Materials Science and Corporate Research - Differentiation via Innovation

Steven C. Freilich
Director, Corporate Strategy
University of Delaware Energy Institute

Director, Materials Science (emeritus)
DuPont Central Research & Development
Science drives differentiated materials businesses

3 characteristics needed to enable profitable materials science

Uncertainty Management
- Balanced portfolio
- Absorption of failure

Knowledge Acquisition
- Sensing
- Absorb/Learn/Create

Integrated Development
- Across divisions
- Throughout stages

The global market challenges materials companies

**Markets rapidly commoditized**
- Margins squeezed; R&D becomes cost
- Stock buy-back for short-term “growth”

**Long innovation delivery times**
- Requires funding by cash businesses
- Hard to absorb research investment

---

![Materials & Chemicals Profit Performance ($B)](chart.png)

J. Boringen, T.J. Simons, McKinsey, Commoditization in chemicals 12/16

![Technology Familiarity](chart2.png)

C. Musso et al, McKinsey Chemical Innovation 5/13
Materials businesses react to investor pressure

- Companies become “focused”- *i.e.* short-term focus on existing products
- Shift spending from research to application development
- Eliminate functions not required for short-term strategy and sales
- Violates characteristics of science-based business
  - Harder to move from discovery to commercialization
  - Reduces the ability to attract new talent and ideas
  - Reduces the ability to sense and incorporate new opportunities

www.supplychain247.com
Depending on start-ups not the perfect answer

- Large materials companies lack the sensing capability and risk tolerance
- Venture money prefers 3-5 years to exit & minimal invested capital
  - Shy away from investment in materials companies
- No one to bridge the Valley of Death

National Venture Capital Association, 2016 Yearbook
Changing the competitive equation- a solar example

Government support is critical to reduce private sector risk
Public/private partnerships can impact the entire supply chain

- US vs. China cost: scale & supply chain, not labor
- Can be reproduced but installed base challenges

- Advanced technology can level the playing field
- Performance transformation leads to:
  - Lower costs
  - Larger scale
  - Discontinuity in the experience curve

AC Goodrich, *et.al.*, *Energy and Environmental Science*, 2013, 6, 2811-2821
Conclusions

• Short-term focus breaks the connection to science-based model
  – Separates invention from manufacture
  – Reduces fundamental ability to convert invention to innovation

• Cripples corporate front-end sensing capability
  – Increases the depth & width of the Valley of Death for external inventions

• Underscores the importance of the historic role of government to reduce private industry risk
  – Government not doing what “the private sector does better,” or trying to “pick winners” and instead is investing in those things that private sector cannot/will not do
  – Drive science that is the foundation for innovation (e.g. ARPA-E, NSF, DARPA)

• Purposeful public-private partnerships can drive innovation and restore US manufacturing in key industries