The world is yours
Nanotechnology in Germany – the investor’s perspective

Dr. Hansjoerg Sage

A presentation to: NanoImpact Tokyo
30 September 2005

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Brief introduction to 3i
3i – the facts

- A world-leader in private equity and venture capital
- Established for 60 years
- FTSE 100 company valued at €6 billion
- Over 500 trade sales and 83 IPOs in the past 5 years
- Over 250 market-facing investment professionals
- Proven international, cross-border offer

As at 31 March 2005
Active across all funding stages

Venture capital
- Early stage
- Focus on technology
- Total investments of €2-50 million
- €1.1 billion portfolio*

Growth capital
- A range of bespoke solutions
- Investments of €10-100 million
- €2.1 billion portfolio*

Buyouts
- Smaller & mid-market buyouts
- Transactions up to €1 billion
- €3.7 billion portfolio*

An exceptional range of venture capital and private equity solutions

As at 31 March 2005

*portfolio value including co-invested funds
A presentation to: NanolImpact, Tokyo
Brief introduction to 3i

3i’s global venture capital team

3i team
- 3i portfolio of companies
- Corporate relationships
- Management teams and entrepreneurs
- Advisers and intermediaries
- Sector communities
- 3i’s people programmes

3i - connecting talent and experience
Overview over German nanotechnology infrastructure
Nanotechnology research conducted both in public and private sector

- Universities
- Corporates
- Nanotech Research
- Research organisations
- Start-ups
Government has increased funds for nanotech research projects continuously.

Main areas in 2005 are Nanoelectronics, Nanomaterials and Optics.

<table>
<thead>
<tr>
<th>BMBF funding (in mn €)</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
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</thead>
<tbody>
<tr>
<td>Nanoelectronics</td>
<td>19.9</td>
<td>25.0</td>
<td>44.7</td>
<td>46.2</td>
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<tr>
<td>Nanomaterials</td>
<td>19.2</td>
<td>20.3</td>
<td>32.7</td>
<td>38.1</td>
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<tr>
<td>Optical technology</td>
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<td>25.2</td>
<td>26.0</td>
<td>26.0</td>
</tr>
<tr>
<td>MEMS</td>
<td>7.0</td>
<td>7.0</td>
<td>9.4</td>
<td>10.2</td>
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<tr>
<td>Communications</td>
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<td>4.0</td>
<td>3.6</td>
<td>3.4</td>
</tr>
<tr>
<td>Nanobiotechnology</td>
<td>4.6</td>
<td>5.4</td>
<td>5.0</td>
<td>3.1</td>
</tr>
<tr>
<td>Production technology</td>
<td>0.2</td>
<td>0.8</td>
<td>2.2</td>
<td>2.2</td>
</tr>
<tr>
<td><strong>Sum</strong></td>
<td><strong>73.7</strong></td>
<td><strong>87.7</strong></td>
<td><strong>123.6</strong></td>
<td><strong>129.2</strong></td>
</tr>
</tbody>
</table>

Source: http://www.techportal.de/
Project funding is complemented by funding for institutions

<table>
<thead>
<tr>
<th>Nanotechnology funding (in mn €)</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMBF</td>
<td>73,9</td>
<td>88,2</td>
<td>123,8</td>
<td>129,2</td>
</tr>
<tr>
<td>BMWA</td>
<td>21,1</td>
<td>24,5</td>
<td>24,5</td>
<td>23,7</td>
</tr>
<tr>
<td>DLG &amp; Caeser</td>
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<td>63,3</td>
<td>64</td>
<td>64,4</td>
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<tr>
<td>Wissensgemeinschaft G.W. Leibnitz</td>
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<td>23,6</td>
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<td>Helmholtz-Gemeinschaft</td>
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<tr>
<td>Max-Planck-Gesellschaft</td>
<td>14,8</td>
<td>14,8</td>
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<tr>
<td>Fraunhofer-Gesellschaft</td>
<td>4,6</td>
<td>5,4</td>
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<tr>
<td><strong>Sum</strong></td>
<td><strong>238,1</strong></td>
<td><strong>256,9</strong></td>
<td><strong>293,1</strong></td>
<td><strong>298,3</strong></td>
</tr>
</tbody>
</table>

source: [http://www.techportal.de/](http://www.techportal.de/)
Research is highly decentralized (I)

- Ultrathin layers
- Lateral nanostructures
- Nanoparticles
- Molecule architectures
- Ultraprecise surface treatment
- Measurement and analysis of nanostructures

- University research
- Non-university research
- Companies

Source: Bundesministerium für Bildung und Forschung, Nanotechnologie erobert Märkte
Research is highly decentralized (II)

source: Bundesministerium für Bildung und Forschung, Nanotechnologie erobert Märkte
US funding is of comparable size

<table>
<thead>
<tr>
<th>Nanotechnology funding (in mn €)</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
</tr>
</thead>
<tbody>
<tr>
<td>NSF</td>
<td>204</td>
<td>221</td>
<td>249</td>
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<tr>
<td>DoD</td>
<td>204</td>
<td>221</td>
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</tr>
<tr>
<td>DoE</td>
<td>89</td>
<td>133</td>
<td>197</td>
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<tr>
<td>NIST</td>
<td>77</td>
<td>66</td>
<td>62</td>
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<td>NIoH</td>
<td>59</td>
<td>65</td>
<td>62</td>
</tr>
<tr>
<td>NASA</td>
<td>35</td>
<td>33</td>
<td>31</td>
</tr>
<tr>
<td>Others</td>
<td>9</td>
<td>9</td>
<td>18</td>
</tr>
<tr>
<td><strong>Sum of U.S. funding</strong></td>
<td>677</td>
<td>748</td>
<td>841</td>
</tr>
<tr>
<td><strong>Sum of EU funding</strong></td>
<td>480</td>
<td>700</td>
<td>740</td>
</tr>
<tr>
<td><strong>thereof German funding</strong></td>
<td>240</td>
<td>250</td>
<td>290</td>
</tr>
</tbody>
</table>

source: http://www.sc.doe.gov/
Areas of interest for a venture capital investor
Nanotechnology spans a wide spectrum of R&D

<table>
<thead>
<tr>
<th>Application areas</th>
<th>Examples</th>
<th>VC Interest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Precision mechanics/optics/analysis</td>
<td>MEMS, Array optics, Diode lasers</td>
<td>Medium - High</td>
</tr>
<tr>
<td>Chemistry/Materials</td>
<td>Carbon nanotubes, functional coatings</td>
<td>Medium</td>
</tr>
<tr>
<td>Energy/Environmental technology</td>
<td>Hydrogen storage, Dye solar cells</td>
<td>Medium - High</td>
</tr>
<tr>
<td>Medicine/Life Science</td>
<td>Tissue Engineering, Drug Delivery, Lab-on-a-chip</td>
<td>Medium - High</td>
</tr>
<tr>
<td>Automotive construction</td>
<td>Nano-particles, anti-reflection coatings</td>
<td>Low</td>
</tr>
<tr>
<td>Electronics/Information technology</td>
<td>Spintronics, OLED, GMR sensors</td>
<td>Medium</td>
</tr>
</tbody>
</table>

Source: Bundesministerium für Bildung und Forschung
In Germany chemical nanotech is one of the focus areas.

**Most important applications:**
- Chemistry and materials
- Information and communication
- Security/defense
- Environment
- Consumer products
- Transport

Major impact: pink, a lot: green, moderate: orange, a little: blue, not at all: yellow

**Opportunities with Chemical Nanotech?**

Source: 3i Survey
A presentation to: NanolImpact, Tokyo
Areas of interest

Appetite with regard to risk / return profiles varies widely

Innovation process

- Core R&D
- Materials Development
- Application Support
- Manufacturing

Existing application

New application

New material, new process

Existing material, new process

Risk?
Challenges associated with VC investments in nanotech
Nanotechnology investing is still in infancy

- Often interesting technology without real, large-scale market need
- Lack of proven business models
  - Materials production (difficult position in value chain, in-house manufacturing not easy for start-up)
  - Licensing (limited value capture)
  - Capital equipment (cash requirements!)
- Long timeframes from research via development to commercialization (40% IRR attainable?)
- Existence of exit markets (especially materials)
- Proven management teams willing to take risks and looking for rewards the VC environment can offer
Examples of German nanotechnology start-ups
A presentation to: NanoImpact, Tokyo

Examples

Advanced Materials and Processes: Other
High throughput experimentation services and equipment

- High throughput experimentation allows acceleration of catalyst development processes
- hte is providing high throughput to chemical and petro industry
- In addition, hte is working on an own line of blockbuster products such as Diesel catalyst
- Customer benefits:
  - Substantial R+D and manpower savings
  - Full offerings of service, know-how and equipment
  - Reduction of development time by a factor 100 to 1000

hte AG

- Location: Heidelberg, Germany
- Website: [www.hte-company.de](http://www.hte-company.de)
- 3i contact: Andreas Kochhäuser, +49 711 222922 0, andreas_kochhaeuser@3i.com
- Dirk Demuth, CEO, +49 6221 74970, dirk.demuth@hte-company.de
Examples

Nano-coating techniques for every surface

- Nanogate concentrates on inorganic-organic nanocomposites as well as self-organising nano-structures based on chemical nano-technology.
- As a complete-services provider Nanogate provides ranges from innovation consulting to materials engineering, production, applications support and marketing all the way to high-availability service.
- The company’s focus lies on materials-based processes to develop, manufacture and market multifunctional materials.

Nanogate Technologies AG

- Location: Saarbrücken, Germany
- Website: www.nanogate.de
- 3i contact: Sören Schuster, +49 711 222922 0, Soeren_Schuster@3i.com
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