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Nanotech Myth and Reality: The Real Opportunities for Entrepreneurs

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What's nanotechnology again?

Not “nano by accident”:

- Ancient Egyptian pottery
- Stained glass
- Cat litter

“The *purposeful engineering* of matter at *scales of less than 100 nanometers (nm)* to achieve *size-dependent* properties and functions.”

Not MEMS; novel properties emerge from the nanoscale

What's special about "less than 100 nanometers?"

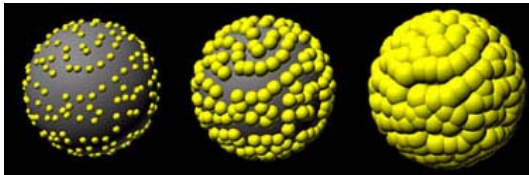
Quantum properties of matter overtake bulk properties



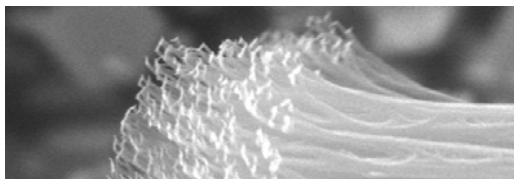
Carbon nanotube crossbar memory
(LSI Logic, BAE Systems licensing from Nantero)
Van der Waals forces hold nanotube crossbars together



Semiconductor nanocrystal biolabels
(Ventana licensing from Quantum Dot Corp)
Diameter of particle determines color of light emitted

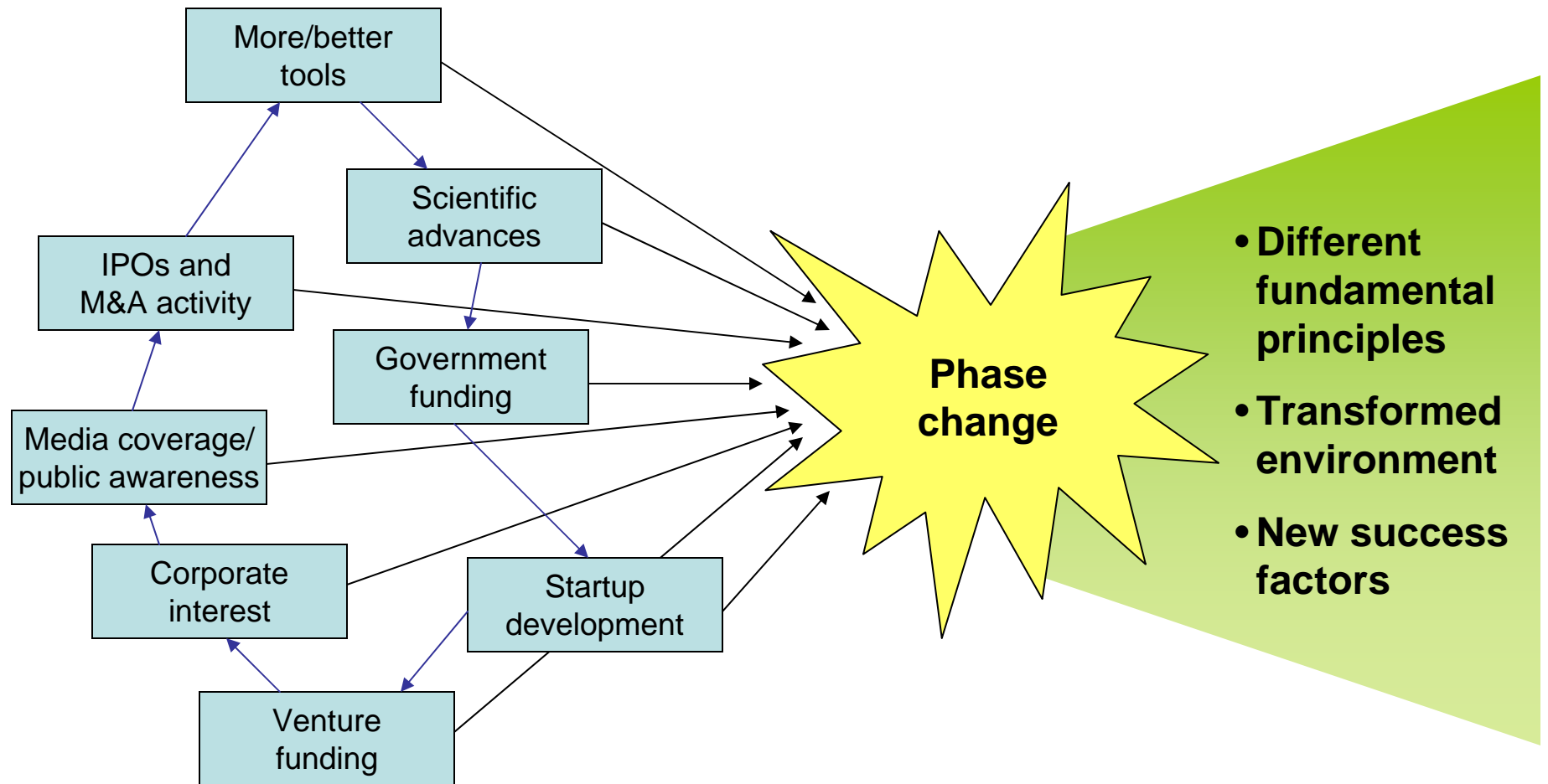


Gold nanoshell cancer treatment
(Nanospectra Biosciences)
Size and curvature of shell determines light absorption



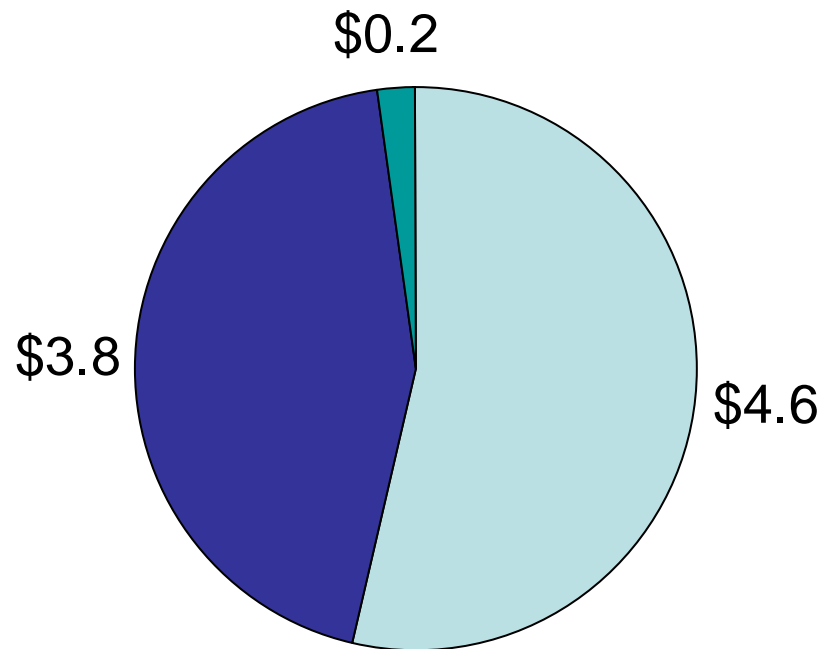
Artificial setae
(U.S. Army contracting with Nanosys to develop)
Weak atomic interactions allow soldiers to climb walls

Nanotechnology commercialization is approaching a broad-ranging transformation – a **phase change**



Funding for nanotechnology R&D will total \$8.6 billion worldwide this year, up > 10% from 2003

Global nanotechnology investment, 2004 (\$ billions)

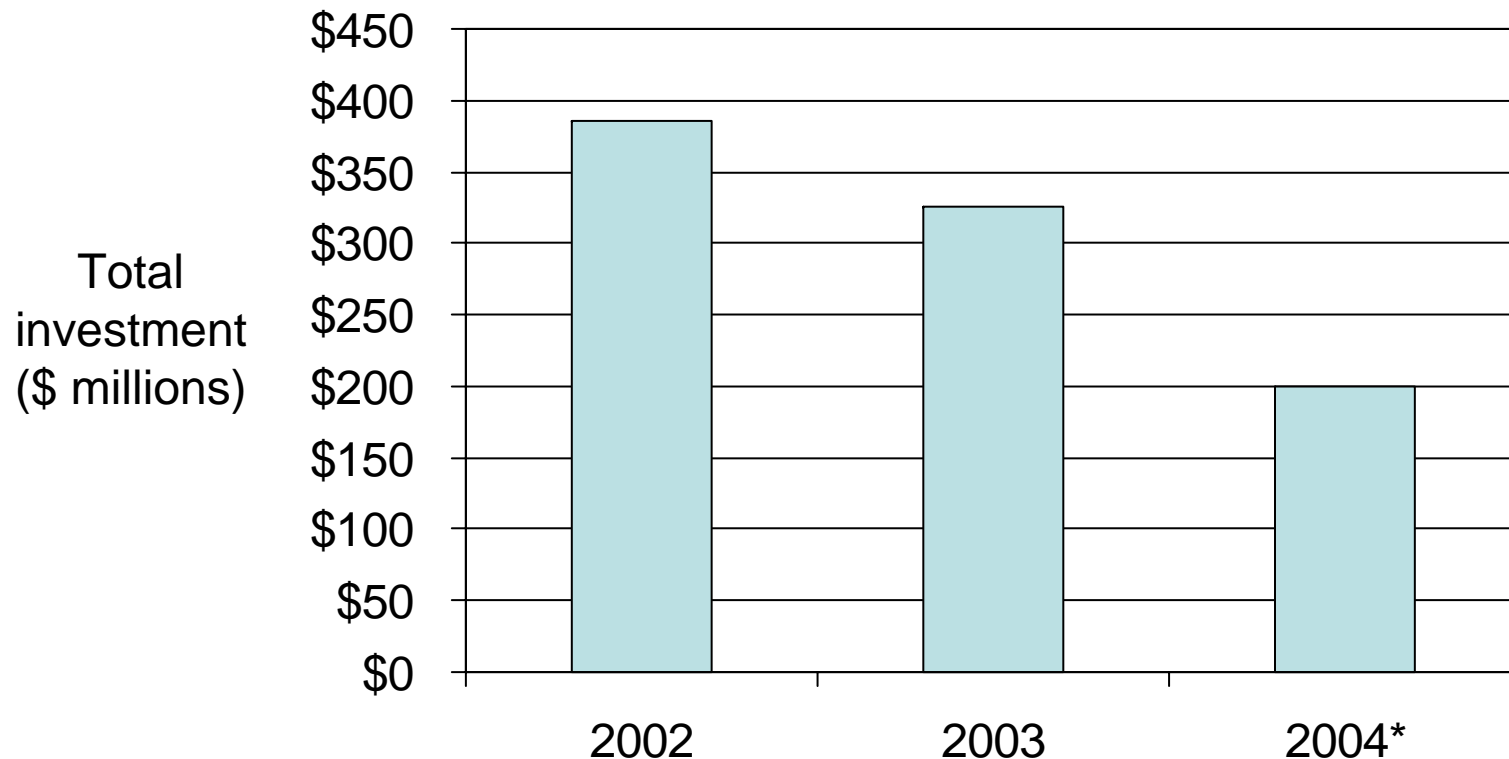


Source: 2004 Lux Research Reference Study "The Nanotech Report 2004;" published spending allocations, government statistics, Lux Research analysis



There is no bubble in nanotech venture capital funding, despite widespread reports to the contrary

Venture capital nanotechnology investment, 2002 to 2004

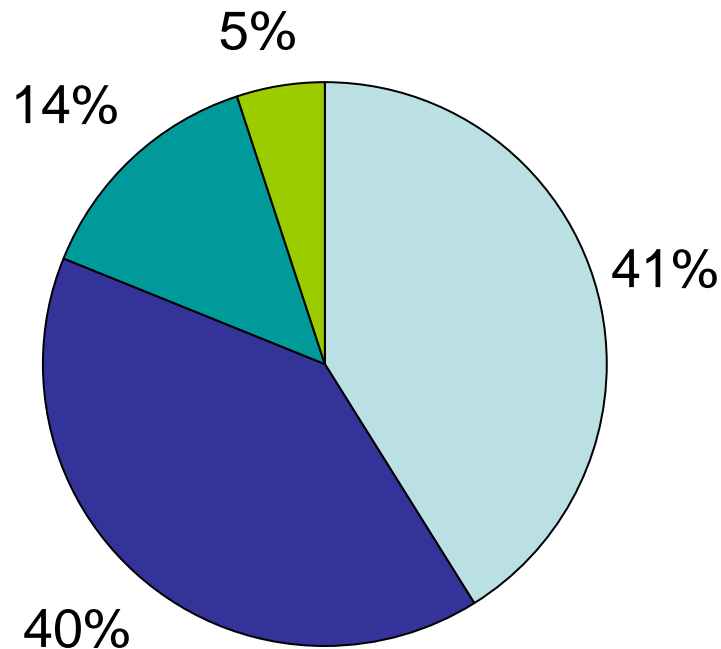


Source: 2004 Lux Research reference study "The Nanotech Report 2004;" includes publicly announced funding transactions, Lux Research knowledge of confidential transactions

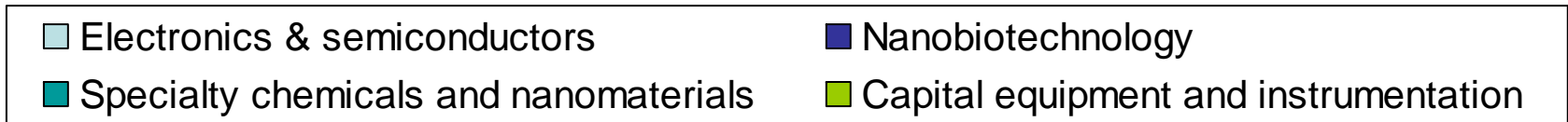
* 2004 figure is estimated; total investment as of June 30, 2004 was \$79 million

109 nanotech start-ups have secured venture capital funding since 1998, representing 119 deals and \$1.1 billion in financing

Distribution of venture capital investment in nanotechnology, 1998 to 2004 (cumulative)

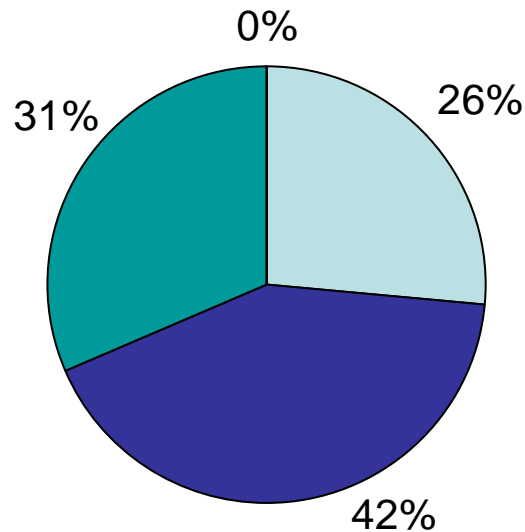


Source: 2004 Lux Research reference study "The Nanotech Report 2004;" includes publicly announced funding transactions, Lux Research knowledge of confidential transactions

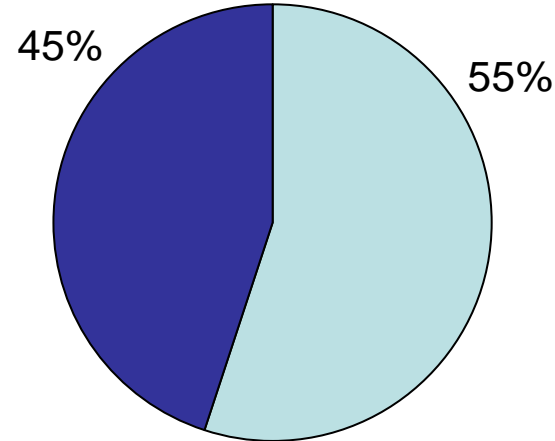


Companies agree that nanotech is a high priority, but aren't well-prepared to exploit it

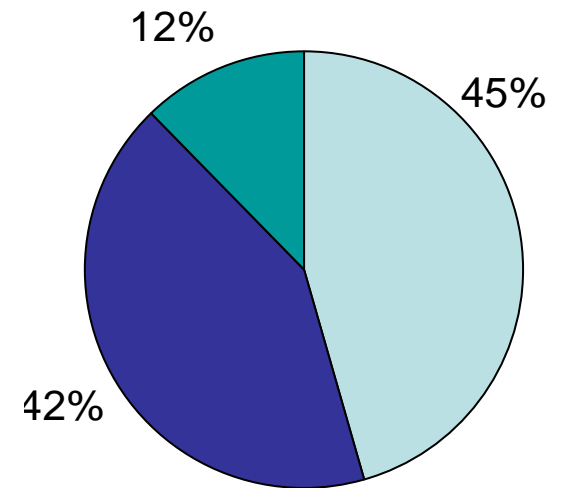
“How high a priority is nanotechnology at your company?”



“Does your company have a strategy for exploiting nanotechnology innovations?”



“How are nanotechnology activities at your company organized?”



Base: 33 global manufacturing, electronics and life sciences firms, > \$5B annual revenue

Source: December 2004 Lux Research Report “The CEO’s Nanotechnology Playbook”

Large corporations are partnering to pursue nanotech. 30% of the Dow components have announced nanotechnology partnerships

- **DuPont:** Researching the use of Nanosys's thin-film technology jointly with Nanosys for applications in electronics. Licensed intellectual property to Konarka for hybrid photovoltaic cells
- **Volkswagen:** Entered into a trial partnership with Israeli startup ApNano to make nanomaterials for use in engines, gears and transmission systems that can reduce friction in moving parts without oil or grease
- **Merck:** Licensed proprietary NanoCrystal drug delivery technology from Elan. Use for new anti-nausea drug Emend (aprepitant); approved by FDA in March 2003, launched in US in April 2003
- **GE:** Conducting joint development project with Molecular Nanosystems to develop synthesis platform for aligned nanorods. Other undisclosed relationships with nanotechnology startups

Conventional wisdom about nanotechnology is wrong

Myth

A “nanotechnology market” is emerging, comprised of “nanotechnology companies” selling “nanotechnology products”

All “nanotechnology products” are new

Anything “nano” has the potential for huge profit margins

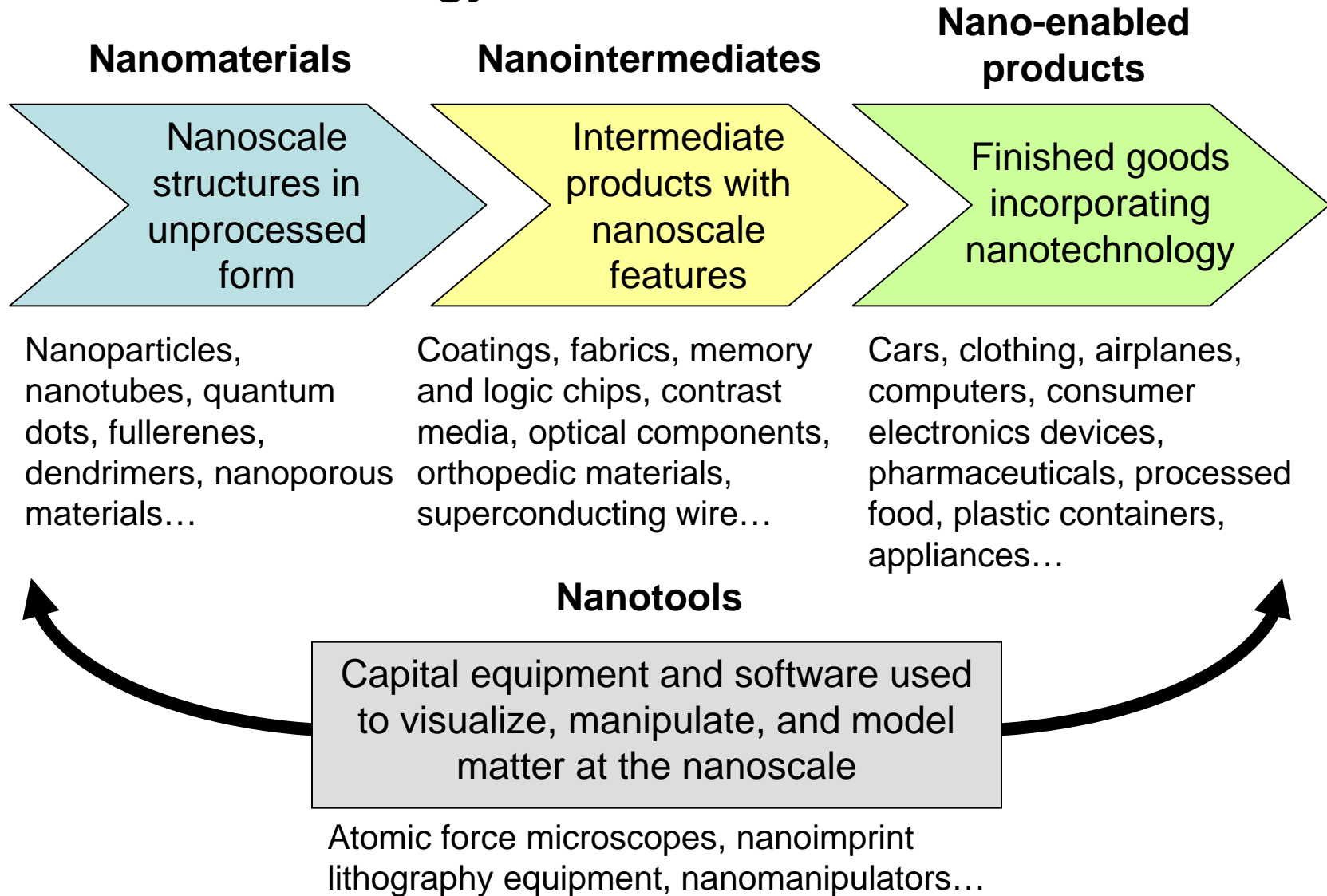
Reality

There is no “nanotechnology market;” there *is* a nanotechnology value chain

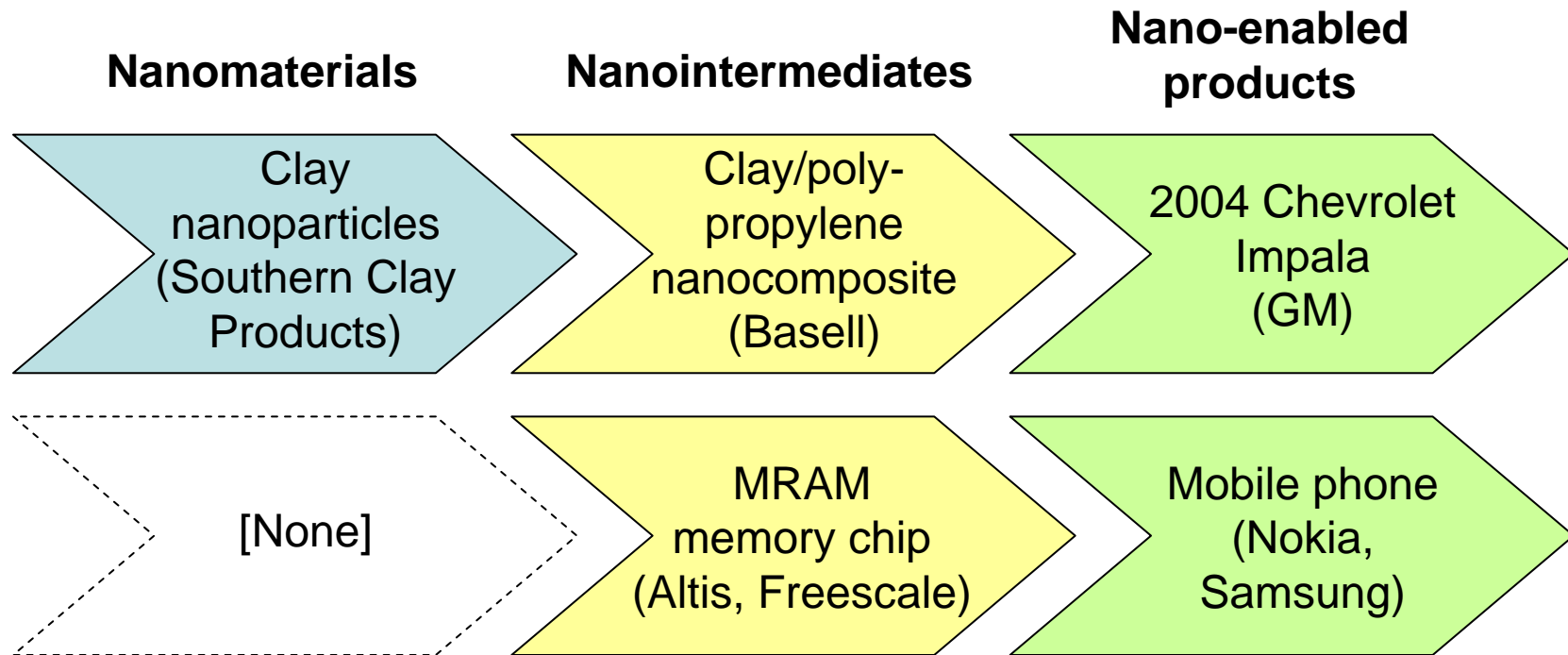
Not all nanotechnology is new. *Emerging* nanotechnology is developing against a backdrop of *established* nanotechnology

Many products incorporating nanotechnology will be only marginally profitable

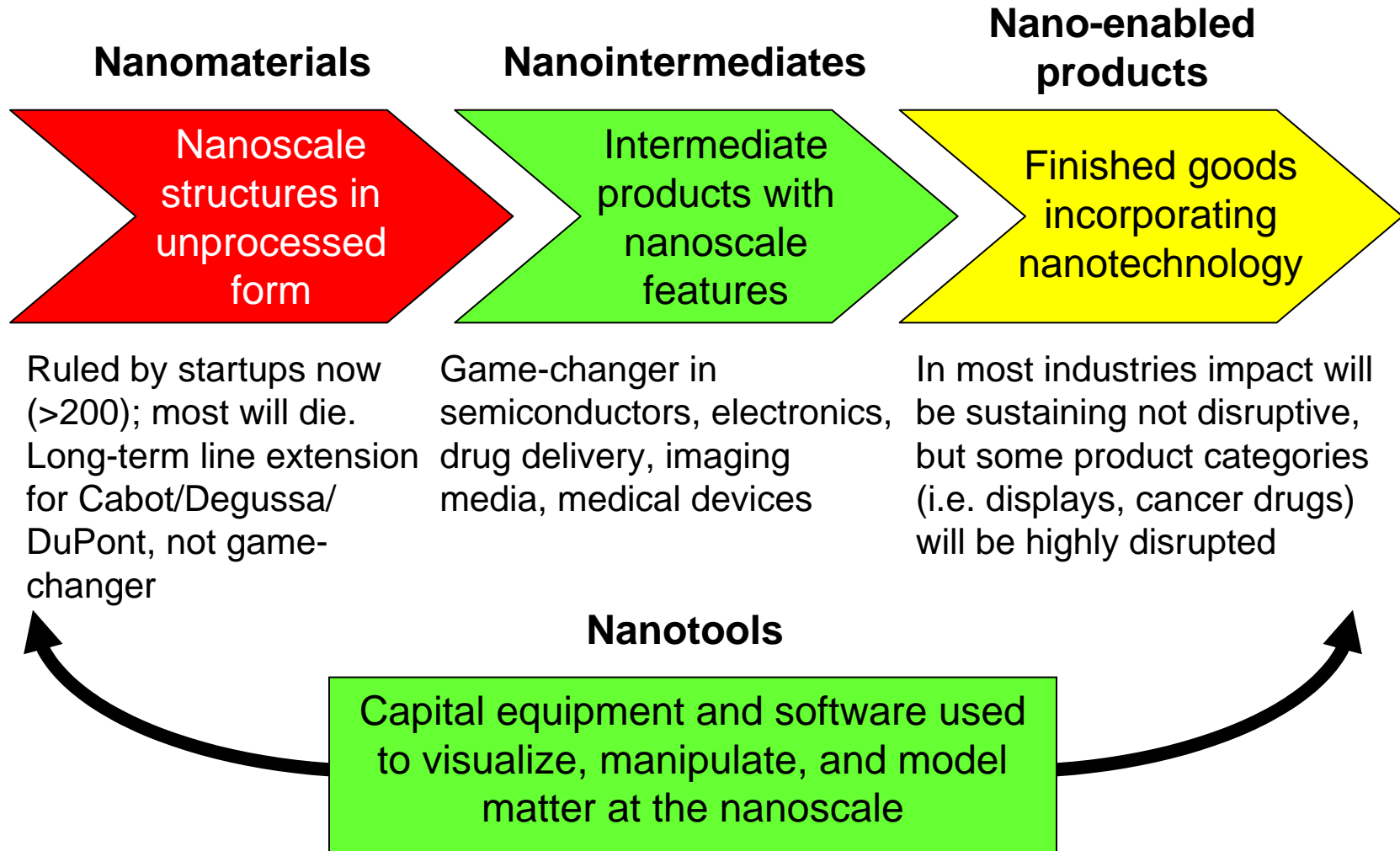
The nanotechnology value chain



Example value chains for specific nano-enabled products



Investment outlook









Firms w/>50% exposure to nanotech research (Veeco, FEI) plus knock-on effects in semiconductor capital equipment and materials

Status of nanotechnology in products in 2004

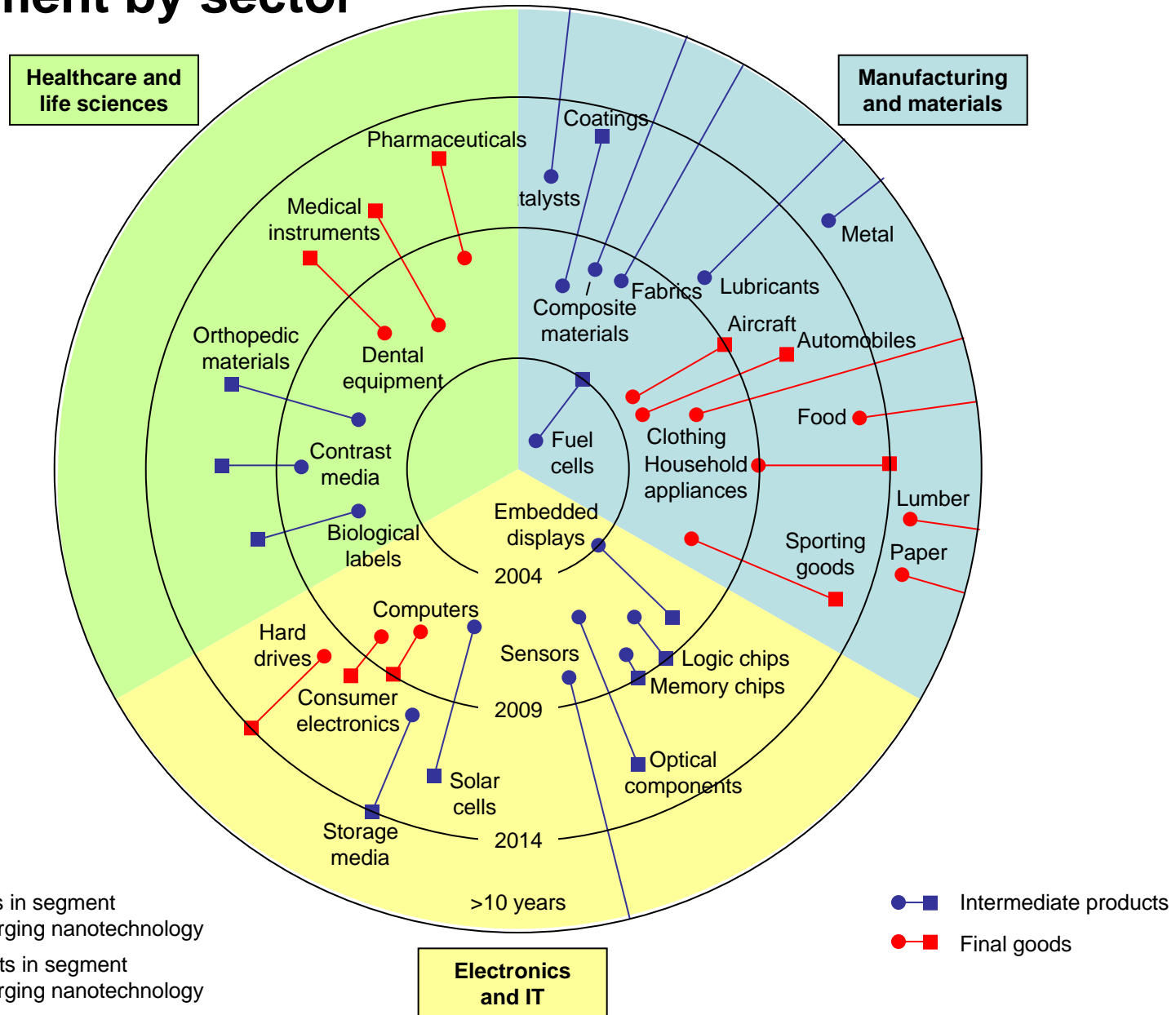
- \$13 billion total output across the value chain this year
 - Nanomaterials \$130 million, mostly nanoparticles (NANX, ALTI) and multi-walled nanotubes (Hyperion Catalysis)
 - Nanointermediates \$851 million, mostly electronics and IT; big chunk is \$350 million in OLEDs/LEPs (EK, PANL, OLED)
 - Nano-enabled products \$12 billion; highly concentrated – \$8.5 billion in auto (GM, DCX) and aerospace
- Early applications focus on coatings and composites
 - 2004 Chevrolet Impala (clay/polypropylene nanocomposite)
 - Duravit Wondergliss bidet (hydrophobic nanocoating)
- Other early applications: OLEDs/LEPs, nanoscale drug delivery carriers

Nano-enabled products exhibit price premiums

Traditional product	Nano-enabled product	Nanoscale innovation	Price premium
 <p>Wilson U.S. Open tennis balls, can of 3 \$2.59*</p>	 <p>Wilson Double Core tennis balls, can of 3 \$3.49*</p>	Clay nanocomposite barrier coating (InMat)	35%
 <p>Dockers Individual Fit Waistband Khaki \$48.00**</p>	 <p>Dockers Go Khaki with Stain Defender \$55.00**</p>	Superhydrophobic nanoscale coating applied to fabric (Nano-Tex)	15%
 <p>Coloplast/Sween Contreet foam antimicrobial garrier dressing with silver, 5x5", 5 count \$48.00***</p>	 <p>Smith & Nephew Acticoat 7 antimicrobial dressing, 4x5", 5 count \$55.00***</p>	Silver nanoparticles instead of micron-scale silver film (NuCryst)	15%

Prices drawn from: * Exsell Sports; ** Amazon.com; *** Allegro Medical; all as of January 8, 2005

Lux Research expectations on nanotechnology deployment by sector



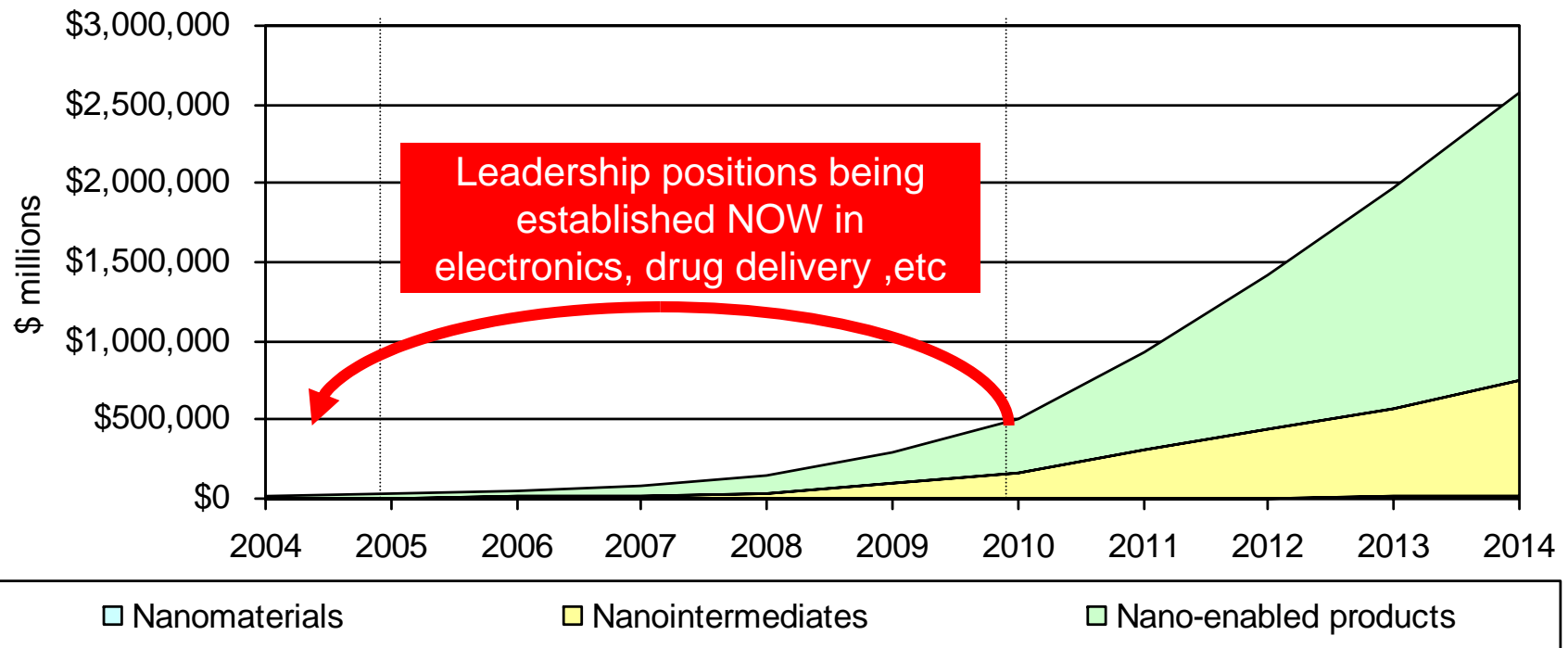
Source: October 2004 Lux Research Report "Sizing Nanotechnology's Value Chain"

Global forecast, products sold incorporating emerging nanotechnology, 2004 to 2014, by value chain stage

2004:
Selective deployments proliferate

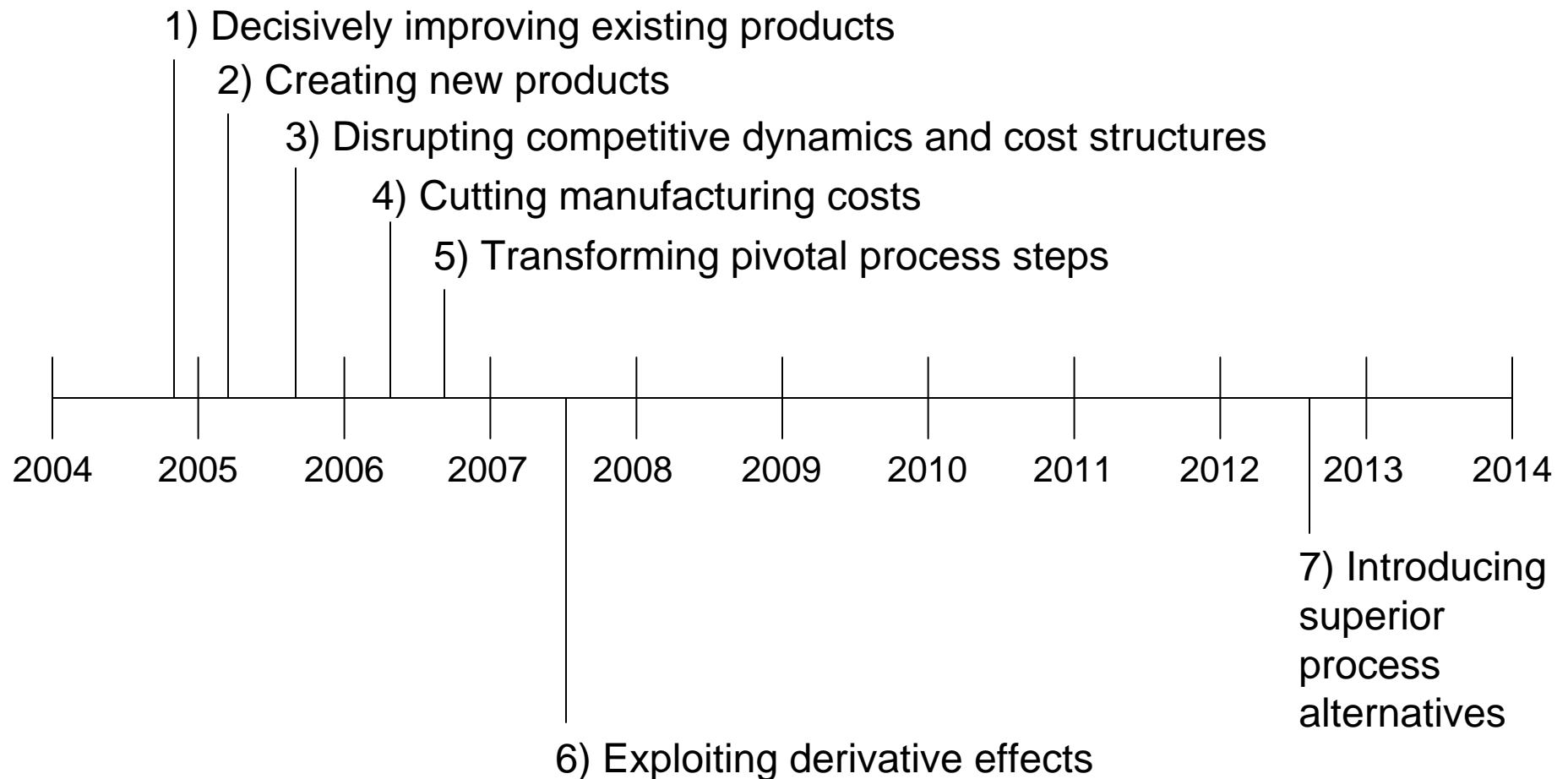
2005 to 2009:
Commercial breakthroughs open markets

2010 to 2014:
Nanotechnology becomes commonplace



Source: October 2004 Lux Research Report "Sizing Nanotechnology's Value Chain"

Seven ways that entrepreneurs will capture value through nanotechnology



Thank you

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