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# Chadbourne on Nanotechnology: The Need for New Policy and Business Paradigms

**By David L. Wallace**

## Introduction: 'Good News' And 'Bad News'

New products frequently give rise to new waves of product liability litigation. With nanotechnology-rooted innovation forecasted to account for upward of $1.5 trillion in global commerce by 2015, the stakes are high. The low-hanging fruit of nanotechnology is being harvested now, with some 600 nano-labeled products on the market internationally (including such things as sunscreens). But the bigger investment and return on nanotechnology is poised to unfold over the next five to 15 years and beyond — in the form of personalized medicine (targeted drug delivery, with fewer side effects); improved, cleaner means of energy production, storage, and distribution; faster (more powerful, miniaturized) computers and personal communication devices; and major advances in infrastructure improvement, in the form of lighter, stronger cement and steel (among other things). Examples of its promise abound. *See Nanotechnology: The Future is Now*, METROPOLITAN CORPORATE COUNSEL at 59 (Dec. 2007).

Without doubt, the emerging field of nanotechnology — involving the design and engineering of material, structures, and devices at the atomic and molecular level — is one holding great commercial and social significance for a broad cross-section of the global economy. *See* D. Wallace and N. Booke, *Industrial Revolution Redux*, PRODUCT LIABILITY LAW & STRATEGY at 1 (Jan. 2008).

At the same time, nanotechnology raises a number of questions yet to be answered concerning the possible variety of human health and environmental risks that might follow in the wake of commercial exploitation. Significantly, these concerns are increasingly being voiced by a broad cross-section of stakeholders, including a lobbying coalition consisting of industry players and environmentalists. *See*, *e.g.*, *Agency Seeks Data about Health, Environmental Risks of Nanotechnology*, WORKER'S COMP. REP. (LRP Pub. Apr. 11, 2008).

At the heart of the matter are worries that through the National Nanotechnology Initiative, a product of the 21st Century Nanotechnology Research and Development Act, the federal government is promoting the development of nanotechnology at the expense of — without sufficient focus upon — the health and environmental aspects of this technology. *Id.* (noting that "less than $10 million" of the federal government's "more than $1 billion" annual expenditure on development of nanotechnology "is being spent on research relevant to understanding and managing the risks of occupational exposure to nanomaterials"); *see also President's Science Advisory Council Blasts Nano EHS R&D Funding*, INSIDE OSHA (Jan. 21, 2008).

In part to address these concerns, in late December President Bush signed an omnibus appropriations bill directing the EPA to commission the National Academy of Sciences to develop and report an overarching strategy to guide "all federal environmental, health and safety research ... so that nanotechnology's potential benefits to the economy and environment are realized at the same time that human health and the environment are protected." *See Congress Directs EPA to Ask NAS for Federal Nanotechnology Program*, CLEAN AIR REPORT (Jan. 24, 2008) (discussing Pub. L. No. 110-161). More recently, and to a similar end, the EPA unveiled its voluntary Nanoscale Materials Stewardship Program, aimed at gathering existing data and information from manufacturers and other users of chemical nanoscale materials in order to build the EPA's "knowledge base in this area" under the Toxic Substances Control Act. *See* 73 Fed. Reg. 4861 et seq. (Jan. 28, 2008). Concurrently, reauthorization of the 21st Century Nanotechnology Research & Development Act is before Congress, amid rumblings from various quarters there for hearings on the safety of nanotechnology.

## Nanotechnology's Fault Lines: Risk and Reward

In many ways, the issues are familiar ones — echoed in earlier public debates over the risks and rewards of innovation and the commercialization of emerging technologies generally, and genetically modified organisms in particular. *See* P. Eccleston, *Scientists Warn of the Risks to Britain Created by Technological Advances*, DAILY TELEGRAPH (London), Mar. 20, 2008, at 10 (quoting Professor Bill Sutherland of Cambridge University to the effect that genetically modified organism (GMO) science was done "too late ... [W]e should have

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identified it as a possible problem before the products came on the market.").

The fault lines through which debate over nanotechnology's future is running — promise and challenge; risk and reward — were on display at a Congressional Nanotechnology Caucus briefing earlier this year, called "Nanotechnology and Innovation, Commercialization and Prize Competitions." On one side — entrepreneurially minded, high-tech enthusiasts, representing scientific and commercial interests; on the other — a cautious band of public interest groups and think-tanks poking sticks into the spokes of innovation, emphasizing the risks inhering in nanotechnology innovation.

Unfortunately, as the following summary of the Congressional Nanotechnology Caucus briefing demonstrates, the two sides are like ships passing in the night, steaming past opportunities to engage one another on key issues — in the main, the route forward that best balances competing interests and safeguards national leadership and competitiveness in regard to nanotechnology. As discussion of New York's unique public-private partnership approach to nanotechnology innovation at the end of this article suggests, multi-stakeholder collaboration is a good starting point.

***'Prize' Competitions: Leveraging Critical Nanotechnology R&D***

In crossing the Atlantic by airplane in 1925, Lindberg claimed a privately endowed prize of $25,000, the offering of which generated (or leveraged) some $400,000 worth of pioneering aviation research and development work — the current equivalent of some $4.5 million — by the French and American teams that competed for the prize. It also gave birth to commercial aviation. Similar scientific, technological, and engineering prize challenges have been financed over the years by private and other investors, more recently leading to innovations like "SpaceShipOne" — the world's first privately funded manned space flight, an achievement spurred by the $10 million Ansari X-Prize. Ten months after claiming this prize, Scaled Composites leveraged its research and technology investment (and resulting visibility) into a partnership with Sir Richard Branson to form a new aerospace production company to build a fleet of commercial sub-orbital spaceships and launch systems.

Investment of this sort cuts at the edge of high-tech research and technology, sowing the seeds for innovation — basically, out-of-the-box thinking. This was the substance of remarks by William Pomerantz, the Director for Space Operations at the X-Prize Foundation. Through the innovation-oriented scientific challenges it mounts, this foundation is, in effect, laying the foundation for all manner of future progress.

His point? Nanotechnology should be part of that equation.

***This marketplace, like time and tide, waits for no one, notwithstanding the shadow of risk and uncertainty.***

***Academic-Corporate Partnerships: SUNY-Albany's 'Nano Mall'***

Edward Cupoli, an economist, told the story of his employer — the nation's first (and leading) college of nanotechnology in upstate New York at the University at Albany. Functioning on a business-innovation model, as opposed to the traditional academic-research model, the University at Albany has attracted more than $4 billion in private sector R&D nanotechnology investment under the umbrella of its operations since its creation in 2004. He described it as a virtual "nano-mall," offering high-tech "critical mass" to the private sector — in the form of state-of-the-art research infrastructure, equipment, and related expertise — for the incubation, development, and commercialization of nanotechnology-based products on a public-private partnership basis.

Reflecting the interdisciplinary nature of nanotechnology, Cupoli explained that Albany's college of nanotechnology integrates chemistry and physics under the curriculum head of "nanoscience" and (through the "nanoeconomics" part of its academic program) trains future scientists to "see through" the development and deployment of nanoscience principles, products, and processes from economic and business perspectives.

***Regulatory Oversight: 'Chemical Synthesis on Steroids'***

David Rejeski, the Director of the Project on Emerging Nanotechnologies at the Woodrow Wilson Center, presented a different perspective on nanotechnology, opining that nanotechnology represented not a promised "green" revolution, but instead a "brown" one — provocatively characterizing nanotechnology as "chemical synthesis on steroids." In nanotechnology, particularly its convergence with biotechnology, he sees great risks, which must be "engineered out of" nanotechnology products and production.

Calling for the nanotechnology "stick" to be pulled back a bit, Rejeski outlined the following roadmap for nanotechnology stewardship. *First*, given the trans-disciplinary nature of nanotechnology, it is critical that researchers get into its "white spaces" — the interstitial gaps separating the various scientific disciplines behind the field — to ensure the full spectrum of environmental, health, and safety risks is run to ground before greater commercialization. To do this, he proposed adopting the Defense Advanced Research Projects Agency ("DARPA") model. *Second*, create a centralized venture capital fund to attract and leverage private-sector investment in order to cover the void between university laboratories as well as small startups — where much nanotechnology is originating — and the market. He specifically advocates feeding this funding through the Department of Energy, on the model of the Manhattan Project. *Last*, he proposed offering "a Green Nano" X-Prize-type competition to jumpstart the renewable energy and environmental promise of nanotechnology.

Summing up, Rejeski expressed skepticism about the likely adoption of his recommendations given what he described as America's less than enthusiastic approach to risk management issues historically.

***Commercio-Politico 'Connections' Crucial***

Scott Livingston, of Axiom Capital Management, an investment banker who has focused almost exclusively on nanotechnology since 2002, closed the session by highlighting the promise of nanotechnology investment from a variety of commercial perspectives. In so doing, he particularly emphasized the health care, energy, environmental, infrastructure, and security sectors. Stressing the long view, he dismissed concern over the recent "troughing" of nanotechnology investment, pointing out that in roughly 15 years Apple went from "dog" to "top-dog," investment-wise, on the back of emerging technology.

He commented that while there is consid-

erable interest in nanotechnology research and technology as a means of addressing global challenges, the investment and political "connections" necessary to make it happen are not yet sufficiently systematized.

## Where Do We Go from Here?

To be sure, the debate over nanotechnology's risk and reward calculus is one that must occur as a matter of public policy and, to the extent necessary, regulation — although not necessarily along the lines and nature of traditional risk-management models and operating principles in respect of innovation. As former EPA official Dr. J. Clarence Davies recently cautioned in remarks at a Chadbourne & Parke LLP nanotechnology conference, "[a] regulatory system that takes two or three years to promulgate a regulation cannot successfully be applied to a technology that changes almost daily." He's right.

### *Need for Novel Business Innovation Paradigms*

The high-tech platform from which nanotechnology commerce is launched and traded will probably require altogether new public policy and business paradigms; ones that bring the various stakeholders in nano-based product and technology lifecycles to the table for constructive dialogue and debate — government, investors, industry, science, and the public. Indeed, rather than mechanically repeating the example of past experience with other emerging technologies, some nanotechnology stakeholders have already opted instead for another way: funding, organizing, and empowering research-driven universities to operate on a business innovation model, in dynamic partnership with private industry, to support critical nanotechnology research and development work, along with the creation of related high-wage, high-tech manufacturing jobs that typically must be close to R&D facilities.

### *New York's Public-Private Nanotechnology Model*

This is the New York model pioneered by former Gov. George E. Pataki, whose public-policy initiatives in support of nanotechnology have revitalized parts of the upstate economy, chiefly through the college of nanoscale science and engineering at SUNY-Albany, which he was so instrumental in creating. By harnessing nanotechnology, this model is powering the development of an internationally significant regional market for high-tech, nanotechnology-specific research and development support — on the basis of novel public-private partnerships and business models.

New York's initial capital investment in this nanotechnology project, which began earlier this decade at a cost of roughly half a billion dollars (increased by $300 million dollars earlier this year), has since leveraged and lured approximately $5 billion in private sector investment to public benefit in the operations of a sleek, sprawling, high-tech complex known as Albany NanoTech. *See generally* D. Wallace, *Nanotechnology and the Power of Innovation*, TECHNOLOGY LAW360 (Jan. 25, 2008) ("In nanotechnology ... New York saw an opportunity to position itself as a worldwide leader in high-tech, university-based research and economic partnership with commercial interests of all sizes.").

The New York model reflects the spirit of the X-Prize Foundation's periodic scientific or engineering prize-money challenges discussed by Pomerantz; it embodies Cupoli's "nano-mall"; it reaches the "white spaces" referenced by Rejeski; and it naturally facilitates the necessary investment and political "connections" stressed by Livingston — helping to bridge the great divide between innovation (the spark of an idea) and its commercialization: the marketplace.

## Conclusion: Getting Nanotechnology Right

This marketplace, like time and tide, waits for no one, notwithstanding the shadow of risk and uncertainty. In the event, the chances of striking the right balance between the promotion and regulation of nanotechnology along the way would seem to be greatest, intuitively, as a product of public-private partnerships and ventures along the lines of something like the New York model. Collaboration of this sort would seem likely to better inform, mature, and synthesize related nanotechnology public policy, regulation and liability considerations than other alternatives.

In sum, the issue of nanotechnology is too important — strategically, commercially, and socially — for the historical cycle of an initial laissez-faire government approach eventually to give way to the specter of mortal risk by litigation or regulation. If nothing else, nanotechnology — which is not going away — calls for the creation of new policy, regulatory and business paradigms every bit as innovative as nanotechnology itself. Approached from this angle, the risks and rewards of nanotechnology are not a chasm, but instead an opportunity for devising new forms of oversight for the 21st century.