

Foreign R&D and the Impact of Globalization on China's Emerging Technological Trajectory

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AAAS Forum on Science & Technology Policy

Washington, DC

April 23, 2004

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advancing business through innovation

The PRC is moving steadily beyond the “Made in China--factory to the world” role in global business affairs.

”China is eager to graduate beyond its role as the world’s factory floor and added to it foreign companies are increasingly shifting R&D and marketing to the country. China has also gained from the diffusion of high-tech know-how through its industries.”

Reuters
April 22, 2002

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China's Impact in Global Perspective

“China is driving a vast reorganization of the international division of labor. It will sometimes bring wrenching changes.... but that has always been the price of progress.”

Financial Times

(January 2004)

Is There a “China” Problem or a Unique Opportunity?

“We are in an economic war with China and if we lose that war, winning in Iraq is not going to mean that much.”

Congressman John Gingrey
Georgia (October 2003)

“The US will do better if companies confront China’s economic ascendancy by seeking their advantage in it. ...trouble is that not enough companies are doing it.”

Michael Cox
Federal Reserve Bank Dallas

Peter Drucker “Revisited”

A New Global Business Paradigm

- According to management guru Peter Drucker, to be a global firm in the 1980s, companies had to have strategic presence in three major markets- the U.S., Europe and Japan
- In 2004 and beyond, to be a truly global firm, a company now must have a strategic presence in China—manuf, marketing, sourcing and R&D
- *“Given the actual and potential growth rates in China in almost all industries, revenue gained or lost in the PRC market could have a dramatic impact on the overall competitive position of most of the world’s leading corporations.”*

James Abegglen “Revisited”

A New Regional Business Paradigm

- According to noted Japan specialist James Abegglen (1980s), “the Japanese economy will be the principle source of growth and technological advance in the PacRim in the 21st century.”
- In 2004, the role of Japan in the PacRim is being subordinated—steadily and explicitly--by the growing presence of China in regional product and technology markets.
- *“Supported by the capital and expertise of over 55 million overseas Chinese, the PRC promises to over-shadow Japan as the major source of dynamism in East Asia in the future.”*

There appears to be an increasing level of coherence between the imperatives driving Chinese economic strategy & global competitive trends*

- ***Growth imperative:*** MNC needs for new markets fits nicely with the timing of China's increased market openness plus the growing prosperity of Chinese consumers [Market access in return for technology]
- ***Efficiency imperative:*** The ability of MNCs to tap into China's labor pool and take advantage of the rapidly upward learning curve among many Chinese manufacturers fits well with China's desire to sustain high levels of employment and to expand exports [Global supply chain integration]
- ***Knowledge imperative:*** MNCs hope to capture China's knowledge assets to enhance their local and global competitiveness dovetails nicely with China's desire to gain expanded access to foreign know-how in design, product development and engineering, etc. [Chinese engineers/scientists]
- ***Globalized competitors:*** Similarly, the fact that competition has become global means that China has become one of the main battlegrounds for the playing out of US-Japan-EU competition, which ensures that newer, more advanced technologies will be increasingly brought into China [Further access \$\$ and technology]

*Adapted from Govindarajan and Gupta, The Quest for Global Dominance (Jossey Bass, 2001)

Three Periods of China Investment Fever



Five Hypotheses Concerning Globalization & China's Emerging Technological Trajectory

- More and newer technologies are flowing into China at an earlier point in their life cycle than has occurred in any other developing country since the end of WWII.
- The proliferation of China's formal and informal commercial and cooperative S&T relations over the last 2+ decades has contributed to a more rapid and sustained pace of technological advance than projected by experts.
- The real strategic value of China for many MNCs lies not simply in access to cheap labor, but rather in access to China's critical knowledge assets—the cadre of heretofore under-utilized scientists and engineers—who now are part of the global R&D system.
- More and more MNCs will not only be setting up R,D&E activities in China, but they will be looking at China as a critical partner within their overall global technology system—leading to greater technological sharing, e.g. ASB
- Globalization, rather than viewed as a “problem,” is now seen by Chinese leaders as a strategic process for obtaining increasingly unencumbered access to state-of-the-art technologies and know-how.

China: A Path to Catching Up?

“Stepping forward into on-going, knowledge-driven competition begins by taking a step back, recognizing that the point of entry is not a teacher’s position, but that of a student. Follower companies can often take advantage of equipment, materials, licenses, process recipes, & consulting services that encompass important elements of the knowledge created by predecessors who have started from nothing. Creating the vital resources needed to succeed in a knowledge driven industry, however, does not begin with purchasing state-of-the-art technology, but rather with creating a basis in people for learning how to use it. Often this means entering the industry with current generation technology, achieving commercial yields, and running at efficient scale to build up the knowledge foundations necessary to seize a leadership position as the next generation emerges. Substandard returns or losses that come with late entry in current technology amount to tuition, reimbursable through timely entry to the next [technology].”

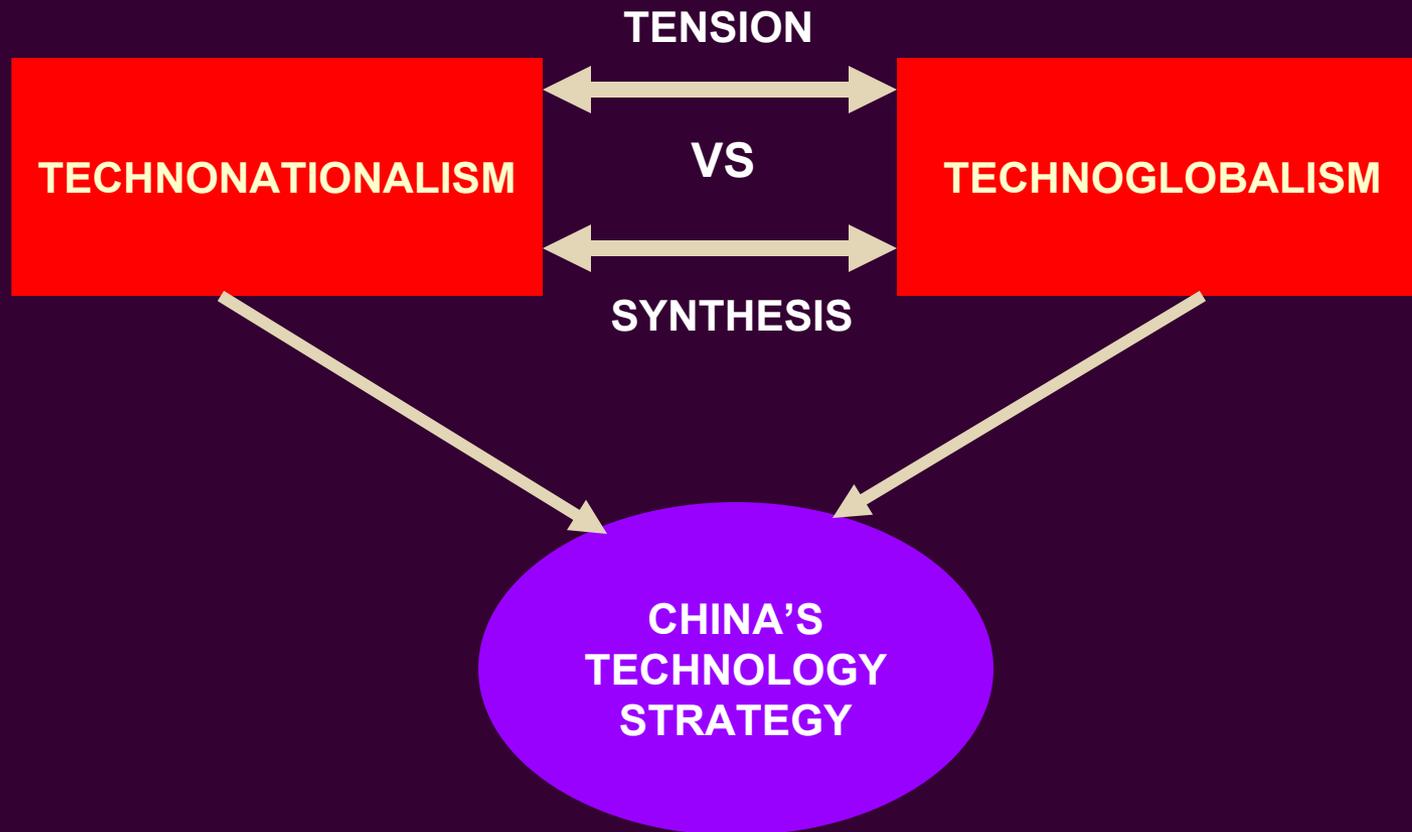
From: Thomas Murtha, et.al, Managing New Industry Creation: Global Knowledge Formation and Entrepreneurship in High Technology (Stanford, 2001)

China: A New Technology Model?

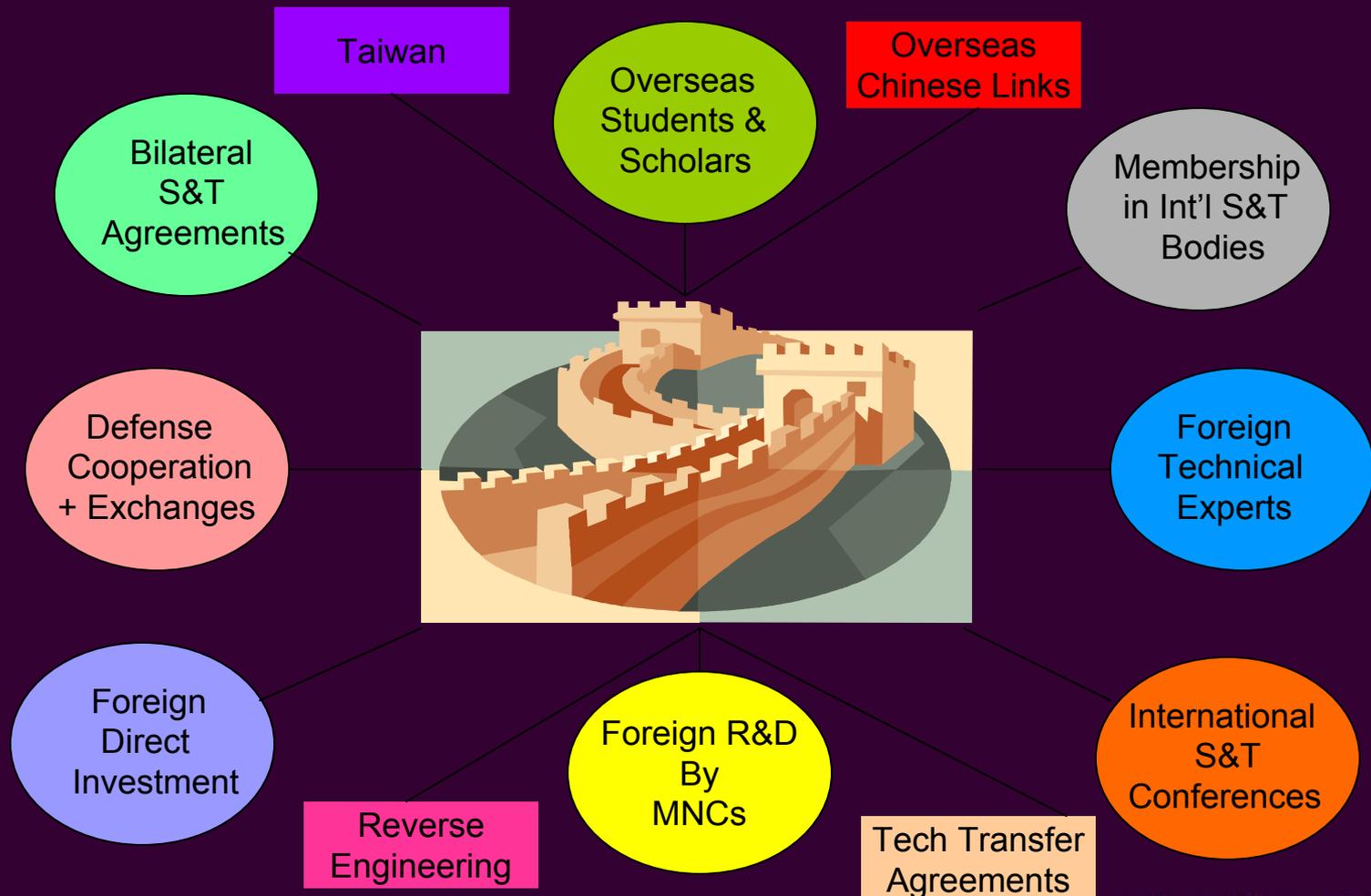
“More than any other country in the world, China is about the diffusion of improvements in production processes rather than improvements in end-user technology. Chinese industrialists and post-industrialists are on a long march to turn low-cost manufacturing capacity into faster-growth innovation capability.”

*Michael Shrage
MIT Technology Review
April 2004*

A False Dichotomy?



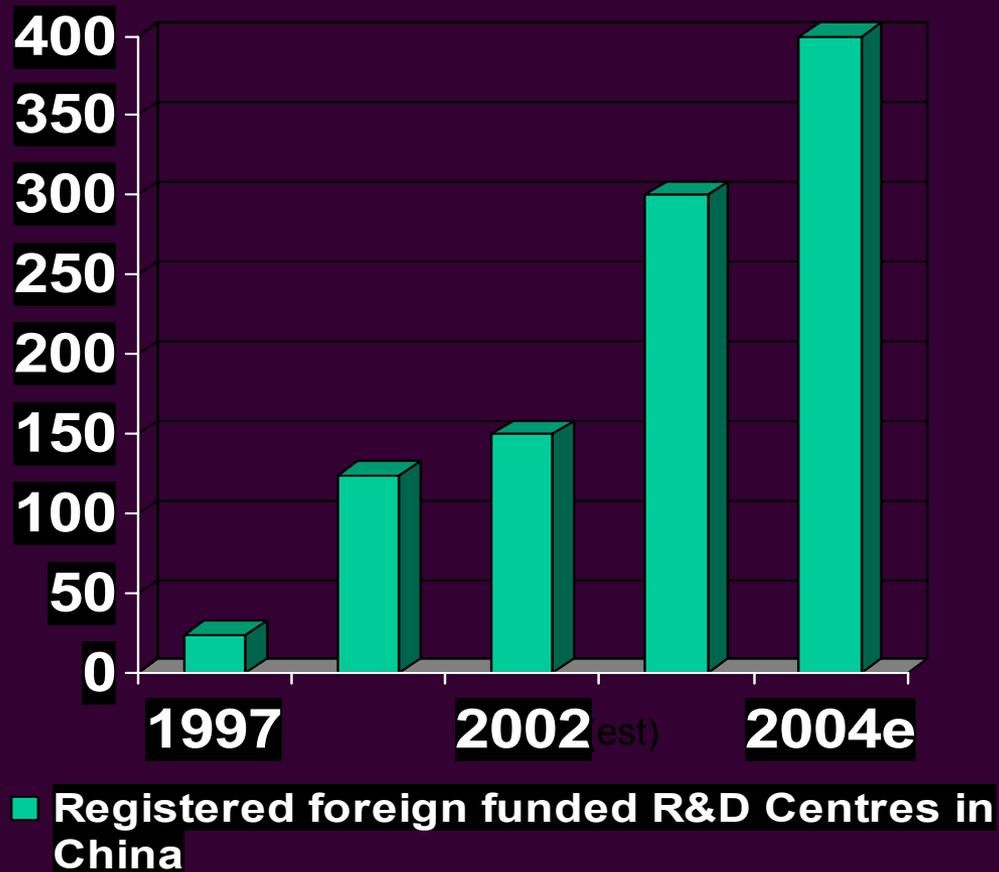
Expanded Channels of Access to Technology: China has become more capable in terms of utilizing its expanded access for “strategic” S&T purposes



China has introduced new legislation designed to formalize the status of foreign R&D centers

- MOFTEC (Circular *Waijingmaozifa #218*) in 2000 formalized the status of foreign R&D centers in China
- In April 2002, MOFTEC's investment legislation modified to promote R&D from “permitted” to “encouraged” form of investment
- 80% of staff involved in actual R&D + college degree
- Two types of R&D activities allowed: different rules
 - *An R&D center may be established for the purpose of general “transfer of know-how” to any party—local IPR ownership*
 - *An R&D center that is controlled by a parent company and is involved in research for which it will be paid expenses plus a reasonable profit—the IPR belongs to the parent*
- Foreign R&D centers may be subject to export license reqts
- Tax incentives as well as tax relief may be provided
- Entry and exit access for S&T experts made easier/simpler

The number of R&D centers established by foreign companies in China has witnessed a dramatic increase over the last 3 years



- MNC R&D centers are expanding focus from only the Chinese market to global markets
- Foreign companies have changed their core strategy in China. They now are bringing world class technology rather than simply 'tweaking' existing products for local market.
- Contract R&D also is beginning to grow

Growth of MNC R&D centers in China is being driven by a confluence of global & local competitive factors

- **Pull Factors: Capabilities + Policies (positive) + Economics**
 - *Gain access to under- and unemployed scientists & engineers as well as growing number of returnees*
 - *Harness those from former third-line industries*
 - *Size of China market and use of market “weighting” to set or enhance new global standards*
 - *Commitment of PRC govt to science and technology*
 - *Education policy—improve and expand training of S&Es*
 - *Commitment to the open door*
 - *Cost factors: contract R&D*
- **Push Factors: Demographics + Competition + Policies (negative)**
 - *Dynamics of global competition*
 - *Market saturation*
 - *Tax policies*
 - *Visa policies*
 - *Salaries and benefit packages*
 - *Availability of technically trained people*

Impact of Foreign R&D in China

- Foreign R&D in China as part of NIS is still a very new phenomenon—too early to measure full impact
- Not enough time has elapsed since its current growth spurt for policymakers to strategize on “capture” possibilities—a strategy is needed
- Contributions may be more intangible than tangible
 - *Training—technical, methodology (design), teaming, universities*
 - *Technology transfer—codified + uncoded know-how*
 - *Standards—best practices, industry standards, quality*
 - *Management—project mgt, business mgt, work environment*
 - *Networks and Access to Resources—knowledge networks*
 - *Spinoffs—new business ventures*
 - *Spillovers—assistance to vendors & suppliers...plus labor circulation/turnover—may be key vehicle for local benefit*

Selected Industry Impacts

- **Middleware Software:** leveraging exposure to ERP software systems as part of system integration efforts, local firms that have lower cost and more experience in dealing with challenges of local market—forcing MNCs to lower prices
- **Automobiles: PATAC (GM and SAIC)**—more focus on design rather than scientific research. SAIC Chery accused of using components copied from VW designs. Accusations that Chery copied design for new QQ car from GM Spark blueprints (originally from Daewoo Matiz II)
- **Telecom:** exposure to advanced switch design. Huawei-CISCO case—software and hardware plagiarism
- **Color TVs**—attempt to move up-market through foreign R&D cooperation—Skyworth Group (Beijing)
- **Electronic design automation (EDA):** PCB design, small ASICs, general IC design—shortened design cycles and faster time to market—still not as advanced as Taiwan—Cadence Technologies

GE's R&D Center in Shanghai

- GE's China strategy is focused on the three 5s—by 2005 GE will have sales of US\$5.0 billion and source \$5.0b from the PRC
- Several GE divisions (GE Medical, Plastics & Industry Systems) have moved Asian HQs to Shanghai
- In June 2000, GE established its Shanghai Research Center – which coordinates and communicates regularly with the GE Global Research Ctr in Niskayuna, NY—US\$12 million investment
- The Shanghai Research Center conducts research in areas such as imaging technology, material science and technology, electronic and photonic systems and technology, and manufacturing technology.
- A total of 400 staff are expected to be working at the center by the end of 2003 and 1500 by 2005. Additional land has been reserved for future expansion of the center.
- GE Medical Systems most active...use Chinese researchers for work on sophisticated algorithms to develop images for CT Scanners—China has ample supply of experts in math and physics
- Permanent magnets for MRI equipment—from Japan to China
- Goal is to create global center of excellence..move up from SKD phase to new product development

Next Major Issues: #1 Semiconductors

- China has become the fastest growing market for semiconductors in the world; by 2010, it will become the 2nd largest source of demand
- Investment from \$4.0B in 2000-02 to \$12B in 2005 and \$25B by 2013: driven by State Council Document #18
- Semiconductors have become a key technology target because like software (Microsoft), they represent dependence on foreign sources: only 10% of domestic demand met internally
- Emergent progress in CPU tech to combat Intel: 863 program
- Major industrial bases emerging in Shanghai, Beijing and Shenzhen: SMIC, Grace, TSMC, Huahong-NEC
- China will have 20%+ of global foundry capacity by 2005
- Significant progress in IC design area: 100% growth(\$533m in 2003) + 463 design houses
- Key issues: value-added tax (17%), standards compliance (WAPI), export controls, and intellectual property violations

Next Major Issues: #2 Standards

- China's growing sophistication with global technology markets is best reflected in its current policy thrust → to set or influence global technical standards
- China's goal: reverse the flow of royalty fees for technology licenses
- RFID (use of computer chips & radio technology to track products): retail and industrial suppliers
- Wireless local-area networks: wireless Internet connections—Chinese agree to delay policy
- Mobile communications: next generation technology that enables video + data plus voice
- DVDs: high volume storage
- Home networking: home entertainment and appliances connected using single wireless network

Whither China, R&D and Globalization?

- Globalization, complemented by economic reforms, has changed the external playing field for China: greater access to advanced technology and know-how
- China has developed a much greater understanding and appreciation for the nuances of the global business environment, suggesting a greater capacity to leverage its various relationships for competitive advantage
- China's strategic value as a market (with increasingly sophisticated customers) as well as a source of knowledge assets will make it more attractive site for advanced manufacturing and R&D by MNCs:”inclusionary strategy” ...no reason technology will stop flowing
- Human resource strategy will be a critical determinant in affecting China's continued attractiveness as an R&D site
- Emerging pockets of excellence are likely to emerge in China as PRC taps foreign expertise to stimulate substantial advance, e.g. communications, nanotech, etc.
- Major issue is not how foreign business will change China, but rather how China will change the global patterns of cooperation/competition

Thank you, Xie Xie!!!

Foreign R&D Data Set

Firm	Sector	# of Sites	Orientation
Alcatel	Telecom	1	Local/Global
Motorola	Telecom/Ele	16	Local/Global
Dupont	Chemicals	3	Local/Global
GM	Auto	3	Local
Accenture	Software	1+	Local/Global
Microsoft	Software	3-4++	Local
Pharma X	Pharma	2	Local
Intel	Semiconduc	3	Local/Glob
GE	Med/Power	1+	Local/Global
IBM	Software	3-4	Local/Global