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project summary

The Atlas of Ideas:
China, India, South Korea and the new geography of science

An introduction to the project
February 2006

'My visits to Asia, especially to China, have convinced me that Asia is in no doubt that it is in a race to the top – investing in technology, innovation, science and skills.'
Rt Hon Gordon Brown MP, Chancellor of the Exchequer, 9 September 2005

'Our ability to work with emerging scientific nations such as China, India and South Korea will be vital to securing Britain's long-term prosperity. I am pleased to offer my support to 'The Atlas of Ideas' project. This important and timely study will improve our understanding of scientific and technological change in Asia, and help policy-makers and the private sector to respond creatively.'
Rt Hon Jack Straw MP, Foreign Secretary, 12 October 2005

'We should be a country with strong science and technological links with the best research around the world. The Demos project will be a valuable tool to inform policymakers, universities and business on how to forge new partnerships in the future.'
Lord Sainsbury, Minister for Science and Innovation, 12 October 2005

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Four snapshots

In September 2004, a group of British scientists set off on a tour of China, South Korea and Singapore to review the state of stem cell research in the region. They were astonished by what they found. Many of the facilities they visited were on a par with the best European and US laboratories. Dr Stephen Minger, Director of the Stem Cell Biology Laboratory at Kings College London, was one of the delegation. 'I came back blown away by the whole thing,' he says. 'It was mind-boggling.' At one research centre in Shanghai, Dr Minger saw seven mass spectrocopy machines in a single lab. 'We have two in the whole university.'[1]

Bangalore's Hosur Road on a Monday morning is barely controlled chaos. Where the city gives way to the countryside sits the research campus of Biocon, one of India's leading biotech companies. There are 1,400 employees on the campus, and more than 60% of them have a higher science degree. They cost roughly a tenth of their equivalents in Munich or Cambridge, they speak flawless English and they are available 24-7 at the end of a high-speed data line. Das Goutham, head of research at the Biocon subsidiary Syngene explains: 'Look if only 5% of Indians were like us, with higher degrees, then we could have a scientific labour force the size of the entire population of the UK.'

J. C. Kim is not used to being thwarted. Kim started his career as captain of a tuna boat. At the age of 72, having built one of the biggest tuna businesses in the world, he is now investing in the future of biotech. He has personally funded one of Korea's leading scientists to create a herd of small, transgenic

[1] Stephen Pincock 'How did that happen?' *Financial Times*, 27 November 2004

pigs. He explains: 'Within ten years, we will be providing hearts for humans. We will have the biggest genetically clean pig population in the world. Using the technologies we are developing it should be possible for people to live fit and healthy lives till they are 100.' We are used to buying electronics components from Korea to upgrade our computers. Why not pig hearts to upgrade our bodies?

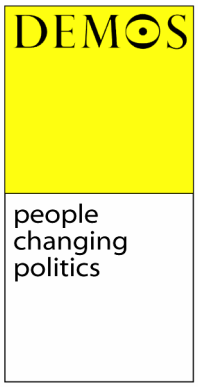
Li Gong was part of China's scientific diaspora. In 1986, he graduated from Tsinghua University and won a scholarship to Cambridge University. For four years, he studied under Roger Needham, the eminent computer scientist. Then, in 1990, he headed for Silicon Valley, and got caught up in the internet boom. For a long time, he thought he would never go back to China: 'But in 2000, things changed. China was becoming more open, there was more funding, and new business opportunities.' He was offered a job as head of Sun Microsystems' Beijing research facility, and now runs a lab with over 500 researchers. The projects he leads are as advanced as anything Sun is doing in the US: 'We get the cream of the graduates here in China. You can't keep them interested and motivated by routine R&D work. They want to own products, they want to be at the cutting edge.'

Project partners

The Atlas of Ideas is supported by a consortium of partners:

The Foreign and Commonwealth Office
UK Trade and Investment
British Council
Scottish Enterprise
Medical Research Council
Microsoft
Vodafone
Institution of Electrical Engineers
South East of England Development Agency (SEEDA)
East of England Development Agency (EEDA)
Universities UK
Irish Management Institute
Forfas
Claydon Gescher Associates (CGA)

Each of these partners sits on the project steering group, alongside a number of independent experts on science, innovation and globalisation.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The new geography of science

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Across the world, the boundaries of science and innovation are being redrawn. Two powerful forces are at work. The first is the greater political and economic emphasis being placed on science and technology by countries such as India, China, Brazil and South Korea. These emerging 'science powers' are investing heavily in their research base in a sustained effort to lead particular areas of IT, biotechnology and nanotechnology within the next ten to fifteen years.

China's long boom, which has seen GDP expand by roughly 9% a year for more than a decade, has fuelled unprecedented investment in science. China's spending on R&D has trebled in the past seven years, and is predicted to rise from 1.2 percent of GDP to 2 per cent by 2010. Already, this investment is starting to deliver some impressive results. Martin Blume, editor of Physical Review, has started receiving a flood of papers from China. 'Other scientific publishers are seeing the same trend', he says.

In India, GDP growth of around 6% is being driven by new knowledge-intensive industries, particularly in IT and business process outsourcing, and increasingly in higher-values areas of R&D. Call centres may have attracted the most media and political attention, but they represent only one piece of a much bigger picture. McKinsey estimates that by 2007, knowledge-based sectors will be a $57 billion export industry, accounting for four million jobs and 7% of India's GDP.

And South Korea, which now commits 3% of GDP to R&D (a larger share than either the US or the UK) has made a series of high-profile breakthroughs in IT, telecoms and biotechnology. The research investment translates into increased patenting and technology gains, with overseas sales of electronics products exceeding $100 billion in early 2006. Large and small companies, from LG Life Sciences to some 600 venture firms, are investing in long-term biotech initiatives ranging from drug delivery to bioinformatics.

Of course, it is wrong to exaggerate these trends. US investment in R&D still dwarfs that of the rest of the world, and American and European scientists dominate the league tables of academic citations and Nobel laureates. In a 2004 *Nature* article, Sir David King celebrates the fact that the UK, with only 1% of the world's population, has 11% of the world's most cited scientific papers.[2] But this picture is changing fast. Such metrics don't necessarily reflect the dynamism and speed with which others are catching up.

[2] D King 'The Scientific Impact of Nations' *Nature* Vol 430, 15 July 2004

A second, but equally significant force is the rise of 'offshore innovation'. The first wave of offshoring, which began more than thirty years ago, saw manufacturing shift gradually to the low-wage economies of the east. As a result, China is now the world's manufacturing hub, last year producing 50 per cent of the world's cameras, 30% of its air conditioners, and 25% of its washing machines. A second wave, which has gathered pace in the past two years, has seen thousands of back office and call centre jobs being created in India.

Yet already, a third wave is underway. This time, it is higher value R&D that is being outsourced or co-located overseas. Some of this is flowing into 'captive' R&D labs, established by multinationals in India or China. And some is flowing to the home-grown giants of the Indian services and software industry, such as Infosys, TCS and Wipro.

The attraction of technology clusters in cities such as Shanghai and Bangalore was originally based on their cheap supply of labour. But as the R&D infrastructure has improved, these cities have become magnets for foreign investment and collaboration. A clutch of hi-tech firms, including Microsoft, Cisco, Nokia, AstraZeneca and Intel, have now opened R&D labs in either China or India. Craig Barrett of Intel argues that the Chinese 'are now capable of doing any engineering, any software job, any managerial job that people in the US are capable of.'[3]

This in turn has created a climate in which thousands of Indian and Chinese scientists, trained in the US or Europe, have returned home to pursue their research careers. Harry Shum, head of Microsoft Research Asia, explains why he's in Beijing, rather than in Redmond at the company's HQ. 'Microsoft began to realise we can't find all the talented people in the US. Nowhere in this universe has a higher concentration of IQ power.'[4]

The Atlas of Ideas will map where China, India and South Korea are already delivering world-class science, and will predict how these trends may evolve. It will identify opportunities for collaboration and specialisation. Above all, it will provide a framework for understanding the new geography of science.

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[3] A Segal 'Is America Losing Its Edge?' *Foreign Affairs*, November/December 2004

[4] C Buckley 'Let a thousand ideas flower: China is a new hotbed of research' *New York Times*, 13 September 2004

Project aims

1. To map emerging trends in the globalisation of science and innovation, with a focus on three countries: China, India and South Korea;

2. To forecast how such trends might evolve over the next 10-15 years;

3. To analyse the implications for science policy and investment in the UK and Europe;

4. To identify new models of networking and collaboration between scientists, policymakers and companies in China, India, South Korea, the UK and Europe.

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Research themes and questions

1. Getting beyond 'the challenge of Chindia'

Invariably, when government ministers now deliver a speech on the economy, globalisation or skills, they make a passing reference to the 125,000 computer science graduates that China and India produced last year. There is a tendency amongst politicians to portray these growing scientific capabilities as a threat – the latest manifestation of what some have dubbed the 'challenge of Chindia'. Two vast, heterogeneous nations – home to a third of the world's population – are perpetually yoked in a form of political shorthand designed to convey the onward march of globalisation.

So a first priority in these debates is to develop a more sophisticated analysis of what is going on. Politicians have concocted 'Chindia' seemingly regardless of these countries' many differences. We need a more nuanced understanding of how different national innovations systems are developing. What are the distinctive political, economic, social and cultural influences? What patterns can be detected by nation, by region and by sector? How are China, India and South Korea faring in emerging areas of biotech, ICT, nanotech and climate science? How strong and sustainable is their science base? How rapidly are companies moving up the R&D value chain? To what extent are R&D activities starting to spread beyond the hi-tech clusters around Beijing, Delhi, Seoul, Bangalore and Shanghai? How might these trends develop over the next decade and beyond?

There is also a tendency for policymakers and commentators to decontextualise these shifts and overstate their novelty. To develop a more meaningful understanding of what these developments represent, we first need to relocate

them more firmly in their historical and cultural context. When Europe was in the grip of the dark ages, Koreans were experimenting with metallic printing presses, Indians were developing advanced forms of mathematics and astronomy, and the Chinese were using gunpowder.

2. New models of collaboration

In March 2000, Europe's leaders signed up to the Lisbon strategy, which aims for the EU to become 'the most dynamic and competitive knowledge-based economy in the world by 2010'. At the time, all eyes were directed towards Silicon Valley as the exemplar of technology-driven growth. Yet only five years on, this strategy appears short-sighted. As the recent Kok Report points out, Europe now faces a twin challenge from the US and Asia.

For Britain, which has its own ambitions 'to be the most attractive location in the world for science and innovation'[5] a retreat into scientific protectionism is not an option. More innovation in Asia does not mean less innovation in Europe. Alongside new sources of competition, there will also be new opportunities for collaboration: the global effort to unravel the genetic code of the Sars virus is an example. We need to develop better mechanisms for orchestrating R&D across international networks and supporting scientists in Europe to collaborate with their counterparts in Asia.

What new forms of networking and capacity-building are required? How strong are the UK's links across the Chinese, Indian and Korean R&D communities, when compared to other OECD countries? What are the attitudes of Chinese and Indian scientists and business leaders towards the UK? Can funding structures (e.g. research councils, EU Framework programmes) be adapted to maximise the potential for collaboration?

3. Knowledge diasporas and talent attraction

Skilled people tend to congregate and agglomerate. Innovators need to be part of a community of knowledge where they can try out and test ideas, learning from the competition. In the past thirty years, there have been massive inflows of scientific talent from Asia into Europe US. As H.P. Khincha of the Indian Institute of Science points out: 'Far from being a threat, in many ways, Indian public science spend actually subsidises the US and UK economies. We train many of the scientists who then go and work in your institutes and companies.'

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[5] HM Treasury/DTI/DfES *Science and Innovation Investment Framework 2004-2014* (London: HM Treasury, July 2004)

But there is evidence that growing numbers of the Chinese, Indian and Korean 'scientific diaspora' are now returning home, encouraged by improved working conditions and other incentives. In Bangalore, a string of companies have been started by Silicon Valley returners. The Chinese government has set up initiatives such as the 'Hundred Talents Programme' to lure back top scientists from institutions overseas.

Will this trend gather pace? As the science base improves in China, India and South Korea, will we see an intensifying 'war for talent' in science and technology? How will the UK fare? Will fewer students travel to the UK and Europe to study and work? And will China, India and Korea follow the example of Singapore in directly recruiting US and European scientists to boost their national science capacity?

4. Science, ethics and sustainable development

The rapid development of particular cities in China and India should not obscure the fact that there are still chronic levels of poverty and underdevelopment across vast regions. To what extent can science and innovation contribute to poverty alleviation and sustainable development? What role can the UK play in catalysing science-based partnerships to tackle poverty, climate change and other social and environmental problems? What alternative energy and environmental technologies are being developed? Will these enable China and India to 'leapfrog' to cleaner, more sustainable models of economic development?

We also need to consider how the relationship between innovation, ethics and precaution may affect the global distribution of research, especially in controversial areas such as stem cell research. The rise of Asian science is sometimes used as an argument for a more relaxed stance on social, ethical or environmental concerns in Europe – the suggestion being that squeamish Europeans may lose out at the expense of the 'wild East'

But instead of seeing ethical considerations as a *barrier* to success in the knowledge economy, can they not become a different form of advantage, leading us down alternative – and potentially preferable – innovation paths? The evidence we have from the environmental sphere suggests that countries can gain competitive advantage from the adoption of higher standards. We need to explore whether similar arguments apply here. And we need to develop networks which allow policymakers and scientists in Europe to forge common purpose and alliances on these issues with their counterparts in Asia.

Project timetable

The project is divided into three phases. Initial research began in May 2005.

Phase 1: Scoping and mapping (May – October 2005)
The first phase has consisted of scoping and mapping R&D trends in China, India and South Korea. Much of this work has been desk-based but we have also undertaken initial research trips to China, India and South Korea, and interviewed around eighty scientists, officials and business leaders in these countries and in the UK.

Phase 2: Fieldwork and working papers (November 2005 – June 2006)
The second phase will be devoted to fieldwork in China, India and South Korea. The project team will spend roughly three months in each country, interviewing scientists, policymakers and business leaders, and gathering available data. As interim outputs, we will produce a series of working papers, which will form the basis of seminars in London and in-country.

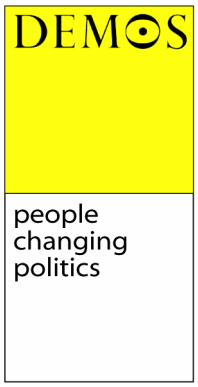
Phase 3: Final report and launch conference (July 2006 - January 2007)
A final period of research will culminate in the production of the project report. This will be launched at a two-day conference in London in January 17th and 18th 2007. We also hope to run launch events in China, India and South Korea.

Project team

- **Charles Leadbeater,** author, government adviser and Demos Associate
- **Dr James Wilsdon**, Head of Science and Innovation, Demos
- **Kirsten Bound**, Project Coordinator – India
- **Molly Webb**, Project Coordinator – South Korea
- **James Keeley**, China specialist and researcher

Contact us

For more information or to get involved with *The Atlas of Ideas*, please contact James Wilsdon, Head of Science and Innovation (james.wilsdon@demos.co.uk) or visit: www.demos.co.uk/atlasofideas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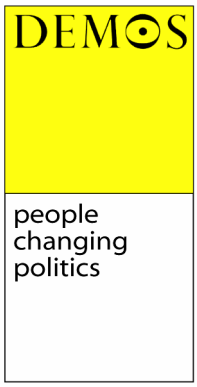

Demos is one of Britain's most influential and creative think tanks. We focus on six areas: public services; science and technology; cities and public space; people and communities; arts and culture; and global security.

Our partners include policy-makers, companies, public service providers and social entrepreneurs. Demos is not linked to any party but we work with politicians across political divides. Our international network – which extends across eastern Europe, Scandinavia, Australia, Brazil, India and China – provides a global perspective and enables us to work across borders.

Demos knows the importance of learning from experience. We test and improve our ideas in practice by working with people who can make change happen. Our collaborative approach means that our partners share in the creation and ownership of new ideas.

As an independent voice, we can create debates that lead to real change. We use the media, public events, workshops and publications to communicate our ideas. All our books can be downloaded free from www.demos.co.uk