



P.O. Box 12293  
Research Triangle Park, NC 27709  
<http://www.southern.org>

*For almost 40 years the Southern Growth Policies Board has informed public policy by framing issues, contributing new information, and raising questions that need thought and answers. In a new series of commentaries we hope to get people thinking.*

## *Investing in the South's Nanotech Future*

*by John Hardin, Ph.D., Executive Director*

*Sharlini Sankaran, Ph.D., Assistant Director*

*Office of Science and Technology, North Carolina Department of Commerce*

**June 2010**

A scientist said to us recently that “nanotechnology conferences are passé,” and the cognoscenti are focusing their attention again on more established, narrower sectors, such as biotechnology or aerospace. We agree with the latter part of that assertion—the number of nanotechnology conferences certainly does appear to be decreasing compared to earlier this decade. But we don’t think this decrease reflects a lack of promise for nanotechnology. Rather, we think the decrease is largely a symptom of people’s fragmented, narrow attention spans and desire for immediate results. Despite appearances, nanotechnology is as “big” as ever. The key to economic success in this realm is a broad, in-depth understanding of nanotechnology’s complex phenomena and implications.

Nanotechnology is the science of creating and manipulating materials, components, devices, and systems at the near-atomic, or nanometer, level. Nanotechnology draws its name from the scale at which the technology operates—at nanometers, or 1/1,000,000,000 (one one billionth) of a meter. This almost inconceivably small dimension is 100,000 times thinner than a strand of human hair – the size of an individual atom. The DNA molecule, the blueprint of life and the basis of the genome, is a twisted double-strand of molecules approximately two nanometers (2nm) across. While nature naturally (no pun intended) works at that level, humans don’t. So it is reasonable to expect that it will take us some time to succeed at the nano scale.

Using nanotechnology, researchers and manufacturers are fabricating materials literally molecule-by-molecule. They are beginning to “custom-design” ultra-precise new material structures, devices, and systems with unique, often remarkable properties—such as materials with vastly increased strength or the ability to

Despite appearances, nanotechnology is as “big” as ever. The key to economic success in this realm is a broad, in-depth understanding of nanotechnology’s complex phenomena and implications.

change shape on demand. Advances at this level have wide-ranging implications, from mundane uses like nanosilver hair-straightening irons, to potentially life-saving uses like radiation-blocking nanomaterials and nanoparticles that deliver chemotherapy drugs directly to cancer cells.

Thus, nanotechnology cuts across almost every scientific and technological discipline and has much to offer by way of economic development potential. Companies in the life science, energy, automotive, textile, agriculture, and information technology sectors are already using nanotechnology to enhance existing products—as well as to create entirely new ones. The economic promise is precisely why the Southern states, and others, should continue to focus on nanotechnology. Advances in this burgeoning realm have yet to reach full commercialization potential, and there are numerous aspects of bringing nano-engineered and nano-enhanced products to the market that merit in-depth discussion incorporating diverse perspectives.

“...nanotechnology is transforming traditional North Carolina industries such as textiles and chemicals and plastics, into high-tech, job creating sectors.”

One such discussion forum is the North Carolina Nanotechnology Commercialization Conference, coordinated by the North Carolina Department of Commerce’s Office of Science and Technology. The conference convenes various stakeholders—researchers, businesses, legal experts, economic developers, environmentalists, students—to discuss commercialization of nanotechnology related products. Interest in the conference is growing, and feedback from attendees has been overwhelmingly positive—many have expressed appreciation that the North Carolina Department of Commerce, and the state in general, continues to emphasize and support those involved in nanotechnology and nanoscience advancement in the state.

The genesis for the nanotechnology conference was the publication “A Roadmap for Nanotechnology in North Carolina’s 21st Century Economy,” released by the Governor’s task force on Nanotechnology and North Carolina’s Economy in 2006. The report highlighted North Carolina’s growing activity surrounding nanotechnology and commercialization of related products and technologies. More recently, a 2009 inventory by the Washington, DC-based Project for Emerging Nanotechnologies (PEN) ranked the Raleigh metro area fourth and North Carolina the eighth highest state in nanotechnology activity nationwide. A related inventory of nanotechnology-based consumer products by the same organization lists over 1,000 manufacturer-identified nanotechnology-based consumer products currently on the market.

These reports and inventories provide affirmation that nanotechnology is transforming traditional North Carolina industries such as textiles and chemicals and plastics, into high-tech, job creating sectors. Fields such as biotechnology and medical technologies are also being heavily influenced by nanotechnology advances. The same emergence is seen in other regions of the South. A 2006 report by the Southern Growth Policies Board, *Connecting the Dots: Creating a Southern Nanotechnology Network*, found that 20 percent of nanotechnology activity in the U.S. is taking place in the South and “The Southern Growth region contains national and global leaders in nanotechnology research.”

The potential of nanotechnology has not been overlooked by other nations. To the contrary, unlike previous major disruptive technologies, the United States does not dominate the world’s nanotechnology R&D effort. According to the President’s Council of Advisors on Science and Technology (PCAST), Europe and Asia each account for about one-third of the estimated global R&D spending on nanoscience and nanotechnology research. Virtually every country that provides significant support for R&D in the sciences has developed a nanotechnology strategy. Asian countries, including Japan, China, and South Korea, as well as several European countries, have made international nanotechnology leadership a strategic national priority.

These countries recognize that nanoscale technologies will drive future manufacturing innovation and process productivity. As important, however, they recognize that developing these technologies will require major long-

term R&D commitments by governments and their domestic industries. Going forward, as economist Greg Tassef argues well in a recent article in the *Journal of Technology Transfer* (June 2010), “The innovation leaders will be the countries and regions that develop entirely new methods allowing the manipulation and assembly of nanoscale components into nanodevices with complex functionality.”

This brings us back to our original point: The key to success in this realm is a broader, in-depth understanding of nanotechnology’s complex phenomena and implications, including potential health and environmental side effects of nano-enabled products. A long-term commitment to economic development should include a unified approach to managing these risks as more nano-enabled products and materials enter the consumer market. The Research Triangle Environmental Health Collaborative, a North Carolina-based multidisciplinary group of stakeholders, is one such organization that is developing recommendations for managing potential environmental and health impacts of nano-enabled products.

“... unlike previous major disruptive technologies, the United States does not dominate the world’s nanotechnology R&D effort. “

Implementing a broader and in-depth development strategy for nanotechnologies requires a sustained focus, a principle reflected in the long history of North Carolina’s Research Triangle Park (RTP). If the experience of RTP is any guide, it takes decades, not years, to grow a successful economy based on diverse and complex technologies. In the case of RTP, it took more than 20 years to develop a large corporate R&D presence and to reach half of its current level of growth and another 20 years to reach its maximum level of growth and become one of the world’s largest and best-known research parks. This is no small amount of time, and achieving success took no small amount of effort.

In sum, to achieve a similar level of prominence in nanotechnology, we think the South should broaden and increase its focus on nanoscale activities, giving equal attention to the short-term as well as long-term payoffs. Somewhat paradoxically, being a leader in the small scale requires a large, broad-scale effort. The South can and should rise to the nanotechnology challenge to position itself as a leader in the 21st century high-tech economy.

---

Southern Growth Policies Board is a non-partisan public policy think tank based in Research Triangle Park, N.C. dedicated to strengthening the South’s economy and creating the highest possible quality of life. Formed by the region’s governors in 1971, Southern Growth conducts research and provides a forum for policy deliberation and collaboration among elected officials, citizens and leaders from business, academia, and economic and community development. Southern Growth works in the areas of technology and innovation, globalization, workforce development, community development, civic engagement and leadership.