

WHO'S AFRAID OF CHINA'S HIGH-TECH CHALLENGE?

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China's miracle growth story may be losing its allure, as the country's economic model increasingly shows signs of stress in the face of stiffening headwinds and ballooning debt. But Beijing's determination to force the pace of China's industrial development and to transform the nation in the next few years into a – even the – global pace-setter across a broad swathe of science and advanced technologies continues to inspire shock and awe abroad.

The list of China's achievements to date looks impressive. It claims already to have installed more DNA sequencing capacity than the US and has recently unveiled the world's most powerful supercomputer. Its universities turn out more engineering graduates – about 2 million annually – than any other country, and it is now the biggest recipient of patent applications, having recently overtaken both the US and Japan. According to Britain's Royal Society, China is on course

to outstrip the US as the biggest source of scientific publications by 2020.

On the face of it, these are remarkable advances by a country that ranks a lowly 90th in the World Bank's league table of income per head and still has 160 million people living below the poverty line. They are all the more striking for having been made in such a short period of time.

China's ambitions are more breathtaking still. The most far-reaching, embodied in its government-led Strategic Emerging Industries initiative, aims not just to catch up with – but to overtake – western and Japanese leadership in seven sectors, including clean energy, information technology, biotechnology, advanced manufacturing and new materials. The programme is backed by state funding estimated at between \$1,500bn and \$2,000bn over five years, boosting progress towards

SUMMARY

Over the last 30 years, the speed and scale of China's economic rise have stunned the world. Now its government has mapped out bold plans for the next phase of the nation's development: transforming it into an innovation powerhouse that occupies a leading, and ultimately dominant, global position in a range of science-based industries of the future.

China's ambitions and the government's central role in formulating strate-

gies and mobilising resources for fulfilling them have evoked mixed responses elsewhere. Some foreign policymakers and businesses complain that the country's dirigiste approach and subsidies distort competition and flout trade rules. Others, in contrast, argue that other countries should be inspired by China's example to embrace more active industrial policies aimed at promoting successful high-technology champions.

This paper examines China's policies

and its current level of industrial development. It finds that many of its efforts so far to stimulate innovation are less impressive than they seem and questions whether the country's ambitions are attainable. It concludes that, while there is a role for the right kind of industrial policy, China's version is deeply flawed and that policy makers elsewhere would be unwise to try to emulate it.

China's objective of lifting research and development spending, currently about 2 per cent of GDP, to 2.5 per cent by 2020.

China's drive to dominate the industries of the future has drawn a divided and sometimes confused response from policy makers and businesses elsewhere. Some have cried foul at the dirigiste policies and public subsidies that underpin it, complaining that they distort international competition and violate trade rules. Others argue that the west should learn from China's example and do more to equip its own industries to hold their own by harnessing the power of the state to setting strategic goals and mobilising the resources and funding needed to achieve them.

This paper does not aim to analyse in detail the rights and wrongs of China's trade practices. Rather, it will examine critically the country's efforts to scale the scientific and technological commanding heights. It will argue that its progress is slower than is widely believed and confronts numerous obstacles that its current industrial and technology policies are poorly designed to surmount: indeed, they may well prove a costly handicap to China's economic development.

GENUINE INNOVATION - OR STATISTICAL ILLUSION?

It is easy to be dazzled by crude statistics charting China's advances in science and technology into believing that it is poised to scale the commanding heights. However, a look behind the numbers exposes a different picture.

One of the yardsticks of successful innovation is patents. China has only had a patent law since 1985, but in the past decade its domestic patent applications have surged. Their growth does not, however, reflect a sudden, spontaneous, explosion of innovation. It has far more to do with the government's numerical targets for patent applications – the official goal is 2 million by 2015 - and with the extensive financial and other inducements it offers applicants and patent authorities in order to try to hit them.

This mechanistic "Soviet tractor factory" approach has,

unsurprisingly, favoured quantity over quality. In 2011, fewer than a third of applications to China's patent office were classified as "innovation" patents, and these accounted for only one tenth of all patents granted between 1985 and 2010. The remainder were lower-quality design and utility-model patents that need to meet far less demanding standards – so much so that some Chinese experts have said that they risk bringing the whole patent system into disrepute.

Several studies have found that patents granted to Chinese owners are generally of lower quality than those held by non-Chinese. The difference is reflected in the huge imbalance between the income China receives from foreign royalties on patents it has issued and its royalty payments to patent holders abroad. In 2011, the value of the former amounted to \$1bn, while the latter was \$18bn – a deficit of \$17bn. In the same year, in contrast, the US ran a surplus of \$82bn on patent royalties.

Some of the shortfall may be explained by multinational companies' practice of charging their Chinese subsidiaries royalties for R&D, marketing and branding. Nonetheless, the evidence seems clear that China remains far more dependent on imported technologies than on those it has developed itself.

Perhaps the most striking, and certainly the most contentious, of China's attempts to close the innovation gap is the pressure it has imposed on foreign companies to divulge their most sensitive proprietary technology in exchange for access to its national market. This policy, dignified – with no doubt unintended irony - by the title of "indigenous innovation", has aroused widespread international condemnation. Although it was supposedly dropped in 2011, foreign businesses say formal requirements have been replaced by less overt official means of inducing them to "share" their technology.

How much these policies have done to raise the technological capacity of Chinese companies is debatable; indeed, they may have even been counter-productive, spurring foreign businesses to devise ways of guarding their most valuable knowhow more effectively and making them even more wary of sharing it with Chinese partners. That could spell danger for China: for instance, reports

have blamed the 2011 high-speed train crash in Wenzhou, in which 40 people died, on a signalling system that failed because the Chinese company that copied it from a Japanese design had been unable to decipher and replicate its vital inner workings.

In any event, China's use of such tactics clearly amount to an implicit acknowledgement that, for all its authorities' brave talk about advancing the frontiers of science, the country actually still lags far behind the global leaders and is struggling – by fair means or foul - to catch up.

China's own research and development efforts will be critical to its ability to do so. It certainly does not lack for the necessary funds: last year, it spent almost \$300 billion on R&D, second only to the US and more than Japan and Germany, the next two largest spenders, combined.

However, R&D spending is, at best, no more than a crude measure of input: it says nothing about output. And there are numerous questions about how well China performs on that score. It undoubtedly possesses many clever - even some brilliant - scientific brains and well-trained and resourceful engineers. However, both their numbers and their capability can easily be, and often are, over-estimated.

Though China's education system turns out vast numbers of science and technology graduates and postgraduates every year, their quality and suitability for employment are often much lower than those in the west. A 2008 study by Duke University found that engineering degrees in the US were generally of a higher standard than those in China, while an overwhelming majority of more than 80 companies worldwide surveyed in 2005 by McKinsey, the management consultancy, considered US-educated engineers to be far more employable than those educated in China or India. Engineering UK, a professional body, calculates that, in relation to its population, Britain trains two-and-a-half times as many employable engineers as China.

Other constraints also hinder R&D in China. Intense competition to achieve quick results and thereby improve personal promotion prospects has led to widespread academic plagiarism; fear or intolerance of failure tend both to discourage unorthodox or original lines of inquiry and

to encourage a "box-checking" mentality more concerned with seeking kudos by completing tasks rapidly than by ensuring that they are done properly. Another commonly-cited weakness is poor team-working skills, which make complex projects difficult to manage. Though not all Chinese engineers and scientists suffer from these drawbacks, they appear to be more the rule than the exception.

More generally, incentives to think freely are weak in China. All big breakthroughs involve, by definition, a readiness to question conventional wisdom and challenge the established order. But in China, such behaviour is constrained both by an education system that emphasizes rote learning and by a political regime that prizes adherence to the party line and penalizes, sometime brutally, those who deviate too far from it.

Since China's new leadership took over last spring, those restrictions have been conspicuously tightened in an effort to strengthen the party's grip and stifle dissent. It has published edicts, which many observers have likened to Maoist tracts, strongly condemning western capitalist values and freedom of expression and reaffirming the centrality of far-reaching Party control over the economy. This climate hardly seems conducive to promoting creativity, radical experimentation and original thinking.

Innovation, by definition, consists of more than invention. It requires the ability to transform laboratory breakthroughs into marketable products and services that fulfil genuine needs and demands and, ultimately, yield a profit for those who supply them. That, in turn, requires the capacity to harness a far wider and more complex combination of skills and capabilities than just technical competence.

How well-placed is China to make the leap from an economy whose growth has depended largely on abundant cheap capital and labour into one that competes on the basis of quality, smart brainpower, technological sophistication and high levels of value-added?

A common gauge of a country's progress towards that goal is Total Factor Productivity. TFP is a "residual" that measures all the economic inputs that cannot be explained

by productivity of capital and labour – and which also enhance their contribution. Those inputs are commonly considered to include technical skills, management capabilities, organizational competence and resource allocation, as well as productive R&D and the ability to apply as well as to develop technology.

In the early years of the 21st century, China achieved rapid annual gains in TFP. Since 2007, however, they are estimated to have fallen by as much as half. At the same time, productivity of capital has declined sharply, as the amounts needed to generate a given increase in GDP have soared, while previous rapid growth in output per worker has recently gone into reverse. Indeed, calculations by Ernst & Young, the accountancy firm, find that China has not been moving closer to the “technology frontier” – defined as the performance level achieved by the world’s most advanced and efficient economies – but slipping steadily further away from it.

Some of those adverse trends may be attributable to the impact of the global economic crisis and of China’s response to it – particularly its massive credit-fuelled stimulus package in 2008, which has led to large-scale misallocation of capital, asset bubbles and a huge build-up of debt. However, more fundamental long-run structural forces are also at work.

GLOBAL GIANTS – OR BUMBLING PYGMIES?

If China is to fulfil its rulers’ dreams of dominating world markets for the products and services of the future, it will need companies capable of realizing them. But it is far from obvious that it possesses enough of them, or will do so any time soon, despite the emergence of enterprising, mainly privately-owned, new entrants on its domestic market in sectors such as online services, smartphones and tablet computers.

China’s industrial structure suffers from three principal weaknesses:

* Fragmented production and the creation of persistent and chronic over-capacity. In the automotive sector, for instance, more than 100 Chinese companies battle for survival, competing largely on price, not quality. Their

share of their home market has dwindled to barely one quarter of total car sales, as Chinese consumers have turned in growing numbers to foreign marques, both imported and produced locally in joint ventures with foreign companies.

In car-making, as in many other sectors, two main factors are responsible for creating and sustaining this situation. One is the patronage of provincial and municipal authorities eager to groom local industrial champions. In addition to being showered with subsidies, many home-grown car makers are sheltered by local protectionist barriers. The result is an atomised home market littered with sub-scale and often barely profitable producers.

The second factor is China’s severely distorted financial system and its heavy reliance on fixed asset investment – currently almost half of GDP – to drive growth. Tight restrictions mean that the main home legally available for China’s plentiful savings is bank deposit accounts, which pay very low – often negative – interest rates. This “financial repression” provides state-owned banks with a vast pool of ultra-cheap money, much of which they lend for investment in unneeded industrial capacity and property development.

However, as China’s growth slows, demand weakens and its 2008 credit splurge turns into something looking ominously like a credit crunch, the system risks becoming a doomsday machine. Companies in industries including steel, motor vehicles, chemicals and solar panels that funded heady expansion in the good times by borrowing heavily are now squeezed by growing unused capacity and severe financial pressures. Many face a harsh choice between raising much-needed cash through distress asset sales, trying to get the government to shoulder their debts or going bust.

China’s authorities are also trying actively to promote consolidation of highly fragmented and excess-capacity sectors through mergers and takeovers. However, they are relying mainly on bureaucratic fiat, not on increasing corporate exposure to market forces. Their approach is unlikely to prove much more than a short-term fix while China continues to shrink from deep financial reforms that would enable capital to be allocated more efficiently.

* The role of State-Owned Enterprises. Notwithstanding a proliferation of smaller producers, SOEs dominate many Chinese markets and in many cases enjoy monopolies or oligopolies that exclude private competitors. They are particularly powerful in sectors viewed by Beijing as being of “strategic” importance, such as banking, steel, aerospace, air transport, telecommunications and energy.

The SOEs enjoy many commercial privileges, including preferential access to finance – they have long accounted for the lion’s share of corporate lending by China’s banks – favourable regulatory treatment, tax breaks, subsidies and the award of many big public procurement contracts. They owe those advantages to their close links with the Communist party, which appoints their top executives, some of whom carry vice-ministerial rank and who often move on to senior government positions.

The SOEs’ defenders like to portray them as the shock troops and standard bearers of China’s industrial advance. In reality, most are far less efficient, nimble and enterprising than privately-owned companies. Indeed, overall they probably destroy more wealth than they create. Unirule Institute of Economics, an independent Beijing think tank, calculates that subsidies accounted for SOEs’ entire reported profits from 2001 to 2009 and that, if these are deducted, SOEs’ real average return on equity was negative over the period.

Though the SOEs’ economic role has diminished somewhat, they still generate an estimated 40 per cent or more of industrial output. They continue to dominate the economic landscape, not because they are innovative or commercially dynamic, but because they provide the government and the party with levers of economic control. At least as important, they are widely reported to be among the main sources of the funds that fuel the political and official corruption that is rampant in China.

Economic reformers argue, with growing insistence, that the SOEs need to be cut down to size by removing many of their privileges and exposing them to stronger competition and market forces. But although Li Keqiang, China’s reform-minded Prime Minister, favours greater liberalisation, it is far from certain that he will be able to override fierce resistance to change by the SOEs’ champi-

ons in the party who profit handsomely from preserving the status quo.

* International capability constraints. Despite all Beijing’s exhortations to companies to “go global” and the ample resources it places at their disposal, few outside the energy and natural resources sector have yet done so successfully, and most are private companies. The exceptions include Huawei, which has become an international force in telecommunications network equipment, Lenovo in personal computers – though it has more obviously prospered on its home market than abroad – and Haier, an SOE, in domestic appliances.

Indeed, for most Chinese companies, overseas expansion means starting from scratch and climbing a steep learning curve. Their performance as formidable exporters is of little value in that endeavour because most are still anonymous sub-contractors to foreign businesses - whose local manufacturing operations generate about half of China’s exports.

As a result, most Chinese companies lack internationally recognised consumer brands and the marketing expertise and distribution channels needed to control the downstream activities from which western competitors’ biggest profits are often made. Furthermore, a succession of health and safety scandals has left several Chinese-owned industries, including pharmaceuticals, toy making and food processing, with unenviable reputations that extend far beyond the country’s shores.

Those factors starkly differentiate China’s “go global” drive from the international expansion by Japanese business that got under way half a century ago, and to which it is sometimes compared. Western companies and consumers may have scoffed then at Japanese-made products as cheap knock-offs. However, as the west was to discover, they were produced with unrivalled efficiency to exacting quality standards by methods that were to revolutionise global manufacturing. Furthermore, Japan’s global advance was led by companies with a decades-long manufacturing heritage and strength-in-depth in sophisticated materials and engineering.

Chinese exporters enjoy none of those advantages. De-

spite government efforts to drive them up the technology ladder, many are still not much more than assemblers of imported components, to which they add relatively little value. Their role primarily as sub-contractors, with little direct contact with markets abroad, has also left them ill-prepared to deal with the important but often subtle variations in tastes, culture and market conditions that they encounter when expanding across borders. One striking example is a new car launched recently by a large Chinese automotive group and targeted initially at the British market. Only when the car was nearing the prototype stage did the realization dawn that it had been designed with the steering wheel and other controls on the left-hand side.

In truth, Chinese industry is embarking on international expansion, not as some unstoppable superior force, but as a demandeur that lags far behind the best practice of the global leaders and has much to learn from them. Unsurprisingly, a growing number of Chinese companies have concluded that buying expertise and experience abroad promises faster results than building it themselves.

However, that route is also littered with pitfalls. Acquisition of “crown jewel” companies in the west has eluded Chinese bidders ever since China National Overseas Oil Corporation launched its disastrously ill-judged hostile bid for Unocal, the California-based oil company, in 2005, stirring up a storm of political opposition in the US. Though the incident taught would-be Chinese acquirers to tread cautiously abroad, they still risk triggering backlashes, as evidenced by the recent outcry in Congress at the proposed \$4.7 bn. friendly takeover by Shinghui of Smithfield Hams - hardly a strategic US asset.

Indeed, despite Chinese companies’ reputation for paying fancy prices, many of their most conspicuous foreign acquisitions so far have been of lame ducks, such as Britain’s Rover and the French Thomson group’s European consumer electronics division, or of unwanted corporate orphans, such as IBM’s personal computer business and Volvo and Saab in Sweden, which their previous owners were all too eager to dispose of.

Chinese companies are far from the first to learn to their cost that dominance of domestic markets – especially when it is due to large doses of government pampering

and favouritism – can be hard to replicate internationally; or that businesses that are giants at home can all too often prove to be bumbling pygmies when they venture abroad. As China’s aspirant world-beaters are discovering, the global stature to match their and their rulers’ ambitions cannot be gained overnight – if, indeed, it can be gained at all.

CONCLUSION

This paper has sought to challenge two common beliefs: that China is on an unstoppable long march to seize world leadership in advanced industries, and that China’s model of state intervention and control is either responsible for the country’s industrial rise or is a model to be copied or feared. The truth, more likely, is that it is holding the country back.

All the evidence suggests that much the most dynamic parts of China’s economy are those where the state and the party have intervened least and liberalized markets most, while the poorest performers are those where they have retained tightest control. By almost any measure – job creation, operating efficiency, exports, profitability or innovation – privately-owned companies as a group have consistently outclassed the lumbering state-owned sector, even though they enjoy few of its privileges and often suffer outright discrimination at the hands of the state.

Grand government projects, such as building the world’s fastest supercomputer or plotting leadership in the industries of tomorrow, may engender a sense of national prestige and, perhaps, underpin the legitimacy of the Communist party at a moment when it faces unprecedented challenges and pressures at home and abroad. But the economic and commercial value of such projects, even if achievable, remains unproven and their opportunity cost imponderable.

To students of industrial history, China’s policies evoke a compelling sense of *déjà vu*: national and sectoral economic plans; government designation of “strategic” national industries; identification by bureaucrats of markets and technologies of the future; visionary strategies and detailed targets for achieving world leadership in them; heavy reliance on “national champion” companies, headed

by technocrats with close links to political power, to implement them; and, of course, massive state support.

That describes China's "model" today. But it was also the approach taken by France – and to an extent some other European countries – from the 1960s until the late 1980s in an effort to promote industrial development. At best, it achieved few of its commercial objectives and, at worst, ended in costly failures.

Its only unequivocal success was the Airbus programme, to which French commitment has been critical. However, while France's policies have endowed it with high-speed trains, cheap nuclear energy and efficient modern telecommunications, they have not yielded the hoped-for global leadership in any of these sectors: few TGV trains have been sold outside Europe, while France was the only market for minitel, an early electronic information system soon rendered obsolete by the advent of the personal computer and the internet. Other grand, and expensively subsidised, plans to blaze a trail in computing, the electronic office, cheap facsimile machines, futuristic audio-visual equipment, consumer electronics and other "frontier" industries sank without trace, casualties of superior international competition or technological discontinuities unanticipated by France's best and brightest bureaucratic brains.

That should be a cautionary lesson both to China's government and to those elsewhere – above all in Europe – who cast envious glances at its state-directed industrial policies and believe they are a model to be emulated. True, China's economy, its market, its financial resources and its state are all far bigger than France's. That does not, of itself, make its policies any more likely to succeed. It does, however, greatly increase the scale of risks and the potential cost of failure.

Europe should avoid the temptation to repeat the same mistakes by succumbing once again to the idea that state dirigisme and mobilization of resources are the magic ingredient needed to promote innovation, competitiveness and growth. Above all, European policymakers should avoid equating China's crude "innovation by numbers" approach with real achievements, when it is at best a – sometimes deceptive – measure of inputs, not of output.

A paper tiger should not be mistaken for a fire-breathing dragon.

That does not mean that there is no place for industrial policy. However, it should not consist of glamorous public schemes that bring a gleam to a bureaucrat's eye. It should, rather, focus on creating the environment in which vigorous entrepreneurship, creativity and wealth generation can freely flourish.

That means that the priority for governments should be to focus on providing public goods such as modern infrastructure, high education and training standards, funding for basic R&D, sound regulation and flexible labour markets, while promoting rising productivity by keeping markets open and maximizing competition on them. All the clever strategic planning and goal-setting in the world cannot make up for falling down on that job; nor are they likely to add much if it is done properly.

As for China, the evidence to date suggests that it is trying to move too far too fast and probably in the wrong direction. The kind of dramatic breakthroughs that its state planners yearn for almost certainly exceed the current capacity of its industries to deliver and risk being frustrated by constraints on creativity. If there is a Chinese Thomas Edison, Henry Ford or Steve Jobs waiting to burst onto the scene, the least that can be said is that there is as yet no sign of it.

A more plausible development path for China is as an incremental innovator, improver and "fast follower" of inventions created by others – a role for which some more successful Chinese companies have demonstrated talent. That may be less glamorous than inventing the jet engine, the microchip, the internet or the iPad. However, as South Korea has shown, it can provide a solid platform for rapid development and a prosperous national economy. But if China is to aspire realistically to fulfill such an ambition, much will need to change there first.

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