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Leapfrogging or piggybacking?

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The economies of India and China are not as sophisticated as they appear

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THE back of Gopal Raj's book “Reach for the Stars” carries a black-and-white photograph of the nose cone of a sounding rocket, carried on the back of a bicycle. The book chronicles the unlikely beginnings of India's space programme, which launched its first rocket in 1963 from Thumba, a fishing village in the state of Kerala. Thumba was chosen as the launch site in preference to another location whose name translated as “White Elephant Island”.

The programme's founder had little patience for scoffers. “One is often told that such and such a thing is too sophisticated” for a developing nation, he wrote. But “I have a dream, a fantasy maybe, that we can leapfrog our way to development.”

India's path since then has remained idiosyncratic. The skills demanded by its industries are those of a much richer country. This can be shown, roughly, by statistics; more sharply by anecdote. General Electric's technology centre in Bengalooru (formerly Bangalore), to pick one, is working on advanced propulsion systems for jet engines. India's Tata Consultancy Services (TCS) produces the software for Ferrari's Formula One cars. India's drugmakers offer 60,000 finished medicines; only three countries produce a bigger volume.

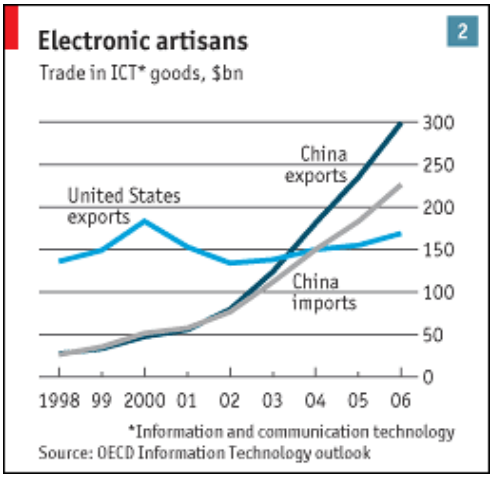
China's evolution also has its peculiarities. In 1964, recently estranged from its Soviet patron, it devoted a larger share of its GDP (1.7%) to R&D than it ever has since. But after the decade-long Cultural Revolution, this is how one study described the state of its industry on the eve of Deng Xiaoping's economic reforms in 1978: “vans and transformers that failed to keep out rainwater, sewing machines that leaked oil onto the fabric, power tillers rusting outside a factory that churned out fresh batches of unwanted inventory”.

Now, according to Dani Rodrik of Harvard University, China's exports are as sophisticated as those of a country three times richer. The goods it sells to America overlap to a surprising extent with the merchandise America buys from members of the OECD, a club of rich democracies, argues Peter Schott of Yale. By this measure, China's exports are more highly evolved than those of Brazil or Israel.

Particularly stunning is the growth of China's exports of information and communication technology (ICT), a category covering high-tech staples, such as telecoms equipment, computers, electronic components, and audio and video equipment. In 2004, the OECD reports, China passed America to become the world's biggest exporter of such goods (see chart 2).

Xu Zhijun, now head of marketing for Huawei, China's leading vendor of telecoms equipment, recalls the “distrust and doubt” he faced from 1998 to 2001. The customers he courted would not believe the products were Huawei's own: “We had to make 100 or

maybe 1,000 times the efforts of an American or European company." Kiran Mazumdar-Shaw, boss of Biocon, an Indian biopharmaceutical company, describes a similar progression: "In the early days, we were taken with a big pinch of salt in India. Now we are beginning to upset the big guys. We have nuisance value. That means we are successful."



A sliver of riches

How big is the technological gap between America and China? Forty-five nanometres, about 1/2,000th of the width of a human hair. That, at least, is the answer you might reach if you visit Semiconductor Manufacturing International Corporation (SMIC), China's leading maker of silicon chips. The company was founded in 2000 by Richard Chang, a Taiwan-born American citizen, who spent 20 years working for Texas Instruments. Having built chip foundries or "fabs" in Taiwan, Italy, Japan and elsewhere, he decided to do the same in China.

Two measurements sum up the stature of a chipmaker: the diameter of the silicon wafers it turns out (bigger is better), and the scale at which it etches them (the smaller the better). Prior to 2000, China could make 6-inch (15cm) wafers, good enough for washing machines perhaps, but more than a decade behind the state of the art. SMIC now boasts two factories that can make 12-inch wafers, as big as any in the industry. Moreover, it can etch circuits at a scale of 90 nanometres; just 45 nanometres behind the industry's leaders.

SMIC's Shanghai fabs defy the stereotype of China's labour-intensive assembly lines. Its wares are not glued, stitched or soldered; they are coated, patterned, etched, doped, annealed, plated and polished. Wages account for no more than 5% of the cost of chipmaking: it is the capital not the labour that steals the show.

Cassettes of wafers move from one expensive piece of kit to the next on overhead tracks, picked and placed by robotic arms. First coated with a thin insulating film and a light-sensitive layer, the silicon is lined up under a "mask", which leaves some bits exposed to a beam of ultraviolet light, other bits protected. The beam inscribes a pattern, like strap marks on a sunbather, which is then etched into the chip by a jet of plasma. The etch-marks expose the silicon beneath, which is then implanted with phosphorus or boran. These impurities, or "dopants", transform silicon from its natural state as an insulator—a tidy latticework of atoms with no loose electrons—into its famous modern role as a semiconductor, permitting electrons to stop or go as the chip designer pleases.

Thanks to its prodigious output of electronic gear, China is now the biggest market for integrated circuits in the world. All the laptops and handsets, as well as the refrigerators and air conditioners, rolling off its production lines have chips inside. But China's foundries can satisfy only a tiny fraction of that demand. Their supply amounts to $3.1 billion, whereas China's demand is $62 billion. The supply shortfall could reach $112 billion by 2010.

This gap is one reason why Lee Branstetter of Carnegie Mellon University and Nicholas Lardy of the Peterson Institute for International Economics caution economists like Mr Rodrik not to overestimate China. China's firms have not managed "to leapfrog ahead and bend or even suspend the law of comparative advantage". China is where electronic goods are made, not where much of the value is added.

As is so often the case, Apple's iPod is the best example. The 30-gigabyte video version was manufactured in China by Inventec, a Taiwanese company. It sold for about $224 wholesale in 2005. But where did that money go? Three economists—Greg Linden of the University of California, Berkeley, together with Jason Dedrick and Kenneth Kraemer of the University of California, Irvine—have peered into the white box to find out. Of the iPod's 424 parts, they reckon 300 cost one cent or less. The display module was worth about $20, but that was made in Japan by Toshiba-Matsushita. China did assemble all these bits and pieces and test them. But that accounted for just $3.70 of the iPod's value.

The largest bite was claimed by Apple: about $80 in gross profit.

Perhaps only 15% of the value of China's electronic and IT exports is added in China, Messrs Branstetter and Lardy think. The rest is imported. Look again at China's trade figures for ICT: exports amounted to almost $300 billion in 2006, the highest in the world. But imports were $226 billion. China had a trade surplus in computers, video cameras, TVs and telephones; but it had a deficit of $92 billion in electronic components, including semiconductors, integrated circuits and audio and video parts.

China fetches low prices for its high technologies. The TV sets it sold in 2003 were worth about $73 a unit, according to Mr Rodrik's numbers. Malaysia's were worth twice that. The machinery America buys from other members of the OECD, according to Mr Schott, is four times as expensive as the stuff it buys from China.

China's high-tech firms are cheap; they are also not very Chinese. None of the top ten, by 2005 revenues, was native-born. Foreign firms owned one-fifth of the assets in the ICT sector in 2004, accounted for the lion's share of exports, provided 16% of the employment and claimed 20% of the earnings. The wages they pay stay in China; as do whatever profits they reinvest. But their know-how stems from overseas. Some Chinese firms may soon make their mark in high-tech industries, Messrs Lardy and Branstetter argue. But the transition of the economy “from net importer of technology-intensive goods to net exporter is likely to take many decades.”

At your service

As the digital professionals of Bengalooru gather themselves for the punishing commute home from Electronics City, a group of exuberant young men parade noisily in the opposite direction. Streaked from head to shoulder with bright powder paint, they dance and holler ahead of a plastic icon of Ganesh, the elephant-headed god, whose birthday fell some days before. Ganesh appears in some unofficial versions of the Mahabharata, a Hindu epic, as a scribe, whose quill pen breaks in his haste to record the poem as a sage recites it. Not to be beaten, Ganesh snaps off one of his tusks, dips it in ink and does not miss a line.

Those virtues of determination and improvisation explain much of the success of India's celebrated IT firms, such as TCS, Wipro and Infosys. Each firm has its epic tales of deadlines made and obstacles overcome. Their exports of IT services (which do not include other back-office services) grew by 36% in the last fiscal year (which ended March 31st) to reach $18 billion, according to NASSCOM, the industry association. IT services employed about 560,000 people. Most of them seem to clog Bengalooru's Hosur Road each morning. The big three have landed several deals each worth over $300m (with companies such as Skandia, General Motors, United Biscuits and British Telecom) and margins are still healthy: Infosys, for example, reported an operating margin of 28% for the third quarter.

AFP

But some in the industry think India should be doing more with its intellectual resources. It should aspire to be the poet, not the scribe. India's exports of its own software—or licensing of its own intellectual property (IP)—amounted to about $450m in the year ending March 31st, a tiny fraction of its service exports. India, argues Craig Mundie of Microsoft, must go beyond renting out IQ and start creating IP.

Services are labour-intensive; products require a bit of capital. It thus makes sense that India started out by specialising in the former. In the 1970s it had lots of well-trained engineers, bred for an industrial future that somehow failed to materialise. Add a roomful of computers and a company could get to work. Indeed, in the early days, even the computers were sometimes lacking. The so-called “body-shopping” model—despatching Indian engineers to work on the site of an American or British client—first established itself after IBM quit India in 1978. At that time, it was easier to export an Indian programmer to an American computer than it was to import the machine to India.

But it is precisely the labour-intensity of services that must ultimately limit the industry's growth. To double its revenues, a service company has more or less to double its headcount, says Kiran Karnik, head of NASSCOM. That is expensive: wages of IT professionals are growing by 15% a year. TCS, for example, now has over 100,000 employees, having added over 12,000 bodies in the most recent quarter. Will its headcount need to swell to 200,000 before its revenues reach the $9 billion-$10 billion mark?

The god of small bits

Eventually, argues Ravi Venkatesan of Microsoft India, the country's firms will need to embody their brain-work in a patentable software product that, like an original poem, can be copied and sold, over and over again. What is stopping them?

One clue is given by a small advert posted in the second-class carriage of a Mumbai commuter train. It proclaims the virtues of Tradeannex, a four-in-one package created by a local software house, which offers small-business owners help with sales, purchases, inventory and taxation. But as well as selling the product, the advert also confesses the company's need for “distributors and channel partners”.

Indian software firms often lack the wherewithal to push a product in the marketplace, and to survive the marketplace's whims. Services yield predictable returns: it is like “an annuities business,” says Mr Karnik. Products, on the other hand, require a heavy outlay up-front, which may never be recouped if the package fails to find enough distributors, “channel partners” and customers. I-flex solutions, India's biggest software-product success, survived its early years by running a services business on the side. Its vice-chairman, R. Ravisankar, thinks other Indian firms lacked the “front-end spit and polish” that a successful brand requires.

India Picture

Revenue per head

To make a successful product, a company needs to be close to its customers. But Indians do not use much software—they bought only $1.6 billion-worth last fiscal year—and when they use it, they do not pay for it. Piracy rates are as high as 72%. One company, Tally, has succeeded by writing accounting programs for small businesses in India and other emerging markets. It touts “the power of simplicity” and traces its origins to the efforts of its founder and his son to computerise their own company's accounts in the 1980s. You can buy the silver edition of Tally's ninth release for 11,232 rupees ($290). This compares well with foreign packages that are “atrociously expensive” and “require two or three PhDs to run,” as Mr Karnik puts it.

Meanwhile, the services firms themselves seem happy renting out IQ. Their aim is not just to add heads but to earn more revenue per head. To do this, they will have to earn money from the right side of their brains as well as the left. K. Ananth Krishnan, the chief technology officer for TCS, uses the analogy of an expensive hairdresser, who might examine you for 15 minutes, then snip two locks of hair. He charges you not for how much he cuts, but for what is left and how he has shaped it. Likewise, India's leading firms hope to move away from charging clients on the basis of inputs—“time and materials”—or even outputs—pieces of code. They want to charge customers on the basis of the gains their IT services can deliver, such as cutting their billing costs.

Mr Karnik thinks it little exaggeration to say that companies are either born as product companies or as service companies, not both. Scribes want to become better scribes. To become a poet, you probably need to be born as one.

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The Factory Of Factories;
How Germany's nimble manufacturers are besting not only their Western rivals, but the Chinese, too.
By Stefan Theil

If you think farm machines are boring and low-tech, you haven't seen the Lexion. The world's most efficient combine harvester is precision-guided by satellite and laser optics to mow grain at the rate of 60 metric tons an hour—enough to feed a city of 350,000 for a day. Real-time sensors measure each square meter's yield, instantaneously adjusting next season's seed and fertilizer quantities. Built by Claas GmbH in a German hamlet called Harsewinkel, the Lexion's €400,000 price tag is one third higher than the competition's top-end model, but its greater productivity means that big farm operators from Russia to Australia can't get enough of them. The 3,000-worker Harsewinkel plant, which ships 76 percent of its production abroad, has an order backlog well into 2009. Competitors in China don't worry Claas. "As long as we keep innovating, we're not afraid of anyone," says Theo Freye, chairman of the fast-growing, €2.7 billion-a-year company.

Companies that turn ordinary metal-bending into worldbeating technological wonders are a prime reason German firms have been among the leading beneficiaries of globalization. Of the world's major economies, only Germany and China have boosted their share of world exports since 2000. Germany's share is up 5 percent, while France, Japan and the United States have steadily slipped—minus 10, 25 and 30 percent, respectively. The United States now represents some 8.6 percent of global exports, up from 12 percent in 2006. Germany's share rose from 8.5 to 9.4, and China's from 3.8 to 8.1.

While other Western countries worry about a slowdown, Germany seems to be chugging right along. In November, the country's machinery producers' association—which accounts for one third of German exports—revised 2007 production numbers upward, showing the sector growing by 15 percent, the fastest rate since 1969. Fresh auto-industry numbers show exports racing ahead by 11 percent in 2007; the sector has boosted employment by 20 percent, or 160,000 workers, since 1995, while the number of jobs dependent on exports has gone up from 5.9 million in 1995 to 8.3 million workers today. With other manufacturing sectors like trains, turbines and chemicals also surging, economists have recently begun to talk about the "reindustrialization of Germany" and a "second economic miracle."

It's a miracle that is based largely on the success of the very countries that were supposed to undermine Germany—emerging markets with cheap manufacturing labor. Rather than undercutting German manufacturers, these nations have actually bolstered them, as their new middle classes buy more German cars and local factories shell out for topnotch German heavy machinery. These are sectors where German companies have long been strong, and have been gaining competitiveness vis-à-vis other Western countries. It's a trend evidenced by the fact that it was Germany, not China, that in 2003 passed the United States to become the world's leading exporter of merchandise; in 2006 German companies shipped $1.11 trillion worth of products abroad, versus America's $1.04 trillion and China's $969 billion. (If you add services, the United States remains slightly ahead.)

All this belies the idea that globalization was supposed to make life near impossible for an Old Economy, high-wage country like Germany. The future was to belong to high tech and services, not old-fashioned manufacturing. But this conventional wisdom is being upended by the Germans, who may offer something of a model for other developed economies.

As neighbors watched in some wonder, German companies regained the competitiveness they lost in the early 1990s. Smart deals with unions, for example, helped big exporters such as BMW and Siemens lower wage costs by about 15 percent relative to competitors in other major exporting countries like France. While Germany's labor market remains ossified by overregulation, the legalization of temporary workers in the 1990s also helped companies become more flexible.

But that's only the well-known part of the story. Much less familiar are the global trends that German companies have been able to leverage in their favor. First and foremost is the Return of the Old Economy. Contrary to popular belief, it's not IT or made-in-China consumer goods that have driven world economic growth since the turn of the millennium. That's because the 1990s boom in IT—which benefited countries like the United States and Japan—has fizzled as prices for tech hardware have fallen.

Similarly, services have been stagnating at roughly one fifth of world trade for years. Instead, there has been an unprecedented surge of equipment-buying in emerging economies, as countries from China and Russia to the Middle East build factories, upgrade transportation and improve infrastructure—a trend economists expect will last years, if not decades. Developing and transition countries have accounted for more than a third of German export growth since 1995, and in 2006 Germany even managed to run an €11 billion trade surplus with these countries—€21 billion if energy suppliers like Russia and Kazakhstan are factored out.

Even as other Western countries have shrunk their industrial sectors, Germans have been expanding market share vis-à-vis their rivals in these strongly growing areas. That's the main reason Germany's manufacturing-heavy DAX Index soared 22 percent in 2007, 18 points more than the S&P 500 and Britain's FTSE, 21 points more than France's CAC 40, and 33 points more than Japan's Nikkei. Behind the gains were export powerhouses such as carmaker Volkswagen (up 82 percent) and industrial conglomerate Siemens (up 44 percent). "China may be the world's factory," says Hermann Simon, CEO of a German consultancy advising exporters. "But German companies are building it." And they're finding it quite profitable to do all that building at home.

The second global trend contradicting the familiar public debate over globalization and outsourcing is the way companies increasingly compete on quality, not just on price. "We all expected China to move into certain sectors, forcing Germany to specialize in something else," says Yale trade specialist Peter Schott. Instead, economists have been astonished to see German companies stay put and even thrive, as they compete in the same products as China. The obvious conclusion, says Schott, is that more-expensive German goods have something customers want, such as better quality or services like lifetime maintenance, systems integration and upgrades. That's why Germany dominates the global markets for exotic factory machines from cocoa processors and carton creasers to warp knitters and lipstick fillers (in each of these niches, a single German company controls 70 percent or more of the global market). The new view, says Schott, is that as long as German workers stay up on quality, they can insulate themselves from Chinese competition.

One indication that German companies aren't waiting for China to catch up is that the premium customers are willing to pay for German products has been steadily rising. Germany's export prices to the United States, the world's largest importer, have risen twice as fast as China's since the late 1990s, even as Americans order more German products. In France, Germany's biggest export market, the German premium has risen even faster even as exports have gone up. Schott says that the widening price gap reflects quality upgrading, as German firms specialize in ever-more sophisticated versions of products.

Take Dorma, the world's leading manufacturer of what seems, at first glance, a lowly and exchangeable product: door locks, hinges and glass walls. Yet it's one of Germany's fastest-growing global companies, delivering to construction sites from Shanghai to Dubai.

How does Dorma beat out dozens of cheaper rivals? The €700 million-a-year firm is one of Germany's top-50 patent holders and one of the very few firms capable of installing the complex security systems to go with its door hardware for über-projects such as the 160-floor Burj Dubai. This isn't just about making the best locks, but about having the top security software, and the best project managers.

Similarly, Würth has turned distributing screws, bolts and construction hardware into a €7 billion-a-year global empire growing at a China-like rate of 12 percent for more than a decade. The product may be low-tech and replicable, says CEO Robert Friedmann, but no competitor can handle 24/7 product queries in 86 countries.

These seemingly old-fashioned yet secretly innovative midsize companies, as well as larger manufacturers like Siemens and Daimler, are at the heart of something like a New Knowledge Economy. Automakers like BMW and car-component specialists like Bosch churn out an estimated two thirds of the global auto industry's innovations, according to data from Oliver Wyman, a consultancy specializing in manufacturing. Germany may not be at the forefront of university-based research, says Jürgen Matthes, an economist at the Institute of the German Economy in Cologne. "But our machinery and auto industries take the IT others have developed and find innovative ways to embed it in our products."

A recent study by Germany's Fraunhofer Institute shows German manufacturers (which represent 90 percent of the nation's R&D spending) are introducing new products at a rate we usually expect from the IT sector.

Machinery makers, for example, make one third of their revenue from products on the market for fewer than three years. "What these companies specialize in might not be high-tech in the conventional sense, but they're among the most complex things you can imagine," says Thomas Kautzsch, machine-industry consultant at Oliver Wyman in Munich. As a result, says Kautzsch, there are dozens of niche sectors where German companies have innovated their competitors right out of the market. Case in point: Herrenknecht, a one-man engineering business in the 1960s, now practically owns the global market for the complex heavy machinery used to dig tunnels. It's using its digging expertise to expand into geothermal energy—another rapidly expanding sector.

Coupling their wares with high-tech products and services is another clever way many German manufacturers are successfully removing themselves from low-wage competition. Claas delivers the farm-management software to go with its harvesters and offers consulting in biofuels. Schmitz Cargobull, Europe's leading manufacturer of trailers, has added a financing unit, lifetime service contracts and GPS cargo monitoring, all of which are providing an increasing share of revenues. Factory builders like Voith, the world's biggest builder of paper-production plants, or Dürr,

which supplies the painting units to many of the world's car plants, also plan construction, train workers, service equipment and supply upgrades—usually with a global service network that minimizes costly shutdowns. The result is also a package no Chinese upstart supplier can match without investing billions, Simon says. Economists call it an "entry barrier." For companies like Voith and Dürr, it secures profits and jobs.

The German boom appears surprisingly resilient. Last week figures for November industrial orders surprised economists expecting a slowdown, showing a year-on-year gain of 13.6 percent. So far, neither the superstrong euro nor the subprime debacle seems to have dented German industrial prowess. Surging exports account for 80 percent of German GDP growth since 2000, helping the country outgrow neighbors such as France (2.5 vs. 1.8 percent in 2007, 2.9 vs. 2.0 in 2006). Now that export successes are feeding into the larger economy via rising employment and wage hikes, economists say rising domestic consumption could help buffer a potential global slowdown in 2008.

Outsourcing to cheaper locations such as Eastern Europe has come to a halt, says Matthes, and some companies are returning production home. Fraunhofer has identified 3,500 firms in the machine and chemical industries that have returned offshored production since 2000, often citing quality problems, logistical costs or disruptive employee-turnover rates in places like China. "We don't outsource, we in-source," explains Bernd Hoffmann, chairman of Schmitz Cargobull.

Neighbors like France are watching closely. In France, President Nicolas Sarkozy is embroiled in a debate over how to gain back the competitiveness the French economy has lost in recent years. "The gap between France and Germany has grown," says Frédérique Sachwald, an economist at the French Ministry of Research. "French companies have been slower to control costs and innovate." Because of past protectionism, she says, they have been less exposed than their German rivals to the competitive pressures of global trade. The competing model for creating growth, a U.S.-style focus on high-tech innovation and entrepreneurial "creative destruction" would require large-scale changes as well. Whether countries like France look for Germany or America as a model, however, the present focus of French government planners—protecting national champions—is exactly the wrong policy, concludes a November report by Bruegel, a Brussels think tank, comparing the French and German export industries.

That's not to say that Germany's gung-ho export model is a cure-all, even at home. While the manufacturing dominance of the German economy is growing, total manufacturing jobs have only lately registered a small uptick. Because of a dramatic weeding out of uncompetitive companies and products, the share of factory labor shrank from 40 percent of the work force in 1990 to 20 percent today. The new mean, lean, tech-heavy factories need not hordes of low-skilled laborers, but highly skilled specialists and engineers who are in short supply, which is already cutting into growth at many exporters.

Government policy could make matters worse. After decades of fruitless debate over migration policy, the country remains all but shut off to skilled immigrants. Lately, Angela Merkel's leftward-leaping ruling coalition has been discussing plans to crack down on temporary employment, which would strip German companies of some of the flexibility that's helped them regain competitiveness in recent years.

The biggest danger, of course, is the possibility of continued financial turmoil—or a recession in the United States putting a brake on global growth. Already, inflationary pressures that are part and parcel of this trouble are making German consumers (always

hypersensitive to inflation) more tightfisted. But even as they pinch pennies, German companies are struggling to keep up with a surge in orders. There's no doubt that a sustained downturn in the United States (their No. 2 export market) could change that two-track picture, pulling overall German growth down much farther. Yet, as long as China and other key emerging markets can balance things out, Germany's re-energized Old Economy may stay one of globalization's biggest winners for a long time to come.