

CSC

AN ARTICLE FROM

CSC
WORLD

FEATURES

The Science of Small:

Emerging Markets in Nanotechnology



NOVEMBER 2009

THE SCIENCE OF SMALL: EMERGING MARKETS IN NANOTECHNOLOGY

by Kelly Koenig

Many people reject the idea that there is an emerging market in quantum nanotechnologies. They argue that such a reality is far off in the future or too complicated for a nonscientist to understand. And tools such as 12-hour, super-capacity laptop batteries and quantum cryptography are thought by most to be unfeasible in terms of availability, price or usefulness.

The truth is, quantum nanotechnology — a branch of technology devoted to producing devices on the scale of atoms or molecules — is already in use around us. Over 800 nanotechnology products from 21 countries are available to the mainstream market.¹ These technologies are competitively priced, and many have been offered to the public for more than 20 years. Many companies, for example, offer “provably secure” data transmission by way of quantum cryptography and quantum networks. Such networks link Harvard and Boston universities; and, quantum cryptography companies such as MagiQ Technologies provide secure communication to large, publicly traded companies. Hospitals use quantum dot particles, known as artificial atoms, to deliver chemotherapy directly to cancer tumors. Processing chips such as Intel’s Celeron 4 include a 90-nanometer (nm) length transistor, which the company is expected to replace late this year with a faster, 32nm version.

WE HAVE MANY SERIOUS ISSUES COMING TO A HEAD — AND WHAT DO THEY HAVE IN COMMON? THE SINGLE MOST VIABLE RESOLUTION FOR EACH PROBLEM UTILIZES NANOTECHNOLOGY.

Such innovations have been coming through the pipeline quietly, but are as ingenious as past technology innovations. From stainless steel kitchen appliances and tableware that maintain bacteria-free surfaces to the Phoenix Motorcars SUV that goes 100 mph for over 130 miles on a rechargeable battery, nanotech is thriving. The technologies that mainstream consumers have grasped onto include Microsoft’s Xbox, OLED (organic LED) computer and TV display screens, and stain-repellant, wrinkle-free khakis (made of fabric with a nanotechnology coating).

So, what underlying cultural changes have shifted our technological and environmental culture into such high gear?

- 1. Increased mobility:** Over the past few years, it’s become *de rigueur* for people to work remotely/offsite or to collaborate and share information with colleagues located thousands of miles away. Furthermore, those outside the U.S. who once perceived attainment of “the American Dream” as the height of success are now rejecting it. Why? Because they can achieve an equally high-quality education and lifestyle in their home country. Thanks to nanotechnology, they might even be able to get cleaner water than what’s available in the U.S.
- 2. Disseminated power:** Companies today are more decentralized than they were in the last generation. During the 1970s, over 68 percent of the global top 100 companies were located in one country. Today, this figure is less than 29 percent.² Successful companies don’t necessarily aspire to traditional models. They’re creating workplaces that work well for them and the cultural surroundings of their business units. This shift will be unmistakable. And it’s going to be driven by a more disseminated group than ever before.
- 3. Increased popularity of the sciences:** Because of these global perception shifts, things that weren’t considered “cool” before, now are. A 2009 *Rolling Stone* article titled “Agents of Change” notes that over 25 percent of today’s change makers are physicists, biologists, climate experts, plant geneticists and quantum physicists. One of them, Harvard University quantum physicist Lisa Randall, wrote a book on quantum theory called *Warped Passages* that made the top 50 at Amazon.com. It’s one of the world’s most successful books on theoretical physics, perhaps because it is a more easily digestible book than past models. But the point is: People want to know about this stuff.

More scientists are specializing in areas such as energy, biotechnology and quantum sciences. MIT recently created a graduate training program called Interdisciplinary Quantum Information Science & Engineering (iQuISE). Scientists



NEXT-GEN COMPUTING

The quantum computer is one of the most enticing and talked about nanotechnologies in development. For starters, quantum computers carry an image of exclusivity — an extension of those elegant quantum physics solutions Einstein sought his entire life. Conventional wisdom tells us that quantum computers will “learn” like a human brain and be able to solve a problem millions of times faster than traditional computers can. But while quantum computers are seen as the next generation in computing, many people don’t realize that these machines are built upon completely different foundations than the computers we use today.

D-Wave Systems is one of the world’s preeminent quantum computing companies. They’ve made vast strides in creating the foundation for programmable quantum solutions. Their published research shows that D-Wave is making wonderful progress in quantum computing. D-Wave also offers their quantum computers to partners utilizing remote access. Geordie Rose, CTO of D-Wave Systems, says their objective is “to create something entirely new that works better.”

While a lot of research is needed before a sustainable quantum computer model is created for the general public, it’s important to note that just 20 years ago, most people believed computers had no place beyond research centers. Now, they sit in nearly every American home. However, we do need to set realistic expectations regarding what opportunities quantum computers may bring.

aim to update our traditional energy models to fit with today’s Green, socially responsible and globally minded world; they see these as exciting challenges to champion. As a result, unprecedented numbers of talented people are getting degrees in the sciences, and enjoying a 43 percent lower unemployment rate than the national average.³

Shifting into exponential times

We haven’t had a foundational change in the energy arena in over 50 years, and are now facing serious challenges to the way we produce, supply and support energy. In addition, computer performance is expected to seriously falter within 20 years (even Gordon Moore admits that “Moore’s law” will collapse), particularly as thermal limits place an upper limit on traditional computer performance.

We have many serious issues coming to a head — and what do they have in common? The single most viable resolution for each problem utilizes nanotechnology.

As per a major industry forecasting firm, in 2007 nanotechnology goods in the global marketplace totaled \$147 billion, and by 2014, could reach \$3 trillion globally.¹ One example of the growth within this industry: Quantum security solutions are expected to revolutionize online security, with a forecasted growth of up to \$200 million within a few years, and \$1 billion annually, long term. This is considered by many leaders to be the next industrial wave.

Making things better for others

People who expose themselves to the challenges of today will learn how to evolve and grow through times of major change. Due to today’s difficult economic conditions many believe that we cannot expect the sciences to create the large number of well-paying jobs they once did. But take note: Over half of the Fortune 500 companies in existence today were launched during an economic recession or depression.⁴

Consultants, scientists and analysts are already 20-plus years deep into solving real-world problems with nanotechnology. Those seemingly “emerging” market solutions are no longer on the frontier; they are at our front door. And we’ll need to spend time connecting the dots because, as discussed earlier, this shift is led by a disseminated group. It won’t come knocking on your door, not like Microsoft’s “one laptop for each household” idea did. Expose yourself to these multiple perspectives and nanotechnologies, because they are changing the way you achieve at your job, and they are most certainly driving the industry that directs each and every career path. ■

For a full version of this white paper go to www.csc.com/quantumnano.

KELLY KOENIG is a senior consultant in CSC’s Global Business Solutions’ Business Intelligence Practice.
GEORDIE ROSE, CTO of D-Wave Systems, contributed to this feature.

1 <http://www.onearth.org/article/our-silver-coated-future?page=1PEN>, The Project on Emerging Nanotechnologies: <http://www.nanotechproject.org/>
2 http://www.forbes.com/2008/04/02/global2000-dropoffs-mergers-biz-2000global08-cx_staff_0402dropoffs_table.html
3 http://www.upi.com/Top_News/2009/03/18/More-students-pursuing-computer-science/UPI-90251237383145/
http://www.usatoday.com/tech/science/2009-07-08-science-engineer-jobs_N.htm
4 The Kauffman Foundation: <http://www.kauffman.org/>



BUSINESS SOLUTIONS
TECHNOLOGY
OUTSOURCING

Worldwide CSC Headquarters

The Americas

3170 Fairview Park Drive
Falls Church, Virginia 22042
United States
+1.703.876.1000

Europe, Middle East, Africa

Royal Pavilion
Wellesley Road
Aldershot, Hampshire GU11 1PZ
United Kingdom
+44(0)1252.534000

Australia

26 Talavera Road
Macquarie Park, NSW 2113
Australia
+61(0)29034.3000

Asia

139 Cecil Street
#06-00 Cecil House
Singapore 069539
Republic of Singapore
+65.6221.9095

About CSC

The mission of CSC is to be a global leader in providing technology enabled business solutions and services.

With the broadest range of capabilities, CSC offers clients the solutions they need to manage complexity, focus on core businesses, collaborate with partners and clients, and improve operations.

CSC makes a special point of understanding its clients and provides experts with real-world experience to work with them. CSC is vendor-independent, delivering solutions that best meet each client's unique requirements.

For more than 50 years, clients in industries and governments worldwide have trusted CSC with their business process and information systems outsourcing, systems integration and consulting needs.

The company trades on the New York Stock Exchange under the symbol "CSC."

CONTACT CSC WORLD: world@csc.com

VISIT: www.csc.com/cscworld