NANOTECHNOLOGY Part 2

By H. Skip Weitzen ■ *Hypergrowth Associates*

"The best way to predict the future is to invent it."
Alan Kay, H-P Research Labs

A few months ago, my Hypergrowth column focused on the burgeoning Nanotechnology Industry. Since then I have attended the Nanotechnology Venture Fair, met with dozens of emerging nanotechnology companies and investors, and observed the hottest applications in the field.

Nanotechnology, which comes from the Greek "nano," means a billionth of a specific unit. It was first introduced in 1959 by physicist Richard Feynman in a famous dinner speech, "There is Plenty of Room at the Bottom". Two decades later, Eric Drexler's book, Engines of Creation, depicted scientists moving and positioning atoms at will. Nanotechnology has even become a hot topic in fiction these days as Michael Crichton's latest novel, Prey, features microscopic machines that run amuck.

The rumblings in the Nanotechnology sector are significant. The National Science Foundation estimates that the U.S. will create 800,000 to 1 million nanotechnology positions over the next decade. This is not just conjecture since the NSF established nanotechnology centers at six universities over the past year to conduct research in various applications. And the president's fiscal 2003 budget calls for $710 million for nanoscale science, engineering and technology, according to the National Nanotechnology Initiative program office.

The Hypergrowth Formula

Hypergrowth is the process of capitalizing an above average rate-of-return for a decade or more. It begins with the search for early signs of change and is realized when you achieve the highest conceptual model of change. When we overlay the Hypergrowth Formula onto the Nanotechnology sector, we can observe several fast growing opportunities.

The Hypergrowth Formula starts with a thorough understanding of existing business and industry norms. The next step is to analyze any departure from the norm, called an anomaly.

Anomaly

Any activity that does not conform to the established norm is called an anomaly. Nanotechnology is full of anomalies as the field moves from exploration to application. Nanoscale electronics has seen rapid progress based on carbon nanotubes (Cees Dekker at Delft, in the Netherlands) and nanowires (Charles Lieber at Harvard) in developing the first electronic components (transistors and simple circuits) made from nanoscale elements. The nanotube and nanowire hold the key to the electronics of the future when the silicon chip is further miniaturized.

Metonymy

Next, a metonymy shows the impact of an anomaly on a business or industry. The first nanotechnology breakthrough outside the information technology market was the microfabricated impact sensor to trigger airbags in cars. The new kind of sensor based on a MEMS (micro-electromechanical system) device means that its function is mainly mechanical rather than electronic.

When first introduced in 1995, the MEMS device turned out to be smaller and more efficient than the sensors previously available. More importantly, it was significantly cheaper than its predecessor and captured the world market in a matter of months.

Inference

The inference is the interpretation of the anomalous activity that confirms an emerging order. The biggest impact of forthcoming nanotechnology applications will be in medicine. While diseases typically arise from malfunctioning at the cellular scale their treatments aren't. Treating cells with a scalpel is like fixing a computer chip with an axe. Or treating them with drugs that invade the whole body is like immersing a computer in a bath to clean up one chip.

Nanotherapy addresses the right group of cells at the right time with the right drug in the right dosage. Nanoscale devices can be implanted or worn on the skin near the problem organ. They contain sensors that assess the physiological state of the malfunctioning organ. Then a computer assesses the correct response and compartments release the drug molecules at the right time in the right place.

Penetration

Market penetration through new products and enhanced services creates a short-lived fad or a new market trend. Nanotech products can repair damage to portions of the human body that would have otherwise required painful and dangerous surgery while improving the immune system's response to diseases. Nanotechnology products can reduce health care costs, health

insurance premiums, and patient discomfort resulting from treatment.

Climbing the knowledge ladder of nanotechnology products and services will see billions of dollars poured into converging arenas such as biomedicine and wireless Internet over the next decade.

Trend

The emerging Hypergrowth trend is significant. Research and development in nanoelectronics has been fuelled by international investments. The Technion Research and Development Foundation in Israel sold the right to three patents for manufacturing electrical circuits based on DNA molecules to US-based Integrated Nano-Technologies. The deal includes a $4 million cash payment and royalties on future sales, as well as an option to convert their royalties into share rights in the US company.

Japanese companies have filed a myriad of patents for nanotechnology with carbon nanotubes being the top item on their R&D list. These nanotubes will be used to make flat panel TVs and monitors using field emission displays.

Hypergrowth

Hypergrowth is achieved when a company grows from start-up to one billion in annual sales. Often these Hypergrowth companies introduce disruptive technologies that create new industries and eventually change the world. Examples of these include the web browser, the light bulb and the combustion engine. Nanotechnology is a disruptive technology with Hypergrowth potential.

This field holds the promise of radically changing the landscape of information technology. Nanotechnology greatly expands the role of integrators. These small, cheap computational devices are placed in everything from shoes to unmanned aerial vehicles. IBM's research in nanoscale technologies is on the verge of disrupting the entire semiconductor fabrication business with a cheaper way of building better microchips.

Nano at DARPA

Some of the most impressive advances in technology have come as a result of government innovation. The Defense Advanced Research Projects Agency (DARPA), which brought us the Stealth Bomber and the Internet, is one of the prime movers in bringing nanotechnology to market through its nanometer-scale molecular electronics program.

The possibility for the production of new types of weapons of mass destruction is emerging in nanotechnology. The science of designing microscopic structures in which materials are machined and manipulated atom-by-atom or molecule-by-molecule has the potential to create entirely new weapons. Fourth-generation nuclear weapons are new types of nuclear explosives that use inertial confinement fusion facilities. Nanosensors are also attached to unmanned aerial vehicles to gather environmental information in combat zones.

Specialized nanotechnology companies manufacture new types of biological weapons. Nanotechniques that deliver medicines in a targeted fashion are also used to deliver toxic substances into an enemy's system.

Nano and the Environment

Environmental protesters are challenging nanotech research, with the potential to derail this Hypergrowth industry. Canada-based anti-biotech research group Erosion, Technology and Concentration (ETC) has written about nanotechnology, "extreme care should be taken that, unlike with biotech, society does not lose control of this technology."

The U.S. Environmental Protection Agency is scrutinizing the potential for nanoparticle damage, including the release of nanomaterials into the environment, which could cause health problems if inhaled.

Nanoethics researcher Emmanuelle Barbour of Rice University has warned that nanotech companies have not analyzed the consequences of their work, "Businesses and venture capitalists tend to think that the science will speak for itself and that society will just accept the idea that the benefits of nanotechnology outweigh the risks."

These may appear to be inane fringe fanatics, but with Michael Crichton's best-selling novel about nanotech reaching the masses, the nanocat is out of the bag.

Conclusion

The potential of nanotechnology is too important to ignore. The nanosizing of electronics is just the beginning. Nanowires, quantum wells, and nanotubes have become the building blocks of nanoelectronic devices. The semiconductor nanowire provides researchers a model for future nanoscale devices and systems.

Cost-effective production is still a tricky proposition. It's no small feat to build instrumentation that monitors the uniformity and effectiveness of the billions of nanomachines contained in a single gram of material. However, it is only a matter of time before these challenges are overcome.

The vast applications in both the military and commercial markets make the development of nanotechnology a national priority. In the near future the benefits of nanotechnology will be made clear at the highest strategic levels, and many nanocompanies will realize their dreams of Hypergrowth. ■

About the Author

Skip Weitzen is the founder of Hypergrowth Associates, a company that specializes in the launch of fast growing products, services and companies. Let him know what anomalies you've discovered in the marketplace by emailing him at skipweitzen@aol.com