People's Republic of China: Revving Up the Nanotechnology Revolution

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Abstract

David Hume (1711-1776) once emphasized about the anthropology of working together as a team by stating that "Everyone has observed how much more dogs are animated when they hunt in a pack, than when they pursue their game apart." In this article, the author discusses how China's pursuit of nanotechnology for military and civilian purposes holds great expectations to the extent of becoming the world leader in the science and technology of this emerging field. Such exuberance is predicated on the fact that, like dogs hunting in packs, China has formed a formidable alliance consisting of the government, business sector, and the academia to synergize the time and the talents of the tripartite. By observing and studying China's application of anthropological concepts such as core group theory and practice, federated groups, and group dynamics in business and industry, one would learn a lot from their experiences because this once "sleeping giant" is now fast becoming the quarterback in this far-reaching science of the nanotechnology field.

Note: I would like to thank Ms. Zara Mokatsian for sharing her editorial talents to enrich this study.

Introduction

The phrase "the last frontier" seems never to apply to science and technology any more for human ingenuity provides new opportunities for business and industry now and then. Nanotechnology is the new scientific kid on the block promising a plethora of products for many essential uses.

Nanotechnology, "nanotech for short", is the study and application of the science to control matter on an atomic and molecular scale. Generally speaking, nanotechnology deals with structures sized between 1 to 100 nanometer in at least one dimension, and involves developing materials or devices within that size (Leach 2009).

Basically in industry, nanotechnology is the art of manipulating materials on a very small scale in order to build microscopic machinery. Nan(n)os is a Greek noun for "dwarf, little old man." The present meaning of nano, of course, stands for a symbol representing something extremely small, one billionth

Nanotechnology is very diverse, ranging from extensions of conventional device physics to completely new approaches based upon molecular self-assembly, from developing new materials with dimensions on the nanoscale to investigating whether we can directly control matter on the atomic scale.

An Early Harvest of Nano Products

Nanotechnology product categories currently run the gamut of cancer cures, medical diagnostics, energy transformation panels, silicon replacement, enhanced coating, efficient printing, space travel, and defense technology to cite a few.

Among the recent scientific advances, nanotechnology is attracting the attention of many researchers, investors, and marketers for its enormous potential. This scientific breakthrough could affect the production of virtually every human-made object from mundane everyday items such as automobiles, electronics, to advanced diagnostics, medicine, surgery, tissue and bone replacements (Roco 2007).

Currently, the focus has been on discovering new materials, novel phenomena, new characterization tools, and fabricating nanodevices by the integration of engineering, science, and biology. Like past innovations, the new technology has problems even though its prospects look bright. The entire success of this new scientific endeavor depends on creative marketing of these products by countering their real or perceived drawbacks encountered by wary consumers. While nanotech shows great promise, Davidson (2004) warns that it also has many perils hidden as unintended consequences or as plain side effects on humans and as well as on the environment.

As the promising opportunities are becoming more evident, the industrial nations are hopping on the bandwagon to benefit from nanotechnology. None of the superpowers are wider awake about the exponential potential of nanotechnology than the People's Republic of China.

China is Revving Up the Nanotechnology Revolution

Napoleon Bonaparte once said of China, "Let her sleep, for when she wakes, she will shake the world." The French Emperor's crystal gazing was right on the money. Today, the sleeping giant is the rising nation and her people and products are affecting the world as never before. That China is a large country is an understatement. It has a mega land, it has a mega population, and it enjoys a mega capital. It has so much surplus money that it frequently loans money to the United States government. With a teaming population of 1.3 billion highly motivated citizens, the industrial nations are courting China for its mega market too.

In most part of China, people are discussing one topic often: China's rising economy and how it has created over 300,000 millionaires in a short span of time. Since 1978, China's economy has doubled every eight years. Presently, the average Chinese has virtually ten times the purchasing power he had some 30 years ago. Becoming a member of the World Trade Organization has introduced local businesses to international companies, and thus opened up their windows of opportunity.

While the average Chinese has improved his standard of living, there are still millions and millions of people in China who have to subside on less than a few dollars a day. Will there be better days for those at the bottom of the economic totem pole? All indicators point in that direction with confidence. One major reason is that China is revving up the nanotechnology revolution by forming an alliance among three powers: the government, the business sector, and the academia.

The Chinese Nano Core Group Alliance for R&D

Progress is seldom achieved without a proper organizing effort. The Chinese officials have recognized the necessity of forming an alliance to expand the horizons of nanotechnology in their own country rather than remain copy cats and pirate the copy rights of someone else's inventions.

Before the turn of the century, the Chinese media had neither mentioned nanotechnology nor had it covered its promise to revolutionize China's high tech industry (Nemets 2004). Despite that oversight, today China has many research centers and many enterprises engaged in the production of technologies in a multibillion dollar industry. Among the most prominent ones are in Beijing, Shenyang, Shanghai, Hangzhou, and Hong Kong. Collectively, they account for over 90 percent of all nanotech R&D. The drive of these centers is to improve China's nanotech R&D and commercialize nanomaterials, nanoelectonic components, nanobiological and medical technologies.

Anthropological Theories for Group Effectiveness

By drawing upon recent business anthropological concepts of core group theory and practice by Kleiner (2005) and effective group dynamics by Johnson (2008), a nation can achieve wonders in research and development. Joining together into a federated group is the key to success. China must have adhered to the preceding concepts; it formed an alliance consisting of the core groups in the government, business sector, and the academia. These various core groups have synergized into a federated working machine: effective organizations need effective core groups, and in federated organizations or alliances, where there are dozens more core groups, there is a chance for a far greater effectiveness than among the core groups of a single company.

Government's Helping Hand

One of the major players in the Chinese nanotech alliance is the Chinese government. Ever since the National 836 Hi-Tech R&D plan, huge investments for nanotech projects poured

from both the central and local governments. This kind of state funding was designed to transform China's nanotech industry by 2010, putting the nanotechnology on par with China's microelectronics, telecom, and other Hi-Tech industries. Furthermore, China is applying the anthropological concept of working together (i.e., team work) for better results. While the United States' pursuits of new technologies are on individualistic basis, China believes in group effort, concerted effort, in mobilizing all available resources for greater effectiveness. This contention will be clear, when we next discuss as how China is fast becoming the premiere country, the flag bearer in the new arena of nanotechnology (Sherry 1988). The China's forte seems to have been based on its focus on federated core groups.

Business Sector's Cooperation

The second major player in China's rapid advances in nanotechnology is the business sector. For example, in 2001, Shanghai Nanotech Promotion Center was established to focus on R&D and the industrialization of tools needed for nanotech research.

China also enjoys the advantage in research of nanometer materials. By the time the center opened, China had more than 300 enterprises in the nanotech sector, with some 7,000 scientists engaged in nanotech R&D.

The Academia

The third major player in the Chinese nanotechnology revolution is the academia. The Nanotechnology Partnership between the Chinese Academy of Sciences (CAS) and Veeco Instruments is one big example. In 2002, CAS launched a joint project with the U.S. company, Veeco Instruments, Inc. The CAS Institute of Chemistry and Veeco formed the partnership to co-operate in the running of a nanometer technology center aimed at providing access to Veeco-made nanotech instruments to Chinese researchers. Additionally, the partnership was designed to provide China access to atomic force and scanning tunneling microscopes invented by Veeco. The center would also provide the Institute of Chemistry's molecular nanotech R&D division with "super-advanced" measuring and controlling devices.

The main reason as to why Veeco Chose to invest in nanotechnology projects in China was based on the confidence of the superiority of Chinese nanotechnology. The partnership between CAS and Veeco came amidst great optimism regarding China's nanotech potential. Veeco executives had been certain that China would gain the leadership position in nanotech. This bold statement of confidence in Chinese nanotech superiority has been affirmed by CAS executives who knew that China enjoyed the advantage in research of nanometer materials.

The Crowning of Chinese Achievement

Building a nanotechnology information network in Shanghai to link academia with industry was the crowing achievement of Chinese push for nanotechnology advancement. This push to accelerate Shanghai's nanotech production was matched by Shanghai Nanotech Promotion Center's (SNPC) objective to establish an information network linking all professionals in the

sector.

Currently, over a dozen of nanotech R&D centers - built in such leading Shanghai universities as Jiaotong University, Fudan University, East China University, East China Normal University, Shanghai University and East China S&T University - are exchanging their latest nanotech results through this network. In this way, Shanghai had developed an extensive nanotech infrastructure, which led to the rapid development of nanotechnologies throughout the early part of the new millennium.

The tripartite alliance is determined to forge ahead in the science and technology of this growing multidisciplinary field. Now that is a formidable alliance, cross pollinating the creative juices of the government, the business sector, and the academia. As a consequence, China will get a lion's bite out of the pie of nanotechnology potential.

Napoleon Bonaparte's Revisit

The outlook for nanotechnology R&D in China is not rosey, it is not promising, it is simply explosive. According to Roco (2006) as reported in the Scientific American, by 2015 products incorporating nanotech will contribute approximately $1 trillion to the global economy. This looming development was already forecast by Ratner in 2003. In terms of world employment, over two million workers will be employed in nanotech industries, and three times that many will have supporting staff jobs.

Other pundits predict that the future of nanotechnology is completely uncharted since it is such a young science. On the other hand, it could be that this will be the science of the future that no other science can do without (Drexler, et al. 1991). Considering its risks, its unintended consequences (Higgs 2009), there is also the chance that this new science will make the world uneasy because of its enormous potential power to transform the world.

According to Davidson (2004), possibilities range from disaster to advances in medicine, space exploration. Reviewing the possible uses of these impending technical developments in various industrial, medical, and national security applications, scientists of different specializations have expressed ambivalence, fear of its risks, and euphoria about the future of nanotechnology (Roco 2007).

When it comes to China, though, one thing is certain for sure: the nanotechnology mobilization will, if it has not already, undoubtedly launch China as the undisputed leader in the world. Currently, several dozens of institutions are engaged in basic nanotech research. These include CAS Physical Institute, CAS Chemical Institute, CAS Solid Physics Institute

(Hefei), Tsinghua University (Beijing), Beijing University, Hangzhou University, Nanjing University, and several universities in Shanghai. In addition, Shanghai, Beijing, and Shenzhen have each created their own Nanotech Centers, uniting local R&D structures. In terms of basic nanotech R&D, China has reached a higher stratum of success than that of the United States.

If Napoleon Bonaparte were to visit China today, he would dub THE ONCE SLEEPING GIANT'S progress as "THE MIRACLE OF THE 21st CENTURY!"

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