

# China's R&D revolution

By Jan Dehn

One of most interesting yet least appreciated facets of modern China is its transformation from a low-cost, labour intensive manufacturer to an economy driven by an indigenous, self-sustaining process of technological change.

The emergence of a home grown research and development (R&D) culture in China will not only help the country transition from developing to developed country status, but also boost its transformation from an export to a consumption-led economy. For the West, the rise of innovation and R&D in China means that the next big wave of Chinese competition is only a few years away – this time from China's innovation prowess, not just its cheaper labour.

## Shifting perceptions

Most foreign investors still harbour over-simplified and out-dated notions of what drives China's economy. To many, China is merely a 'black box' that imparts the odd exogenous shock to the global economy or commodity markets when it releases its growth numbers. To more enlightened observers, China is a country that has achieved phenomenal economic expansion through the brute application of its vast reservoir of low-cost labour to the reproduction of manufactured goods designed by others. Only very few appreciate that China is now well underway to establishing its own indigenous culture of innovation and R&D. This paper outlines how innovation arrived in China, why it manifests itself the way it does, what the future holds for R&D in China and what it means for China and the rest of the world.

## China is addressing a key question in its development: how to make the tricky transition from growth through factor accumulation to growth from technical progress

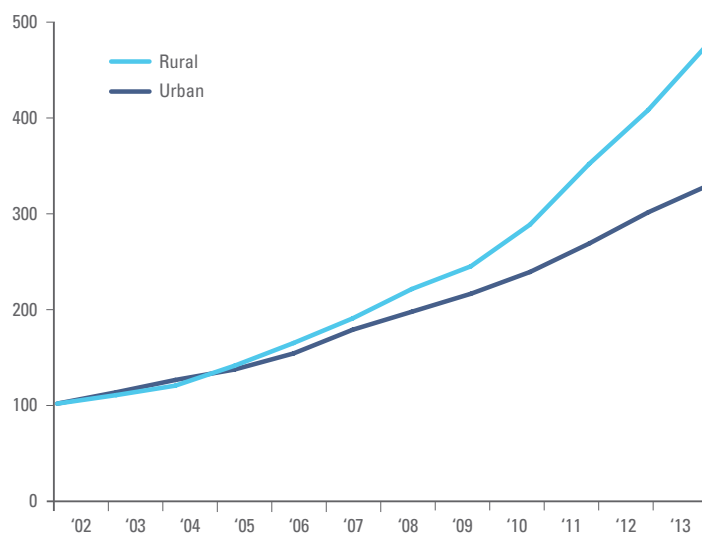
### Lewis model

For decades China followed a near-classic Lewis model type of economic growth.<sup>1</sup> That is, the economy drew upon a vast reservoir of labour in rural areas that was put to work making basic manufactured goods. Due to the enormity of its stock of 'excess labour', China was able to expand output in manufacturing with little impact on wages, while the opportunity cost in terms of forgone agricultural output was minimal due to low rural productivity. On the other hand, profitability in China's manufacturing industries was enormous due to unparalleled economies of scale.

## Limits to labour

To China's leaders, it has been obvious for more than a decade that growth based solely on factor accumulation is unsustainable. As rural labour has gradually become scarcer, wages and productivity have begun to rise in rural areas. As the loss of labour to the cities has become more costly to the economy, so wages have begun to rise in urban areas too. Running out of excess labour, China suddenly found itself faced with one of the most vexing questions in development: how to increase productivity. Or to put it slightly differently: how to make the tricky transition from growth through factor accumulation to growth from technical progress.

Fig 1: Rural and urban wages (index 2002=100)



Source: National Bureau of Statistics of China, Bloomberg, Ashmore.

<sup>1</sup> Lewis, W. Arthur (1954), "Economic Development with Unlimited Supplies of Labor", Manchester School of Economic and Social Studies, Vol. 22, pp. 139-91.

## Teething problems

Unsurprisingly, early government-sponsored attempts to build an indigenous Chinese culture of R&D and innovation from scratch failed. This led China's leaders to ask a more fundamental question about how, exactly, innovation comes about?

Education is part of the answer, but while education gives workers the skills they need to build complex things, it does not explain where the ideas themselves come from. Other difficult questions also presented themselves. What kind of business culture, entrepreneurship, risk-taking and financing conditions are required to facilitate the process whereby ideas can migrate from the idea stage through concept generation and product design all the way to actual production and finally, via marketing, into the global market place?

China's answer to these questions was to go to where innovation is found, namely abroad. Europe became a particular target for Chinese companies in search of innovation. Europe was favoured over the United States due to Europe's less stringent rules governing technology transfer.

In the early days of the search, Chinese companies adopted one of two models. One involved buying and operating technology companies abroad, the other was to bring acquired firms back to China. In both models, China placed great emphasis on strong Chinese control and leadership.

Both models failed. The single biggest problem was the Chinese corporate culture. Senior Chinese management, whose hierarchical decision-making processes differed sharply from the more inclusive information-sharing approaches used in European firms, typically stifled innovation and led to loss of key staff.

## As well as rapidly growing in number, R&D centres in China are changing away from pure cost saving towards knowledge generation

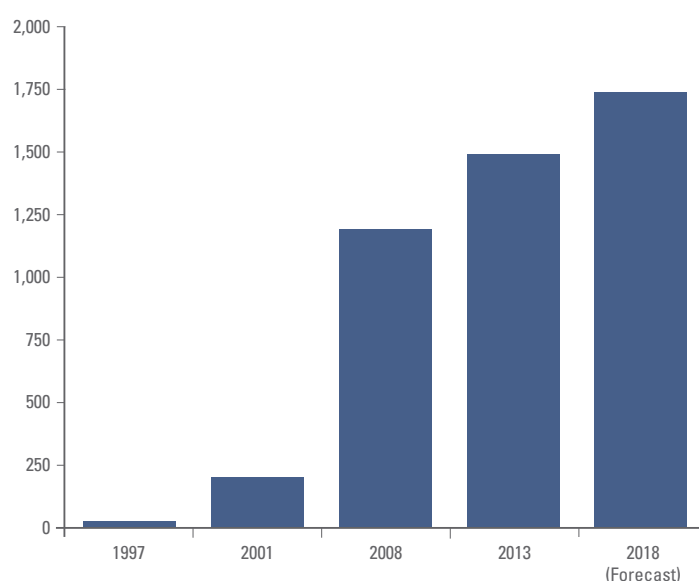
### Learning and moving on

Today's more viable model of Chinese innovation rose from the ashes of these failures. In particular, Chinese companies quickly learned three important lessons from the early teething problems. The first was that it is inefficient for China to build an R&D industry from scratch entirely on its own. This led Chinese companies to conclude that they had to actively seek to interact with foreign companies with capabilities in R&D. Second, Chinese firms learned that innovation processes are subtle, demanding a much more sensitive management style. This led Chinese companies to leave the management of acquired R&D companies alone. Instead of direct control, the emphasis shifted towards building trust between acquirer and management. Finally, Chinese companies and their acquisition targets began to eye a win-win situation in bringing together the capacity for innovation in European companies with the scale economies available within the domestic Chinese market. These three principles now form the basis for the most successful joint ventures between Chinese and foreign companies.

## Changing landscape of R&D

Reflecting these changes, the number and focus of foreign R&D centres in China are changing sharply. According to George Yip, a scholar on innovation at CEIBS, China's leading business school, the number of foreign R&D centres in China could reach about 1,750 by 2018 from just 24 in 1997. The focus of R&D centres is also changing away from pure cost saving towards knowledge generation. According to Yip, the number of knowledge-driven R&D centres doubled between 2008 and 2013 and their share should reach 30% by 2018. Over the same period, the share of pure cost-driven R&D centres will decline to just 10% from 30%, reflecting the greater importance of innovation in the production processes of leading Chinese firms.

Fig 2: Foreign R&D centres in China



Source: George Yip, CEIBS 2015.

## Innovation in China today

Today, the standard model for Chinese companies to acquire innovative capacity begins with identifying a company in Europe or elsewhere that has the capacity to innovate in a line of business that the Chinese company deems complementary to its own production and hence potentially enhancing for its future growth.

Once acquired (in part or wholly) the foreign firm is then largely left to manage itself with minimal interference at senior management level. Below senior management level, however, extensive interaction takes place between the two firms to allow the innovations to be integrated into production itself.

It is a particular feature of innovation in China today that the R&D is principally applied with a view to gaining market share within the Chinese home market. The reasons for this are many, but an important one is that innovation is scarcer in China than abroad, so the returns from innovation are simply greater. Another reason is that once ideas have been converted into products in China they can be launched into a very large, well understood mass-market. In other words, for now Chinese companies principally use innovation to outcompete other Chinese companies at home.

## The emergence of an indigenous R&D culture

The increasing rate of success with which Chinese companies are introducing R&D into domestic production has allowed many Chinese companies to establish a genuinely indigenous and unique Chinese culture of R&D and innovation.

One of the most important characteristics of this new culture is that innovations tend to be smaller and more incremental in nature than elsewhere. Innovation also tends to be extremely rapid. Customisation of existing technology is a particularly common manifestation of Chinese innovation. This can perhaps best be illustrated using an example. One Chinese mobile phone provider updates its entire software and services package on a weekly basis based on suggestions that customers submit directly to the company via a simple app. This allows the company to engage in rapid incremental innovation, which stands in sharp contrast with Western companies – even very successful ones such as Apple – that typically launch brand new products only every few years.

## Many people misunderstand the huge changes taking place in China and their effect on the global economy. The pace of Chinese innovation is a major gap in this understanding

### Challenges

Why are Chinese companies innovating in a rapid, incremental fashion instead of going for the big revolutionary ideas?

One obvious reason is that Chinese companies face challenges in protecting their intellectual property (ideas). Although China has modern legislation to help to protect intellectual property it is nevertheless the case that the theft of ideas is widespread within Chinese industry. Chinese companies are well aware of this, so they understand that they can only hold on to the advantages that arise from innovations for a very short time. So they put their ideas into production quickly and incrementally for the simple reason that if they don't others will just copy them.

This may seem like a very sub-optimal situation but, ironically, the lack of enforcement of intellectual property rights has probably been to China's advantage over the past couple of decades. After all, while China was not actually generating any new ideas of its own, turning a blind eye to imported ideas spreading like wildfire across the industrial landscape of China

probably helped the country to advance very rapidly and in a broad-based fashion up the technology ladder.

This situation is now changing. As Chinese companies begin to innovate on their own they need to be able to protect their intellectual property rights. The whole point of intellectual property legislation is that it protects companies that innovate so that they can recoup their often-substantial innovation costs through temporarily protected markets.

In light of the rise of Chinese innovation it is therefore no accident that the Chinese government is now placing far heavier emphasis on the rule of law and the functioning of markets – as laid out in the recent Third Plenum policy guidelines.

### The macroeconomic context

There are many reasons to believe that R&D will be assigned even greater importance in China over the coming years.

As well as transitioning from a growth model based on factor accumulation to one hinging on technical progress, innovation also plays a critical role in China's efforts to rotate away from its export-led growth model of the past few decades. China's leaders take the view that the West will try as fast as possible to convert its debt problem into an inflation problem. For China, this means having to cope with a stronger currency and therefore rising headwinds for exports.

China's reply to this expected future challenge to its export model – and with it China's entire growth model – is to rely more on consumption-led growth. The big difficulty of relying on domestic demand-led growth in a country such as China (that, to generalise slightly, is a closed economy with a bit of trading around the edges) is that any expansion of domestic demand quickly risks creating 'excess domestic demand'. This leads to inflation and unsustainable currency account deficits. To avoid this, China must also increase productivity, both of domestic suppliers and exporters. To do this it must innovate.

China's efforts to support productivity are material. In addition to backing companies that seek to obtain R&D capabilities from abroad, China is deliberately trying to improve productivity by reforming of the public sector, notably state-owned enterprises. Greater emphasis on market forces, judicial reforms and local government reforms are extremely important to this end. Over time, however, as the share of the private sector in the economy as a whole grows the single most important driver of R&D and product innovation will take place at firm level.

### Conclusion

China is the most interesting credit story in the world today, in our view. No other country has so clearly defined for itself a vision of the future of the global economy and its role within it. And no other country comes close to exhibiting the same determination and courage in pursuing the bold reforms required to realise this vision.

Investors, the media and governments around the world risk continuing to misunderstand and underestimate the profundity of the changes taking place in China and their eventual implications for the global economy. Appreciating the scale and pace of Chinese innovation is a major gap in this understanding.

It is going unnoticed not because Chinese firms are not innovating, but because, thus far, they are doing so mainly at home. However, right now Chinese firms are only a few small steps away from engaging in direct competition with Western companies in the R&D arena. Already, they are entering markets in parts of Africa and Asia.

The last big wave of Chinese competition was based on cheap labour. China's second coming will be based on innovation prowess and the cost advantages that derive from mass-production at home.

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