Spinverse

Your Emerging Technology Partner

Finance and Investor Models in Nanotechnology

International Symposium on Assessing the Economic Impact of Nanotechnology

Washington DC, 27th March 2012

Tom Crawley, Lauri Tolvas, Terhi Marttila, Pekka Koponen
Agenda

• The Structure of Private Investment in Nanotechnology

• The Challenges of Investing in Nanotechnology

• Conclusions & Recommendations
The Structure of Private Investment in Nanotechnology
Nanotechnology is funded by various players with different success measures

- Corporations
  - Corporate Venture Capital
    - R&D
    - Commercialization
- Institutional Investors
  - Venture Capital
    - Equity and Other Investments
- Shares and Bonds
- Governments
  - Basic Research
  - Applied Research
  - Commercialization
  - Market Entry
  - Mature Markets

Funding research
Funding commercialization
Structuring demand (e.g. Feed-in tariffs)
Corporate investment is directed to research and commercialisation

- **Corporations**
  - R&D
  - Commercialization

- **Institutional Investors**
  - Corporate Venture Capital
  - Venture Capital
  - Equity and Other Investments
  - Shares and Bonds

- **Governments**
  - Basic Research
  - Applied Research
  - Commercialization
  - Market Entry
  - Mature Markets

- **Funding research**
- **Funding commercialization**
- **Structuring demand (e.g. Feed-in tariffs)**
Corporations invest to grow, renew or increase profitability

### R&D
- Research and experimental development
- Metrics
  - Number of patents
  - Research intensity (R&D expenditure as a percentage of turnover)
  - Return on Investment (ROI) of R&D activities
- Strategic considerations such as defensive patenting

### Commercialization
- Activities necessary to take an innovation to market
  - Production facilities; hiring and training workers; sales and marketing
- Metrics
  - More explicit focus on ROI
  - Expected returns: increased sales
  - Costs: building production facilities, marketing
  - Expected payback time, cost of capital

Increased revenue from new or improved products in new or current markets
Improved profitability from reduced costs
From 2010 corporations overtook governments as the largest funding source for nanotechnology.

- **Corporations**
  - 2009: $8.4 Billion
  - 2010: $9.0 Billion

- **Governments**
  - 2009: $8.4 Billion
  - 2010: $8.2 Billion

Venture capital accounts for a less than 5% of overall nanotechnology funding

Corporate Venture Capital

Venture Capital

Equity and Other Investments

VC Investments
2009: 0.8 BUSD (4 %)
2010: 0.6 BUSD (4 %)

Venture Capitalist (VC) seeks to finance rapid growth with high returns

### Investment mode

<table>
<thead>
<tr>
<th>Direct equity investments</th>
<th>Convertible loans</th>
<th>Senior debt</th>
</tr>
</thead>
</table>

### Investment criteria

<table>
<thead>
<tr>
<th>Profile of the company’s management</th>
<th>Market potential</th>
<th>Business model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exit plan</td>
<td>Valuation of the company</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Development stage of the company and its technology</th>
<th></th>
</tr>
</thead>
</table>

- Venture capitalists invest in portfolio of companies that return money back in 3-5 years.
- Best cases are expected to return 10 to 100 times the original investment, typically by listing to stock market or sale to large corporation.
- Over half of investment are expected fail, thus high returns expectations.
The number of nanotechnology-specific VCs remains low, whole sector has troubles in EU

- VCs more important in US than Europe
  - Systematic effect: EVCA figures show investments in Europe down 78% from their 2006 level
- Few nanotech-specific venture funds

**Nanostart**
- Nine firms in the portfolio
- Medical implants, cancer therapies, optical sensors, and coatings for sports equipment
- Three firms in Singapore, two in the US, four in Germany

**Nanodimension**
- Has invested in seven companies
- Construction materials, electronics and targeted vaccines
- All but one based in US

European Venture Capital Association, [http://www.evca.eu/](http://www.evca.eu/)
Institutional investors channel funding through share and bond purchases.

- Corporations
- Institutional Investors
  - Corporate Venture Capital
  - Venture Capital
    - R&D
    - Commercialization
    - Equity and Other Investments
- Shares and Bonds
  - Markets
- Governments
  - Basic Research
  - Applied Research
  - Commercialization
  - Market Entry
  - Mature Markets
  - Structuring demand (e.g. Feed-in tariffs)
  - Funding research
  - Funding commercialization
Nanotech firm stock market performance has been very poor – too early listings?

- PowerShares Lux Nanotech Portfolio (Exchange Traded Fund):

<table>
<thead>
<tr>
<th>%</th>
<th>Company</th>
<th>Ticker Symbol</th>
<th>Sector</th>
<th>5 Year Share Price Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>6,75</td>
<td>Headwaters Inc</td>
<td>NYSE:HW</td>
<td>Energy</td>
<td>-86.6 %</td>
</tr>
<tr>
<td>6,66</td>
<td>Flamel Technologies</td>
<td>NASDAQ:FLML</td>
<td>Nanomedicine</td>
<td>-79.9 %</td>
</tr>
<tr>
<td>6,36</td>
<td>Valence Technology, Inc</td>
<td>NASDAQ:VLNC</td>
<td>Energy/Transportation</td>
<td>-39.05 %</td>
</tr>
<tr>
<td>6,31</td>
<td>Veeco Instruments Inc</td>
<td>NASDAQ:VECO</td>
<td>Tools &amp; Instruments</td>
<td>+41.36 %</td>
</tr>
<tr>
<td>5,78</td>
<td>A123 Systems, Inc</td>
<td>NASDAQ:AONE</td>
<td>Energy/Transportation</td>
<td>-89.11 %*</td>
</tr>
</tbody>
</table>

- 5Y performance on 15.2.2012. NASDAQ performance +19.19% over the period
- *Since floating at $19.6/share on Sept 25th 2009
Public funding plays a critical role in enabling private funding.

Governments

Funding research

Funding commercialisation

Structuring demand (e.g. Feed-in tariffs)

Mature Markets

Market Entry

Commercialisation

Equity and Other Investments

Venture Capital

Corporate Venture Capital

R&D

Commerciaлизation

Corporations

Institutional Investors

Venture Capital

Equity and Other Investments

Shares and Bonds

Basic Research

Applied Research
Public funding partly compensates lack of VC money in Europe

Sources of Funding for Companies Using Nanotechnology in Europe.
Source: Spinverse analysis of ObservatoryNano company survey data
Largest nanotech R&D investments in Europe have had a matching government component...

<table>
<thead>
<tr>
<th>Inno.CNT, Germany</th>
<th>Genesis, France</th>
</tr>
</thead>
<tbody>
<tr>
<td>• 90 million € in total</td>
<td></td>
</tr>
<tr>
<td>• Government funding 45 million €</td>
<td></td>
</tr>
<tr>
<td>• Federal Ministry of Education and Research: &quot;Materials Innovations for Industry and Society&quot; program</td>
<td></td>
</tr>
<tr>
<td>• A research network of more than 90 partners from research and industry</td>
<td></td>
</tr>
<tr>
<td>• BASF, Bayer, EADS, Siemens, Varta...</td>
<td></td>
</tr>
<tr>
<td>• Fraunhofer, Max-Planck, Leibniz-Institut, several universities...</td>
<td></td>
</tr>
<tr>
<td>• Carbon nanotubes (CNT)</td>
<td></td>
</tr>
<tr>
<td>• Started in 2008</td>
<td></td>
</tr>
</tbody>
</table>

| • 107 million € in total |
| • Government funding 46 million € |
| • OSEO-ANVAR: funding and assistance for industrial innovation |
| • A network led by Arkema |
| • 16 partners from France and abroad |
| • Industrial groups, SMEs, and several university laboratories |
| • Nanostructured materials, carbon nanotubes in particular: design and applications in a number of markets |
| • Started in 2008 |

• Public funding partially mitigates the risk of corporations investing alone and enables creation of value-adding open innovation networks
... not forgetting globally single most significant nanotech investor - Rusnano

RUSNANO, Russia

- 8 BUSD nanotech investment fund by Russian government
- Invests globally in companies and venture capital funds
- Investment targets expected to establish operations in Russia
- Drives Russian industry modernization and commercializing scientific innovation
- Attracts over 50% private investment in each case
The Challenges of Investing in Nanotechnology
Nanotechnology presents distinct technology and market acceptance risks

Technology risks
- Scalability from laboratory to industrial scale
- Integration of nanomaterials or components with larger systems
- Intellectual property risks

Market acceptance risks
- Existing solutions may be "good enough"
- Adoption needed throughout value chain
- Regulatory, safety and societal factors
Sector specific factors have a greater impact on investment success than nanotechnology per se

Transportation & Aerospace
+ Improved batteries for electric vehicles; New materials
- Strong competition; Adaptation needed from users

Nanomedicine
+ Many opportunities to contribute to innovative products
- Regulatory approval process

Electronics
+ Downscaled sizes; 'More than Moore'
- Well optimised existing solutions

Energy
+ Energy storages; Photo-voltaics; Catalysts; 'Clean Tech'
- Cost competitiveness of existing solutions

Materials
+ Potential to transform other sectors
- Difficult to evaluate as an investment class

Food & Food Packaging
+ More degrees of freedom within packaging; Strong incumbent players
- Public image of “nano”
Conclusions

- The value of nanotechnology will be realized when it is embedded in mass-produced products
- Much of the complexity and investment risk occurs in the commercialisation stage
- Commercialization often needs many players to co-operate over value chain
- Corporations still cannot bear all the risks of required development and value-chain integration alone
- Venture capitalists require fast growth and high returns. Nanotechnology companies cannot often meet the timeline
- There is a clear need for government interventions to support activities which take nanotechnology closer to market
Recommendations
Industrial investment can be encouraged with public-private partnerships and risk sharing

Pooling knowledge between the corporate, SMEs and research worlds

• Integration and information sharing along a value chain
• Forming new combinations, beyond traditional industries

• As the benefits of an enabling process technology are shared by a number of companies, so should the costs
• Public funding is often required to catalyse these combinations, and reduce risk to individual firms
• Research funding should be more application-oriented
Venture capital will still play a role, but it has to work in partnership with public funding

- Venture capital investors compare nanotechnology-enabled businesses unfavourably to e.g. software business
- Nanotechnology will always have high capital requirements and long payback times, but there are ways to mitigate this

→ An optimal combination?
  → opportunity identification skills and commercial rigor of best venture capitalists to accelerate commercialization
  → deep pockets and patience of government-backed funds
  → joint use facilities and financing for proof-of-concept and pilot production
  → networks to complementary expertise and customers
  → leveraged upside ROI for private investment
Thank you.

Pekka Koponen
pekka.koponen@spinverse.com
+358 40 545 0008

Your Emerging Technology Partner