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The China Phenomenon

China is poised to take over the world's manufacturing. And that's not all; it will soon move into software and hardware development. Chinese enterprise will begin with simple assembly manufacturing and by serving huge *internal* markets. China will be a world leader in technology by combining its emerging semiconductor industry with the engineering output of its growing university system. China's rapidly growing internal markets are good for domestic and for international companies. The huge supply of cheap labor and of engineering graduates is also good for companies, but not good for individuals outside China, who may be displaced on a large scale. Westerners displace manual labor with cheaper manual labor. Manual labor is located at a specific place. When we move a plant to a cheaper place, laborers lose their jobs. With Chinese capacity expanding and the Internet providing a global communications network, we are seeing for the first time that *mental* laborers—of which engineers are the largest group—are subject to these same dynamics on a large scale.

China: Big Markets, Big Opportunities, Big Problems

GENERAL	Slightly smaller area than the U.S.
POPULATION	1.3 billion, frugal, enterpreneurial
LITERACY	>80%
ENGINEERS	700,000 engineering graduates per year
INDUSTRY	18 million people per year enter the workforce
UNSKILLED LABOR RATE	$0.60 per hour
ENGINEERING SALARY	$4800 to $8800 per year plus housing, medical, and pension
GOVERNMENT	Looming financial problems
BANKS	The four major state-owned banks are insolvent (but operating)
PENSIONS & SOCIAL SECURITY	Unfunded obligations may exceed GDP
STOCK MARKET	Markets in Shanghai and Shenzen are subject to manipulation
FOREIGN INVESTMENT	$40 billion a year
CHIP MANUFACTURING	World's second highest foundry capacity by 2003
OTHER MANUFACTURING	Also moving to China from the rest of the world
MARKETS	Economy has grown at 10.9% per year since 1979
PCs	5% penetration. 18% annual growth. World's largest market by 2006
CELL PHONES	167 M users. World's largest market. Will double by 2004
INTERNET USE	56 M users. World's largest by 2006

I spent three weeks in China in November 2000. I received an invitation to visit the Three Gorges River project and the Yangtze River valley with a U.S. civil engineering delegation. (The Yangtze River runs generally west to east across much of China.) Although, I'm not a civil engineer, I like construction projects and heavy equipment, so I went. Our delegation met with Chinese planners and engineers along a route from near Wuhan, just below the dam site, to Chongqing, upriver. We visited construction sites, including the main site for the dam. There we walked among the workers (no OSHA, no hard hats).

The Three Gorges Dam is the largest construction project in the world. Its scale is breathtaking. The dam construction project employs 100,000 workers and a good portion of the world's heavy cranes. There's not much machinery between the workers and the heavy cranes. Digging a trench, which involves a backhoe and a single operator in the United States, employs a dozen workers with

In This Issue:

China is a big, populous country. It is *so* big that it is the first country that can be *both a major source of goods and a major market for goods, indefinitely.* China is the first country big enough to use the world as an economic starter motor to get its own engine running—and to not need the world to keep going.

In many ways, China is an economic asteroid on a collision course with the world's economy. The world, especially electronics engineering and manufacturing, will never be the same. I give my opinions and a status report.

picks, shovels, and wheelbarrows. I saw six or eight workers using ropes and their leg and back muscles to move boulders. I saw loads of rebar (twenty-foot-long steel rods for reinforcing concrete) transported by *bicycle*. I also saw an ultra-modern cable-stayed bridge near the dam site.

As we cruised upriver from the dam site, I got the impression that China is an agrarian economy that hasn't changed in hundreds of years. The Yangtze River valley is a patchwork of tiny farms. There is no farming machinery. There are few paved roads. Smoke shrouds the countryside like an inland fog—from burning soft coal, China's universal heating and cooking fuel.

I returned in June 2002 to speak at an integrated-circuit design conference. This time, I visited Zhuhai, a city on the Pearl River delta and a short ferry ride from Hong Kong. Instead of sleepy countryside, I saw a modern and booming metropolis. The contrast between inland farms and coastal cities is shocking—it's still there and it's an important part of the story.

China is slightly smaller in area than the United States, but China has *1.3 billion people*. Its people are *industrious* and *entrepreneurial*. More than 80% are *literate*. They *value education* and they *value engineering*. Like any emerging country, China is both primitive and modern. It uses animals, not tractors. It skips wired telephones and goes directly to wireless. It skips generations of bridge-building evolution and goes directly to modern structures, but paved roads are still the exception. There are fifteen miles of paved road in the United States for every mile of pavement in China (2.5 million miles vs. 170 thousand miles). It adopts state-of-the-art electronics and semiconductor manufacturing and skips decades of evolvement.

Foreign investment in China averaged $40 billion a year in the late 1990s and was $45 billion in 2001. Ninety percent of foreign investment goes to coastal provinces with access to international shipping. (The Three Gorges Dam will open much of China's interior to ocean-going ships.) Technology investments get a two-year tax exemption plus three years at half of the standard 15%. Land and labor are cheap. Import and export tax policies are favorable. Exports grew 43% per year between 1985 and 1998. Internal markets are emerging.

What's not good? There are significant language and cultural barriers. Local companies have the advantage dealing with bureaucracies. Foreign companies can enter the economy by partnering with local companies, but companies complain of pressure to share intellectual property with joint-venture partners. In emerging technical markets, standards are set by the *government*. Ordinarily, deviating from international standards leads to dead-end products, but China's internal markets are large enough to make this work. Its membership in the World Trade Organization will encourage China to adopt international standards.

China's economy has grown at 10.9% per year since 1979 and should continue to grow by at least 7% per year for several decades. This rate can be sustained by the growth of internal markets and does not depend on world economic conditions. PC penetration in China is only 5%. *Internal* PC shipments are expected to grow at 18% through 2006, when China will pass the United States to become the world's largest PC market. China has 167 million cell phone subscribers this year—already the world's largest cell phone market. New cell phone users number *4 to 6 million a month* and will reach 320 million by 2004. Internet use in China has risen 300% in the last twelve months. China has 56 million Internet users; it overtook Japan this year to become the second largest, in number of users, behind the United States. By 2006, China will be number one in Internet-connected users. China's software market was $1.6 billion in 2001 and will grow at 37% per year, reaching $7.8 billion by 2006.

The booming Chinese economy has skeptics. They point to bad loans, corruption, weakening exports, and lack of visibility into financial transactions as reasons to doubt the reported growth in China's gross domestic product. But secondary measures—estimates of electricity, coal, steel, long-distance phone calls, wages, and employment—verify China's growth to within the accuracy reported by Western countries.

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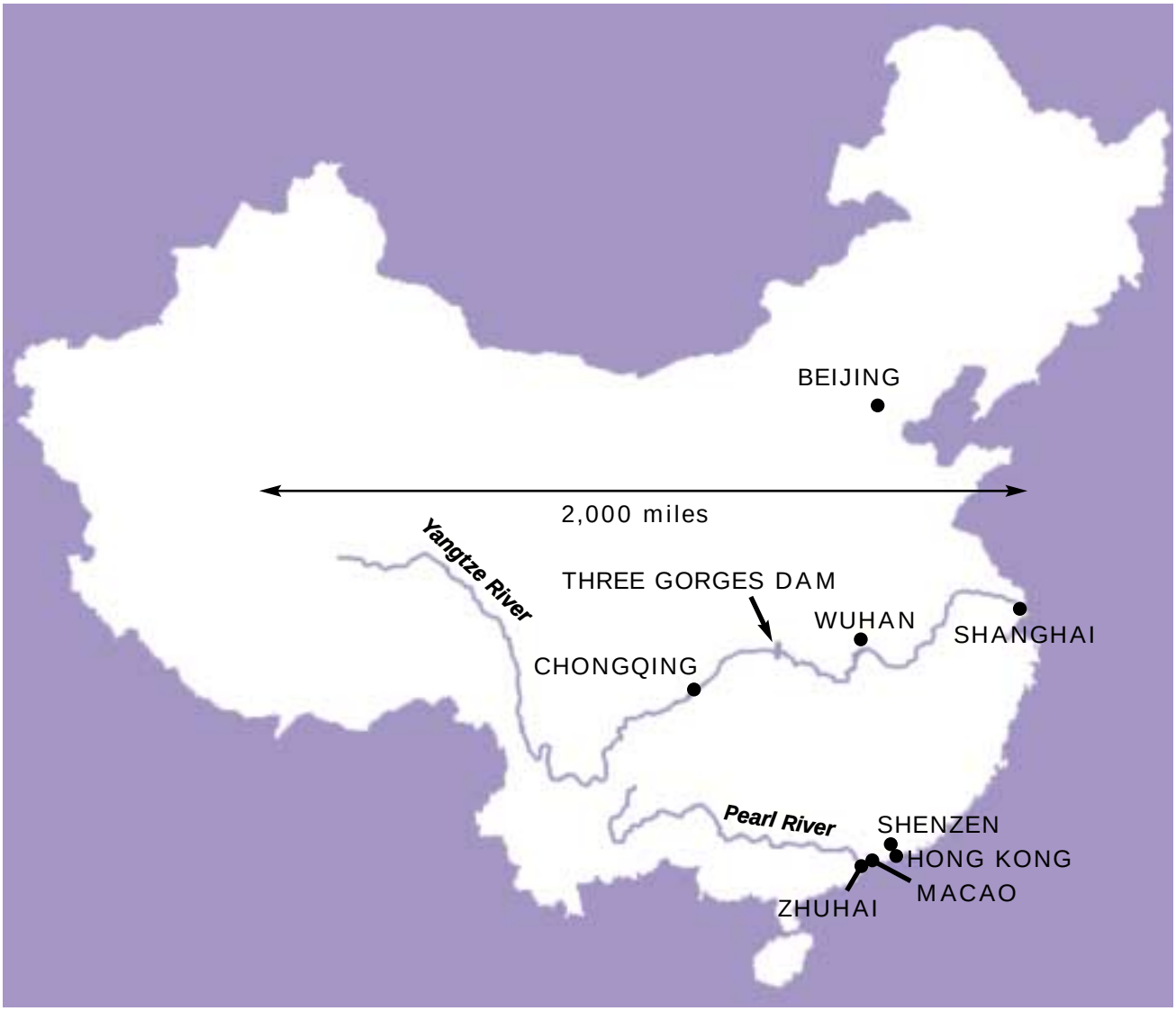

Semiconductors

China isn't just about circuit board assembly and internal markets. Its semiconductor manufacturing is growing rapidly, with forty new semiconductor plants announced so far this year. Half of China's chip production is in Shanghai. By 2005, Shanghai will have a dozen semiconductor plants with an aggregate capacity of 500,000 wafers per month. That's about one-and-a-half times market-leader Taiwan Semiconductor's (TSMC) monthly capacity.

In March 2002, the government of Taiwan approved investment in semiconductor manufacturing in China, limited to 200-mm diameter silicon wafers and to process tolerances not better than 0.25 microns. As a result, both TSMC and United Microelectronics (UMC) have begun to invest in foundries in China. As Taiwan's foundries move to 300-mm wafers, they will move their legacy production to China. By 2003, China will be second only to Taiwan in foundry capacity.

China's domestic markets consumed $15 billion in semiconductors in 2001. It's growing at almost 25% per year, so domestic consumption should be $35 billion by 2005. Domestic production of semiconductors was $1.2 billion in 2001, implying that China imports more than 90% of its semiconductors. Even with domestic production growing faster than 80% per year (all those new semiconductor plants coming online), it will rise to only $13 billion by 2005. China will still be importing 70% of the semiconductors for its internal markets in 2005.

Manufacturing

As China's economy shifts from centrally planned to market-driven and from agrarian to industrial, the huge population provides an infinite supply of cheap

labor. Eighteen million people enter the workforce each year. Unskilled labor is *sixty cents an hour*—a quarter of what unskilled labor costs in Malaysia and an eighth of what it costs in Singapore. Unskilled labor in the United States and in Japan costs twenty times what it costs in China. As a consequence, manufacturing is shifting from Japan, Korea, Malaysia, Singapore, Thailand, Indonesia, Taiwan, the United States, and even Mexico to the coastal provinces of China. Motorola, Texas Instruments, Sony Ericsson, Samsung, and Nokia are investing in cell phone production in China. AMD, IBM, and Intel package chips in China.

Bootstrapping. Flextronics (FLEX, www.flextronics.com) began as a "board stuffing" business in Newark, California, in 1969. Board stuffers placed and soldered electronic components on circuit boards. Silicon Valley system makers generally contracted their overflow work to independent board stuffers. The contracting company supplied the circuit boards and the electronic components to the board stuffer. Board stuffing was a labor-intensive, low-margin business. Flextronics first introduced automated manufacturing to reduce labor costs, but in 1981, it moved to Singapore to further reduce operating costs.

From board stuffing, Flextronics moved up to contract manufacturing. It now ordered components and tested boards too. Next, it moved into printed-circuit-board design, computer-aided design, and front-end component testing. With these new services, a customer could approach Flextronics with just an idea; Flextronics responded with a complete manufacturing plan for the customer's approval.

By the late 1980s, Flextronics expanded its services to include *system* assembly. The company could build ready-to-ship products for its customers. Flextronics built disk and tape subsystems for Sun Microsystems and it built modems for Hayes. It built the Microsoft mouse and the original Palm Pilot. Today, Flextronics uses an "industrial park" model—locating suppliers close to the manufacturing plant to lower costs and to improve flexibility and responsiveness.

What I have described above is a "bootstrap operation." Flextronics pulled itself up by its bootstraps to move from board stuffing to manufacturing complete systems. It grew, in thirty-three years, from 2 employees to 70,000 employees in a capital-intensive business. It expanded from a local operation to an international business. It did this by starting in a business most would find uninteresting.

Flextronics builds Motorola cell phones, Dell circuit boards, and 3Com fax modems on Chinese production lines. While Flextronics operates in twenty-eight countries, its lowest-cost operations are in China. In 2002, Flextronics will double its operations in China. By 2004, 40% of its worldwide production could be in China. Among its "manufacturing partners" are Cisco, Ericsson, HP, Microsoft, Motorola, Nokia, Nortel, Philips, Siemens, and Xerox. Flextronics is in the right place at the right time with expertise in electronics manufacturing services. Based on its potential for growth in manufacturing in China, Flextronics is a Dynamic Silicon company to watch.

In most countries, as experience and skill increase, wages rise, leading to higher costs for the manufacturer. In China, unskilled labor gets especially low wages. As their experience and skill increase, workers move to skilled jobs in other plants. China's huge population means that there are always workers entering the labor force to backfill vacant positions at low wages, keeping manufacturing costs *constant*. What Flextronics did for one industry, China will do for the world. Laborers bootstrap their skills and companies bootstrap the sophistication of their manufacturing operations. With the infinite supply of cheap labor, China can draw in manufacturing from the rest of the world, bootstrap both it and the labor force, and *never outsource anything*. In addition to exports and to existing internal demand, the bootstrapping labor force grows the internal markets for its own products. This demand for products grows with the increasing size and affluence of China's labor force.

Legend. You have probably never heard of Legend Group Limited (LGHLY.PK). It's the largest PC manufacturer in China. It has 30% of China's domestic PC market. Legend outsells its domestic rivals by at least three to one and it outsells its international rivals by at least seven to one. Legend is not just a box maker. Legend understands the support needs of a population new to personal computers; it has more than 570 sales, service, and training "Legend 1+1 Specialty Shops" around the country. In addition to low-end PCs for homes and small businesses, Legend makes servers and notebooks. In the last quarter of 2001, it broke into the world's top ten in server sales, with servers based on Intel's Xeon microprocessor. This year, Legend introduced notebooks using the Pentium 4 microprocessor.

Legend partners with Intel, IBM, Microsoft, AOL, Siemens, and Texas Instruments. Legend distributes HP printers, Cisco routers, and IBM midrange computers. The Siemens and Texas Instruments partnerships help Legend in wireless and in handheld markets.

This June, just two years after development began, Legend announced six multi-function cellular handsets. Five are GSM handsets, one is CDMA. Legend's dual-liquid-crystal-display handset is the smallest and lightest on the market. Legend has more than 1,700 sales outlets for its handheld devices.

Legend's partnership with AOL lets it offer simple Internet connections to the home. China's few television stations are about as entertaining as C-SPAN, so the Internet wins the contest for eyeballs.

Legend builds PCs primarily for the low-end of the domestic market. By copying techniques from successful high-volume manufacturers, Legend achieves efficiencies that equal Dell in average time from order to delivery. Legend is growing with China's domestic PC market, but with its efficient manufacturing and its low cost, it will—guess what—sell its PCs internationally. Legend qualifies as a Dynamic Silicon company for its opportunity in the PC market. The Chinese government, through Legend Group Holdings, owns 60% of Legend Group Limited.

The stories of Flextronics and of Legend are being duplicated in countless factories throughout coastal China. Flextronics and Legend are China in microcosm—bootstrapping operations from simple manufacturing to sophisticated end-products. But now the new time scale will compress decades to a few years. And there'll be no move overseas, since China will remain the cheapest place to manufacture. The endless supply of cheap labor keeps costs low even as many prosper.

Education

China will grow beyond manufacturing. Chinese society puts education on a pedestal. Families, restricted to a single child, see education as the way to betterment. As China bootstraps its manufacturing and its internal markets, it is developing its educational system to support emerging requirements for engineering talent. University programs are expanding. In 1992, only 5% of the candidates participating in the national three-day entrance exams advanced to universities. This year, 14% of the candidates will advance to universities. Though only the top 14% get to go to college, *Chinese universities produce 700,000 engineers a year—37% of college graduates*. U.S. universities, in contrast, produce only 65,000 engineers a year—6% of graduates—from a pool that's not nearly as selective.

B.S.-level engineering graduates can expect to earn $4,800 to $8,800 per year plus housing, medical, and pension. For the hiring company, these benefits add 50% to the cost of an engineer.

Many of China's new engineers take jobs in Taiwan, Singapore, or the United States. For a few years, they gain experience in semiconductor manufacturing, assembly, testing, and a host of other tasks. Then they return to build and to manage manufacturing, testing, and assembly plants in China.

Software piracy

In most countries, hardware revenues are twice software revenues. In China, the ratio is nine to one. Illegal copying and counterfeiting of software have been rampant. As much as 90% of the installed base of software was illegally copied. Copies of Microsoft Windows operating systems could be had for a dollar.

Here's what got the *Chinese government* to clamp down on software piracy. China may have an infinite supply of cheap labor and it may have lots of cheap engineers and programmers, *but even cheap resources can't compete with theft and counterfeiting that avoid all expenses except copying and packaging*. Leaders in the Chinese government's State Council, realized that a *domestic* software industry couldn't develop in this environment. They issued Document 18 in 2000, "Notice of Certain Policies to Promote the Software and Integrated Circuit Industry Development." Document 18 institutes fines of ten times the product's list price for purchasers of pirated software. For *sellers*, penalties include confiscation of equipment, jail, and even execution. Capital punishment for software piracy!

With Document 18 in place and with software piracy dwindling, international software suppliers are entering the market and a domestic software industry is emerging.

And the ultraselective education system motivates families to buy PCs, which signals a growth market in educational software.

Globalization

Perhaps I should have been a civil engineer or a mechanical engineer because I like big machines and heavy equipment, but I'm an electrical engineer. There's a controversy today over the H-1B visa program that brings electrical and computer engineers into the country in the midst of hard times for local engineers seeking jobs. The Institute of Electrical and Electronics Engineers, in spite of being an international organization, has taken a protectionist stance against H-1B visas. I'm against H-1B, but not for protectionist reasons. I'm against H-1B because it's temporary; we should *encourage* immigration and citizenship for these engineers.

H-1B opponents say companies hire foreign engineers because they're cheaper. "We should employ our citizens first." This is the idea that limiting the number of doctors and dentists keeps professionals' incomes high. The idea is to limit competition for engineering jobs by restricting immigration, visas, and even the output of engineering schools. That might work for civil engineers or for environmental engineers—as it does for doctors and lawyers and dentists—because their workplace, their work, and their customers have geographic ties that make outsourcing impractical. But the Internet makes money, status (including live camera coverage), design files, and contracts available anywhere in the world. Most electrical and computer engineering design projects are eminently portable. Circuit boards, integrated circuits, and systems can be designed and manufactured anywhere. Integrated circuit manufacturing is in Taiwan and, as we've just seen, circuit board and system manufacturing are moving to China. It's a global market, so we have three choices: our "citizen" engineers can take the jobs at competitive rates; we can give the jobs to immigrants who will work for less; or we can let the jobs go overseas. Protectionist policy won't work; raising barriers to immigration will cause the *jobs* to emigrate.

Government

Banks. The biggest Chinese banks are state-owned (the Bank of China, the Industrial and Commercial Bank of China, the China Construction Bank, and the Agricultural Bank of China) and they are *insolvent*. The problem has two legs. The first is the Chinese workers and the second is the autocratic political system. Each year, Chinese workers' savings deposits equal 40% of the gross domestic product—the highest individual savings rate in the world. At the direction of political leaders, these state-owned banks make huge loans to state-owned enterprises. Executives at these enterprises, knowing that both the banks and the enterprises are state-owned, view these loans as free money. The cash value of these loans on the banks' balance sheets might be as little as 10% of their face value. The banks have been borrowing short (workers' demand-deposits) and lending long (enterprise loans)—a recipe for financial collapse. If depositors had investment alternatives, such as a reasonable stock market, or if they *knew* that the banks were insolvent, the withdrawals would lead to a banking collapse. China's banks are running the world's largest Ponzi scheme. The banks, which have received bad-debt bailouts twice before, expect government bailouts. But this problem is too big for the Chinese government.

Stock markets. China's stock markets operate in Shenzen and in Shanghai. They are loosely regulated and they are subject to manipulation, to corruption, to deceptive accounting, and to insider trading. This situation will not improve soon. Small shareholders aren't well represented; there's a permanent ban on shareholder lawsuits. Major shareholders manipulate and defraud the small shareholders. Right now, it's just as well that the stock markets are corrupt; if the stock markets worked, the movement of even a small percentage of workers' savings into equities would cause the banks to collapse.

The central government created the stock markets to sell equities *in state-owned enterprises*. The central government is also the stock markets' regulator—a clear conflict of interest. The government needs to sell equity in state-owned enterprises to raise money for other obligations (insolvent banks and pension and social security shortfalls, for example), but it cannot do this without triggering a precipitous fall in stock prices.

Pensions and other obligations. Darn! It's those unintended consequences of central management again. China is successfully controlling its birthrate by decree. Births are down. The limit is one child per family. Birthrates have fallen below replacement levels. Parents want a male heir, so more males than females survive. The imbalance reduces the birthrate further, accelerating population aging. When everyone is old, who pays pensions and social security? Current workers' pension and social security obligations are unfunded. The system is running behind by amounts that may *exceed the gross domestic product*. The payments that are being made—a small fraction of obligations—for pensions, for unemployment insurance, for guaranteed living allowance, and for other social welfare programs are paid out of *current* revenues. This can't work for long. As time goes by, obligations dwarf revenue as the population ages.

Lessons

I've said good things about China. The boundless supply of cheap labor is great for manufacturing. The people work hard and they are entrepreneurial. Favorable tax and trade policies encourage international investment, making it attractive for foreign companies to import components, to manufacture in China, and to export to international markets. That's great for companies such as Flextronics, Legend, IBM, Intel, and Motorola that have expanding operations in the rapid-

ly growing coastal provinces. They have access to shipping to reach international markets and they have access to fast-growing internal markets.

I expect the entire world's manufacturing to move to China. As the world's manufacturing moves to China, the growing local workforce becomes affluent—creating great internal markets for products. Burgeoning internal markets improve corporate profitability by avoiding international transportation and distribution costs.

Chinese are literate and their culture values education. China's university system is competitive, and it's turning out hundreds of thousands of engineers every year. The growth of China's university system is decreasing its dependence on foreign education. But many students still go to United States and to European universities for both undergraduate and graduate degrees and return to China. Engineering graduates frequently go to places such as Taiwan or Singapore to gain experience in semiconductor design and manufacturing and to return to China to manage local manufacturing and design operations. That's good for China and it's good for companies that want to bootstrap from low-level manufacturing into circuit board design, or into electronic systems design, or into electronics research. IBM, Intel, and Motorola have research centers in China. The pool of qualified candidates for research positions yields thousands of applications for dozens of positions, making these organizations more exclusive than their counterparts in other countries.

It sounds ideal: cheap labor, literacy, university educations, engineering talent, favorable tax and trade policy, and cultural and political alignment. I see a great future for companies investing in manufacturing, in engineering design, and in research in China. It's a great environment for Flextronics for electronics manufacturing; it's a great environment for Chartered, for TSMC, and for UMC for semiconductor manufacturing; it's a great environment for manufacturing and for internal markets for Legend Group Limited; and it's a great environment for internal markets for Via Technologies.

My positive comments do not apply to state-owned enterprises or to the Shanghai/Shenzen stock markets. China has problems with its banks, with its stock markets, with its political system, with its underfunded pension plans, and in paying its social security bill. Potential government interference in Legend's operation is a concern, since the government owns the holding company with a majority interest in Legend Group Limited.

Nevertheless, China is about to explode on the scene.

NICK'S SCORECARD: WHO WINS, WHO LOSES

The future is excellent to good for all these companies. This is so because this issue is about benefits that accrue to employers.

COMPANY	TYPE OF COMPANY	FUTURE POSITION	THE WAY I SEE IT
Flextronics International	Contract manufacturer	Excellent	Manufacturing experience in 28 countries. Established in China. Positioned to benefit from growth of internal and of export markets.
Legend Group Limited	Personal computer systems	Excellent	Positioned to serve China's fast-growing demand for PCs. Moving into portable devices and cell phones. Advanced manufacturing and low production cost position it to enter international markets.
TSMC, UMC	Foundry	Excellent	Taiwan's major foundries are well positioned to move legacy semiconductor production to China.
Chartered Semiconductor	Foundry	Good	It has fewer restrictions for investing in foundries in China than Tiawanese companies, but it must overcome barriers in language and culture.
Dell	Personal computer systems	Good	There's room for international brands in China's expanding PC market.
Via Technologies	Fabless	Good	Positioned to supply microprocessors and chip sets for China's growing "value PC" market. Needs to complement its x86 microprocessor chip offerings with an x86 soft core.
IBM, Intel, Motorola, Texas Instruments	Integrated	Good	China imports 90% of its semiconductors. Because the end markets are expanding, imports fall slowly as domestic production rises.

The "position for the future" and "the way I see it" apply only to the topic of the issue. Possible positions for the future are: excellent, good, OK, struggle, and fail. A company that is "excellent" with respect to horizontal fragmentation of an integrated business may, for example, "struggle" with cultural obstacles in another technical transition. A company listed as "struggle" in another issue could be listed as "good" in this issue since issues cover different topics.

Dynamic Silicon Companies

The world will split into the tethered fibersphere (computing, access ports, data transport, and storage) and the mobile devices that collect and consume data. Dynamic logic and MEMS will emerge as important application enablers to mobile devices and to devices plugged into the power grid. We add to this list those companies whose products best position them for growth in the environment of our projections. We do not consider the financial position of the company in the market. Since dynamic logic and MEMS are just emerging, some companies on this list are startups.

Company (Symbol)	Technology Leadership	Reference Date	Reference Price	7/31/02 Price	52-Week Range	Market Cap.
Altera (ALTR)	General Programmable Logic Devices (PLDs)	12/29/00	26.31	11.83	10.37 - 33.33	4.530B
Analog Devices (ADI)	RF Analog Devices, MEMS, DSPs	12/29/00	51.19	24.10	20.99 - 52.74	8.811B
ARC Cores (ARK**)	Configurable Microprocessors	12/29/00	£3.34	£0.24	£0.21 - £0.62	£70M
ARM Limited (ARMHY***)	Microprocessor and Systems-On-Chip Cores	11/26/01	16.59	7.08	5.55 - 19.20	2.378B
Calient (none*)	Photonic Switches	3/31/01				
Celoxica (none*)	DKI Development Suite	5/31/01				
Cepheid, Inc. (CPHD)	MEMS and Microfluidic Technology	12/17/01	4.73	2.93	1.48 - 11.48	76.0M
Chartered Semiconductor (CHRT)	CMOS Semiconductor Foundry	7/31/01	26.55	16.64	16.06 - 30.36	2.306B
Coventor (none*)	MEMS IP and Development Systems	7/31/01				
Cypress (CY)	MEMS Foundry, Dynamic Logic	12/29/00	19.69	11.48	10.45 - 28.95	1.409B
Cyrano Sciences, Inc. (none*)	MEMS Sensors	12/17/01				
Energy Conversion Devices (ENER)	Ovonic Unified Memory	6/18/02	27.69	12.55	9.47 - 25.73	274.8M
Flextronics International (FLEX)	Contract Manufacturing	8/6/02	7.68	7.92	5.85 - 29.99	4.73B
Foveon (none*)	CMOS Imaging Chips	6/18/02				
Legend Group Limited (LGHLY.PK)	PCs and Consumer Electronics	8/6/02	6.63	7.25	N/A	N/A
Microvision (MVIS)	MEMS-based Micro Displays, Nomad Head-Worn Display, Scanners	6/18/02	6.80	3.30	2.64 - 21.50	44.6M
National Semiconductor (NSM)	Geode x86 Microcontrollers, Consumer Orientation, 51% Ownership of Foveon	6/18/02	32.30	18.11	17.70 - 37.30	3.246B
QuickSilver Technology, Inc. (none*)	Dynamic Logic for Mobile Devices	12/29/00				
SiRF (none*)	Silicon for Wireless RF, GPS	12/29/00				
Taiwan Semiconductor (TSM†)	CMOS Semiconductor Foundry	5/31/01	14.18 ††	9.12	7.6273 - 19.0818	33.696B
Tensilica (none*)	Design Environment Licensing for Configurable Soft Core Processors	5/31/01				
Transmeta (TMTA)	Microprocessor Instruction Sets	12/29/00	23.50	1.06	0.96 - 4.47	143.0M
Triscend (none*)	Configurable Microcontrollers (Peripherals)	2/28/01				
United Microelectronics (UMC†)	CMOS Semiconductor Foundry	5/31/01	10.16	5.94	4.25 - 11.52	15.843B
VIA Technologies (2388.TW)	x86 Microprocessors for "Value" PCs	6/15/02	78.00	67.00	64.00 - 156.00	N/A
Wind River Systems (WIND)	Embedded Operating Systems	7/31/01	14.32	4.65	4.18 - 20.14	365.8M
Xilinx (XLNX)	General Programmable Logic Devices (PLDs)	2/28/01	38.88	19.19	17.22 - 47.159	6.486B

† Also listed on the Taiwan Stock Exchange

†† TSM reported a stock split on 6/29/01. The Reference Price has been adjusted for the split.

* Pre-IPO startup companies.

** ARK is currently traded on the London Stock Exchange

*** ARM is traded on the London Stock Exchange (ARM) and on NASDAQ (ARMHY)

NOTE: This list of Dynamic Silicon companies is not a model portfolio. It is a list of technologies in the Dynamic Silicon paradigm and of companies that lead in their application. Companies appear on this list only for their technology leadership, without consideration of their current share price or the appropriate timing of an investment decision. The presence of a company on the list is not a recommendation to buy shares at the current price. Reference Price is the company's closing share price on the Reference Date, the day the company was added to the table, typically the last trading day of the month prior to publication. The authors and other Gilder Publishing, LLC staff may hold positions in some or all of the companies listed or discussed in the issue.