td>
<td>0.15%</td>
</tr>
</tbody>
</table>
Roadmap: Scale and focus

• Increase funding of 120 million DKK annually
  • Through a percentage of the budget of new building projects

• Establish innovation consortiums within strategic areas

• Convert basic funds
  • Through increased competition and new types of performance contracts

• Increase number of researchers and university research
  • Through a new research program with special focus on post-graduate studies
Roadmap: Learning in construction

• Establish a central knowledge (one-stop-shopping) to better coordinate dissemination of knowledge from institutions

• Improve dissemination to educational institutions

• Require mandatory dissemination plans for research projects

• Improve knowledge dissemination from the two national building defects funds

• Strengthen education and networks
Results?

• No innovation fund established
  • KIG (Koordinations- og InnovationsGruppen)
  • No additional funding provided

• Realdania research (277 million DKK in 2003-2010)
  • Six research centres (145 million DKK): Urban spaces, strategic urban research, housing, construction management, indoor environment, and facility management

• Innovation consortia – not direct result of roadmap
  • 1) Digitalisation (Det Digitale Byggeri) 2000-10
  • 2) Knowledge centre on energy savings 2008-11
  • 3) Sustainable industrialised construction (InnoByg) 2010-14
Results?

- Conversion of basic funds
  - Two 5 million DKK budget cuts (in 2003 and 2012) of national building research institute
  - Redistributed in calls on ad hoc themes – reduced gearing, short-termism
  - Overall 2 % efficiency cuts annually
- Increase number of researchers and university research
  - No program established
  - Lasting effect of Realdania funding?
Results?

- Organisational changes
  - University reform 1 Jan 2007 – mergers (SBi -> AAU)
  - Emergence of CLiBYG at CBS
  - DTU – separation of BYG and MAN – construction management disappeared as separate research field
Perspective

- A call for a business analysis including R&D update
- Making reliable estimates of construction R&D investments is not so straightforward