Coming of age: Asia’s evolving R&D landscape

An Economist Intelligence Unit report

Commissioned by MERCER
Contents

Preface 2

Executive summary 4

Introduction: Understanding Asia’s high-tech R&D landscape 7

From low cost to high value: Why are companies investing in R&D in Asia? 9
  Centres of excellence 10
  Market opportunity 10
  On the defensive 12

Local, global, glocal: What types of R&D are companies pursuing in Asia? 13
  Global going local 14
  Case study: Honeywell 15
  Local going global 16
  Just “D” or “R” too? 16

Location, location, location: Where in Asia are companies investing in R&D? 18
  Towards a “global brain” 19
  New organisational structures 20

Great expectations: Is the reality of investing in R&D in Asia living up to the hype? 21
  Tackling turnover 22
  Depending on diaspora 22
  Back to school 23
  Addressing IP 23
  Case study: National Instruments 25

Outlook: Asia’s role in R&D can only increase 26
Coming of age: Asia's evolving R&D landscape is an Economist Intelligence Unit (EIU) report, commissioned by Mercer. The EIU performed the research, conducted the interviews and wrote the report independently. The findings and views expressed in this report are those of the EIU alone and do not necessarily reflect the views of the sponsor.

Justin Wood was the author of the report and Sudhir Vadaketh was the editor. Ross O’Brien assisted with further interviews. Kane Juan Tan was responsible for design and layout. The cover image is from iStockphoto.

We would like to thank all interviewees for their time and insights.

August 2012

Interviewees, in alphabetical order:

Scott Anthony, managing director, Asia Pacific, Innosight
Roland Busch, board member responsible for Asia, and CEO of the infrastructure and cities business unit, Siemens
Achmad Chadran, product marketing manager, Dell Storage
Ric Clark, vice president, marketing and strategy, Asia Pacific, Alcatel-Lucent
Simon Dale, head of technology and innovation, Asia Pacific, SAP
Karl Davies, vice president and general manager, North Asia, retail branding and information solutions, Avery Denison
Wim Elfrink, chief globalization officer, Cisco
Ronald Fons, business development director, FSI enterprise solutions, Huawei
Gerd Hoefner, managing director and CEO, Siemens Technology India
Shantanu Ghosh, vice president and managing
director, Indian product operations, Symantec

Marc Graf, CFO Asia, Intel Semiconductor

Antonio Hidalgo, chief technology officer, Philips
Consumer Lifestyle

Bhupesh Lal, marketing director, Asia Pacific,
Progress Software

Danny Lay, president, South-east Asia, Emerson
Electric

John Melo, global VP of human resources,
Progress Software

Charles Moon, principal analyst, Informa

Shouvick Mukherjee, vice president and CEO,
Yahoo! India R&D

Chandran Nair, CEO, South-east Asia, National
Instruments

Yasuaki Onishi, corporate vice president and
executive general manager, research & technology
group, Fuji Xerox

Mark Pinner, product communication director,
mobile internet and digital home business unit,
Lenovo

Rameshbabu Songukrishnasamy, vice president
and general manager, Honeywell Technology
Solutions China

Vincent Tong, senior vice president, worldwide
quality and new product introductions, Xilinx
Over the past 50 years, Asia’s emerging markets have grown at staggering speeds, yet have produced relatively few innovations. Instead they have largely adopted ideas developed elsewhere in the world. This so-called “catch-up” growth came by adopting multiple waves of technology without having to go through the time-consuming process of inventing them.

Today, emerging Asia is starting to produce significant amounts of its own innovation. Global multinational companies (MNCs) have recognised this blossoming of invention and are investing ever more heavily in research and development (R&D) in Asia.

How are these companies approaching their Asian R&D investments? Where are they investing? Why? Is the work meeting the expectations of the companies behind these investments? This report explores the contours of Asia’s R&D landscape in the context of high-technology companies in a bid to answer these questions. It is based on technology sector research, in-depth interviews with senior executives and R&D experts, as well as Economist Intelligence Unit (EIU) forecasts.

The key findings of the research are as follows:

- **The rationale for investing in R&D in Asia has shifted from cost to competencies.** During the 1990s and early 2000s, Asian R&D strategies were all about finding large pools of skilled engineers with low wages. Today it is rare to find firms investing in R&D in Asia as a way to cut costs. Largely this is because the wages of Asia’s engineers have climbed sharply as the region’s R&D centres have moved up the value chain. Rather than just doing low-end tasks, they have moved with astonishing speed into doing sophisticated work.

- **Moving R&D to Asia is also about capturing market opportunity.** Back in 1990, Asia (ex-Japan) contributed 13.2% of global GDP (measured using purchasing power parity). By 2016, the EIU expects that figure to climb to 33.8%. The region’s importance to the technology sector is climbing in line with its growing economic weight. In order to capture this opportunity, firms understand that they need to put their R&D operations much closer to their new customers in emerging Asia.

- **Companies are investing in R&D in Asia as a defensive measure.** Many global firms have recognised that Asia’s nascent corporate landscape has the potential to create highly disruptive innovations that could reshape whole industries. Products designed in these markets have different specifications for different price points, giving rise to highly elegant solutions that are extremely low-cost and could easily go global. Locating R&D in
emerging markets helps firms keep on top of these developments.

- **R&D in Asia is shifting from product localisation to development.** Traditionally, many firms used their R&D teams in emerging markets to “localise” existing products and services by simplifying them to make them more affordable. Today, Asia’s R&D centres are instead firmly focused on developing new products and intellectual property. These innovations address both local and global needs. Indeed, many R&D centres in Asia now take the global lead for developing product lines.

- **As well as running global R&D programmes, Asia’s R&D centres are developing excellence in emerging market innovation.** Customers in emerging Asia have differing needs and levels of income. Rather than localising global products, companies are using the needs of local customers as the starting point for designing new products. For many firms, Asia’s R&D centres have taken the lead in developing products and services for emerging markets globally.

- **Companies are recognising that the process companies use to pursue innovation in emerging markets is different.** The approach to R&D used in developed markets is often inappropriate for emerging markets. What’s more, companies in emerging markets have much to teach their Western counterparts. They innovate at greater speed and lower cost, and are better at exploring “adjacent opportunities”, and pursuing co-innovation with partners. Many global MNCs have put in place programmes to emulate the best R&D practices of their local Asian competitors, combining those lessons with their own best practices.

- **In much of emerging Asia, the focus of R&D is still heavily on product development rather than pure science.** Many R&D heads note that pure research is harder and more expensive than product development, and in Asia there is still so much opportunity around doing development that there is less need to pursue pure research. However, this is starting to change. In more sophisticated markets, notably Japan, Singapore, South Korea and Taiwan, pure research activities are already well developed.

- **In choosing where to locate R&D centres in Asia, the overriding consideration is the availability of skilled workers.** Given the sheer quantity of graduates produced in China and India, these two countries are attracting the lion’s share of new R&D investment. However, Australia, Japan, Singapore, South Korea and Taiwan are also popular for certain industries and sectors. Within China and India, new R&D locations are emerging. Well-established centres, such as Bangalore, Beijing and Shanghai, have drawn so much R&D investment it is becoming tough to hire scientists and engineers there. As such, many MNCs are setting up in new emerging centres, including Chengdu and Dalian in China, and Hyderabad in India.

- **Government incentives are of limited importance in choosing a location for R&D.** All else being equal, companies are happy to accept tax breaks and government offers, but these factors are rarely a deciding factor. One R&D director observes: “Companies run by engineers make R&D decisions for the right reasons: they look for the talent. Companies run by operations specialists, who understand short-term financial performance but are often ignorant of the technology, tend to be more swayed by government incentives.” Government policy, and the degree to which governments support education and promote technology adoption, is much more important.

- **Increasingly dispersed R&D activities are giving rise to a “global corporate brain”.** Many Asian firms are raising their R&D investments in the West just as Western firms
are investing in Asia. Some observers liken this process to building a “global brain”. Increasingly, firms try to move their scientists around these new global R&D networks in order to mix different skills and experiences and foster new innovation. This pursuit of a “global brain” creates big organisational challenges for MNCs.

- **Investing in R&D in Asia is meeting expectations, but major challenges exist.** Staff turnover and difficulties in recruiting the right calibre of engineer are big headaches. Many companies choose to set up in Asia to access the region’s rising supply of science graduates, only to find the demand for those workers is increasing at a greater pace, forcing up wages. Many companies also complain that only a small percentage of graduates in Asia actually have the right skills or education.

- **Companies are learning how to live with staff shortages by deploying a range of personnel policies.** One factor helping to address staff problems is the more stimulating nature of work being done in Asia’s R&D centres. With the shift from low-end work to high-end product development, employees become more engaged and more loyal. A related factor is a change in corporate culture. As Asia’s R&D centres have taken on more global responsibility, so they have adopted Western management cultures which are less hierarchical and more open, all of which also improve staff retention. Many companies are addressing local talent shortages in Asia—especially for senior positions—by hiring Asian nationals working in the West. Whereas in the past the thousands of Asians studying at Western universities were keen to pursue careers overseas too, studies show that today many want to return to their homelands because they see greater opportunity in the East than in the West.
Coming of age: Asia’s evolving R&D landscape

© The Economist Intelligence Unit Limited 2012

It is well established that innovation boosts productivity and drives economic growth. When companies develop new products and services that are cheaper or better than before, they deliver growth. When they dream up new processes and business models that improve efficiency, they deliver growth. Without ideas nothing changes; companies and economies stagnate.

For much of the past 50 years, Asia’s emerging markets have grown at staggering speeds, yet have produced relatively few innovations. Instead they have largely adopted ideas developed elsewhere in the world. This so-called “catch-up” growth came by embracing multiple waves of technology and productivity gains without having to go through the time-consuming process of inventing them. Cars, computers, penicillin and production lines, for instance, were not invented in Asia, but adopting these technologies has enabled the region’s economies to grow.

More recently, however, this picture has been changing. Today, emerging Asia is starting to produce significant amounts of its own innovation. The ideas driving Asia’s growth are increasingly coming from within the region rather than from outside it.

Global multinational companies (MNCs) have recognised this blossoming of invention and are investing ever more heavily in Asia’s research and development (R&D) landscape. Research from Zinnov, an India-based consulting firm, shows that the number of MNC R&D centres in China and India grew almost fourfold between 2001 and 2010, from 557 to 2,009.

Indeed, the Asia Pacific region is now home to a sizeable share of the R&D investment at most MNCs. Take Honeywell, a US engineering giant that serves industries from aerospace to pharmaceuticals to oil refining. Fifteen years ago the firm had almost no R&D staff in Asia Pacific. Today, the firm has more than a third of its 21,000 scientists and engineers based in the region. Or consider Yahoo!, a US Internet services business. Back in 2002, when the company opened its first R&D facility in India, Yahoo! had no R&D staff in the region. Today, it employs 2,500 researchers in Asia who produce 40% of the firm’s output of intellectual property.

Figures compiled by UNESCO and the World Bank show that Asia’s expenditure on R&D is rapidly approaching US and European levels. The value of R&D investment in the 10 Asian nations that spent the most on R&D in 2009 came to US$339bn. By comparison, the figure for the 10 biggest R&D investing nations in Europe and North America came to US$556bn. The West is still out-investing Asia, but the gap is closing. Consider China. In 2009, it invested US$113bn in R&D—roughly the same as France, Germany and Switzerland combined (see chart A).
Chart A: Total public and private spending on R&D (US$ bn, measured using purchasing power parity) for the 10 biggest R&D investing nations in Asia (shown in green) and the 10 biggest R&D investing nations in the West (shown in blue), 2009

Source: UNESCO, World Bank

Given the speed and scale of this shift in the global R&D landscape, it is important to know how companies are approaching their Asian R&D investments. Where are they investing? Why? What sort of work is happening in Asia’s R&D centres? Is the work meeting the expectations of the companies behind these investments? If not, why not? And what is the next stage in this rapidly changing picture? This report explores the contours of Asia’s R&D landscape in the context of high-technology companies in a bid to answer these questions.1

1 This study focuses on high-tech companies involved in electronics and IT equipment, telecoms and telecoms equipment, software development, Internet services, and industrial and automation technologies.
From low cost to high value: Why are companies investing in R&D in Asia?

The motives for investing in R&D in Asia vary in their nuance from company to company and from industry to industry. However, certain trends are readily apparent across most businesses. In the beginning, during the 1990s and early 2000s, Asian R&D strategies were all about low costs. Just as global manufacturing firms moved their production lines to Asia to benefit from cheap labour, so those same companies also began to move parts of their R&D to Asia where it could be done more cheaply. Such moves—in both manufacturing and R&D—were enabled by the rapid development of computer and communications technologies that enabled managers to run companies on a much more globalised basis.

In those early years, much of the R&D work was low-end and unexciting; the tedious stuff, such as software coding and testing, that still needed bright, educated minds, but which was of little interest to Western scientists and engineers. Companies discovered that places such as China and India were producing huge armies of science and engineering graduates who were happy to do such work. Statistics on exactly how many graduates come out of each country are difficult to compare because of different definitions over what constitutes an “engineering” graduate. However, good estimates suggest that China produces more than four times as many such graduates as the US, while India produces twice as many. In the early days, these large pools of talent could be hired for a fraction of the cost of similar workers in the West.

Over time, however, the “labour cost arbitrage” story has evolved dramatically. True, some firms do still value the low wages of engineers who are entering the labour force. R&D programmes always have an element of repetitive work such as testing and debugging, and Asia’s large labour pool offers a way to perform these activities at a relatively cheaper cost. However, cheapness has become a far less important element in the calculus of investing in Asia. For a start, the wages of Asia’s engineers have climbed sharply, in some cases reaching levels comparable to those in Europe and the US.

“For entry-level engineers, salaries are still substantially lower than in the West,” says Shantanu Ghosh, vice president and managing director of Indian product operations at Symantec, a US IT services and software company. “But the higher up the hierarchy you go, the more that arbitrage disappears. At director level, salaries in India and the US are the same.”
Centres of excellence

Just as important, after two decades of ever rising investment from Western firms, Asia’s R&D centres have moved up the value chain. Rather than just doing low-end work, they have moved with astonishing speed into doing sophisticated work that in many cases matches that done by similar centres in the West. Symantec’s teams in China and India have developed “domain expertise”, whereby they work directly with industries and customers to understand their needs. The firm’s software engineers in Asia no longer only do programming and testing on products designed elsewhere; they design the products too. They have shifted from being a software production line into being a full end-to-end operation that conceptualises as well as builds new products and services.

“The rationale for investing in R&D in Asia today is no longer about cost, it is about competencies,” says Mr Ghosh. “China and India have become centres of excellence for certain product lines. We might have 70% of the global team for a particular product based in India.”

The story at Symantec is one that is played out again and again across the region. Companies moved to Asia for cost, but in just a short space of time, the motives for investing shifted to harnessing the skills and competencies that Asia’s engineers have developed.

Consider the scientific output of a country such as China. Between 2003 and 2008, the volume of scientific papers published in research journals by China-based scientists rose from 4% of the global total to 10%. By contrast, the US’s share of scientific publishing fell from 26% to 21%.³

Of course, merely publishing more research papers does not mean that the quality of the science is improving. A better measure of quality is the number of times that a country’s research output is cited by other researchers. On this count, China’s rise is equally apparent—its research papers made up 4% of global research citations in 2008, up from 2% in 2003. Over that period, the US’s share of citations fell from 36% to 30%.

China and other countries in emerging Asia are clearly not yet in the same league of science and R&D as some more developed countries. But the volume of science and research coming out of the region is rising rapidly. And the quality is increasing too.

Market opportunity

The past two decades have seen another important shift driving R&D investment in Asia: the rapid growth of Asia’s economies. Back in 1990, Asia (ex-Japan) contributed 13.2% of global GDP (measured using purchasing power parity). By 2016, the EIU expects that figure to climb to 33.8% (see chart B). In just 26 years, Asia (ex-Japan) will have more than doubled its share of the global economic pie and will represent more than a third of global income.

The region’s importance to the technology sector is climbing in line with its growing economic heft. Take mobile-phone subscribers: in 2001, Asia Pacific (including Japan) had 331m. By 2016, that number will rise to 3.9bn, or 60% of the global total. Or look at expenditure on IT and communications equipment: between 2001 and 2016, Asia and Australasia’s spending will rise from US$1.2trn to US$6.4trn, or 47% of the global total (see chart C).

While many Western firms were slow to recognise this shift, today it is abundantly clear that Asia is where the growth is. In order to capture this opportunity, firms understand that they need to put their R&D operations much closer to their new customers in emerging Asia. Because incomes are generally lower in emerging Asia, these R&D operations are increasingly becoming the places that take the lead in designing products and services for the whole universe of emerging markets, not just the ones found in Asia.

Alcatel-Lucent, a French telecoms equipment and services company, has shifted 25% of its R&D resources into Asia. “Some of our biggest clients globally are in Asia,” says Ric Clark, the firm’s vice president of marketing and strategy in Asia Pacific. “For example, China Mobile is now our biggest global client by sales. We need to be in Asia to understand these markets, and we need to be here to work with our clients. We do a lot of co-creation work in partnership with China Mobile.”

Much of the market opportunity in Asia stems from rising incomes and spending power from local consumers, companies and governments. For some investors, however, Asia’s opportunity centres on the rise of production and manufacturing in the region. Back in 2000, China, India and South-east Asia produced 11.2% of global exports (measured by value). By 2016, the EIU calculates that figure will more than double to 23.4%.
“As a manufacturer, R&D is intimately linked to the plants where the products are made,” says Danny Lay, president of South-east Asia at Emerson Electric, a US technology and manufacturing business. As Emerson’s factories have shifted to Asia, and as the factories of Emerson’s industrial customers have also shifted to Asia, so the company’s R&D teams have followed. “Being close to global manufacturing hubs is our primary driver for choosing where to put our R&D. The rise of China has been especially important in that regard,” he says.

On the defensive
Interestingly, one further reason for investing in R&D in Asia is not about gaining market share, but rather about defending it. Given the flourishing of R&D in the region, many global firms have recognised that Asia’s nascent corporate landscape has the potential to create highly disruptive innovations that could reshape whole markets. This is particularly true given that consumers in Asia have relatively low incomes compared to those in the West. As such, companies in China, India and other countries are focused on creating products and services at much lower price points.

“There is definitely a defensive element to being in emerging markets,” says Chandran Nair, CEO for South-east Asia at National Instruments, a US maker of testing and control equipment. “Stuff designed in these markets has completely different specifications for different price points. You see very elegant solutions being produced that are extremely low-cost and could easily go global. Locating our R&D in emerging markets helps us keep on top of these developments.”

Consider Logitech, a US firm that makes computer accessories. In 2009, it found itself suffering in China at the hands of Rapoo, a Chinese company that had designed a computer mouse that was dramatically outselling Logitech’s products. The local rival had not only designed a mouse with comparable performance to a Logitech device, but it had done so at a much lower price point. What’s more, Rapoo was in closer touch with local consumers and had realised that a traditional international mouse design was failing Chinese consumers. Many of them used their computers as home entertainment devices, surfing Internet video sites, and they wanted a mouse that had the functionality of a TV remote control. Once Logitech learned of the situation, it brought out a new mouse design within six months that addressed the Rapoo challenge head on.
Local, global, glocal: What types of R&D are companies pursuing in Asia?

Given all the investment from global companies pouring into R&D in Asia, it is important to ask what sort of work the region’s engineers are doing. Is it predominantly for local markets? Is it for global markets? What sort of character does the work have?

Traditionally, many firms have used their R&D teams in emerging markets to “localise” existing products and services. In other words, they take innovations developed elsewhere and then tailor them to local needs. In some cases, this means simplifying or de-featuring complex products in order to make them more affordable to local customers where incomes are lower. In other cases, it means adapting global products to meet local market requirements, for example, if product regulations are different.

Today, the role of localising global products is becoming less and less important for Asia’s R&D centres—in large part because firms recognise it does not work as a strategy. Instead, research centres in Asia are firmly focused on developing new innovations and intellectual property. Those innovations address both local and global needs.

Shouvick Mukherjee, vice president and CEO of R&D for Yahoo! India, says his team has now developed 20 new products to date, and is increasing its filings for new intellectual property by 40% every year. Some of these new products, such as Yahoo! Cricket, a service supplying cricket news and statistics for sports-mad local fans, are for the Indian market. Others are for the global market, including a new set of algorithms for determining which advertisements to display to different customers when they click on Yahoo!’s websites.

“Five or six years ago, the teams in India just did follow-the-sun R&D, where we did development work on global projects. We picked up where the US left off and carried on coding through the night,” he says. “Today, we have moved the whole eco-system around certain products to India, both the R&D staff and the non-R&D staff. We have global ownership and responsibility for these products.”

The situation at Yahoo!, where Asia takes on responsibility for managing global R&D programmes, is increasingly common. SAP, a German software firm, set up a development team in Bangalore in 2002. Initially the Indian team was doing relatively low-grade coding work, says Simon Dale, SAP’s head of technology and innovation in Asia Pacific. Today, Bangalore has global responsibility for developing the firm’s NetWeaver platform, the foundation and technology backbone upon which SAP software applications are based.
Global going local

As well as running global R&D programmes out of Asia, international firms are also developing completely new offerings for local markets, thanks to rising recognition that local markets are different. These markets have different—usually lower—levels of income. Local customers have unique needs, and they put different values on a product’s features and characteristics. This recognition is leading companies to shift away from simply localising global products. Instead they are recognising the importance of taking a blank sheet of paper and using the needs of local customers as the starting point for designing new products.

What’s more, companies are recognising that the whole process of pursuing innovation in emerging markets is different—from the methods, to the priorities, speeds and costs. Some commentators have dubbed this process “frugal innovation”, focusing on the lower cost nature of emerging market innovation. But this ignores many other aspects of the process.

Siemens, a German electrical and engineering giant, has a strategy for R&D in emerging Asia that it calls SMART (Simple, Maintenance-friendly, Affordable, Reliable, and Timely-to-market). The idea is to have an innovation process that differs from the way the company practices R&D in other parts of the world, and which develops products appropriate to local markets in Asia.

“You can’t develop products for Asia in Europe because the skills you need to do innovation in Asia are different,” says Roland Busch, the board member responsible for Asia at Siemens, and CEO of its infrastructure and cities division. “You can’t ask an engineer to develop the engine control system for a BMW in the morning, and then do the same for a Chery QQ [a Chinese car] in the afternoon. The skills, the thinking, the whole approach to the task are very different.”

Many other companies are also changing their approach to doing R&D in Asia. Their goal is to learn how local emerging market companies practice innovation, and combine those lessons with the best that MNCs have to offer. GE, a US engineering and financial services conglomerate, has a programme it calls “In China for China”, whereby products for the Chinese market are developed and created by researchers working in China. Many of GE’s products are focused on clean energy, a field that the Chinese government is keen to promote among domestic companies. By operating on the ground among these firms, GE is working at the heart of an emerging industrial cluster focused on technologies such as wind power. Already, GE’s research labs in Shanghai are delivering results, having produced 20 patents in clean energy and wind power alone since opening in 2003.

Honeywell is another company seeking to emulate the type of innovation happening at local companies in Asia. Indeed, the company has a strategy that it calls “Becoming the Chinese Competitor”. Honeywell has shifted much of its R&D to China and has adopted an approach that lets it compete more effectively by learning from Chinese rivals. (See case study: Honeywell)
Honeywell is learning from its Chinese rivals how to pursue R&D that is appropriate for emerging markets

Ten years ago, Honeywell, a US engineering firm, was struggling in China, in large part because it found itself surrounded by fierce competition. A business unit could face as many as a thousand competitors compared to just a handful in the US. These competitors were nimble and fast-moving.

At the time, Honeywell was pursuing a traditional policy of introducing global products to China with a few tweaks to make them more affordable. But this strategy was failing. Chinese competitors were able to take Honeywell products and develop imitations for a far lower price point.

To solve this problem, Honeywell embraced a new strategy that it called “Becoming the Chinese competitor”. The idea was to learn from Chinese rivals in all aspects of running a business, from sourcing to manufacturing to marketing. Instead of a traditional West-to-East (W2E) innovation flow, the firm decided to take an “East for East” (E4E) approach by moving its R&D activities to China and practising innovation in a market-appropriate way.

Rameshbabu Songukrishnasamy, vice president and general manager of Honeywell Technology Solutions in China, admires the way Chinese companies pursue R&D, including their lower costs and their ability to co-innovate with partners and customers, and so understand their needs much more clearly. Co-innovation also speeds up the R&D process.

As Mr Songukrishnasamy says, “Chinese competitors are used to working in an extremely high-growth environment and their innovation processes work at the same speed.”

But, he stresses, Honeywell has its strengths too, including its commitment to quality, its approach to intellectual property, its research rigour, and the fact that the company has global processes that stitch together disparate research teams in a harmonised way. His aim is to take the best of Honeywell and combine it with the best of what Chinese competitors have to offer. So, for example, Honeywell is working much more closely with big Chinese companies on co-innovation projects, for instance teaming up with Haier, a Chinese white goods maker, to develop new green technologies.

Thanks to changes in the way it practices R&D in China, Honeywell is now developing another strategy called “East-to-West” (E2W). By innovating in a Chinese way, the company is creating products that not only win business in emerging markets, but which are drawing strong interest from developed markets too.

For example, Honeywell has an industrial automation product called Experion that is used by large chemical refineries. In China, many of the refineries are on a much smaller scale, so Honeywell worked with these smaller players to develop a mid-sized version of the product, PlantSource. Honeywell has launched it in China and is now finding strong demand for it in the West too.

“Our R&D in China is developing a whole new mid-level segment for the company,” enthuses Mr Songukrishnasamy, “products for middle-income consumers and products for mid-sized companies.”
Local going global
As MNCs move their R&D activities to Asia, and as they adopt approaches to innovation that are appropriate to the market, many are finding that the products they develop in Asia are not only succeeding in local markets, but succeeding globally too. Some low-cost products can appeal to the wealthy just as much as to the less wealthy.

In India, engineers at Alcatel-Lucent developed a low-cost congestion monitoring system based around mobile phones. The system uses a series of Bluetooth sensors placed along traffic routes that identify the Bluetooth signatures of mobile phones as people pass by in their vehicles. By tracking the progress of these mobile devices as they move through a town, the system can calculate levels of congestion and journey times.

“It’s an extremely cheap way of monitoring traffic,” says Mr Clark at Alcatel-Lucent. “We developed it for India in Bangalore, but already it’s being adopted in markets like Denmark.”

Philips, a Dutch electronics company, is also seeing its Asian innovations flowing back to the West in ever greater quantities. Work that Philips has done in China on rice cookers, for example, has influenced the design of paella and risotto cookers in Europe. India is contributing in equal measure. Indian meals often require lengthy time spent grinding down spices. The machines used for the grinding can be extremely noisy, so the Philips India team developed new technologies around sound insulation and vibration control. Those new sound dampening technologies are now finding their way into the company’s line of vacuum cleaners in the West, and into the new range of clothes irons being developed in Singapore.

Just “D” or “R” too?
R&D centres in Asia are clearly producing ever more innovation and finding ever greater success with it. But how ground-breaking is this work? Are Asia’s scientists and engineers doing the type of science that creates new knowledge? Or are they instead focused on product development that is based on existing technologies?

Antonio Hidalgo, chief technology officer for the Consumer Lifestyle division at Philips, sees examples of every type of research work in Asia, from pure science, to product development work, to the engineering aspects of bringing a new product to life. At first, he says, his company was focused mostly on the low-end engineering aspects of R&D in Asia—in other words, localising global products for regional markets. Today, he notes, the focus at Philips in Asia has shifted and is now focused on product development—a step up in sophistication. His Asian research centres are developing new products, but these are largely built by using existing technologies in new ways.

However, he adds, Philips is also starting to invest in the highest end of the spectrum too, the pure science side of R&D. In China, for example, consumers are concerned about food safety after a raft of scandals in recent years. Many of those scandals centred on milk following a number of cases where producers added poisonous chemicals, notably melamine, in order to boost the milk’s protein content. As such, many consumers have switched to drinking soy milk that they make at home. Philips is responding to this shift by developing a range of soy milk makers. In doing so, it is investing in new science exploring how to extract protein and other nutrients from soybeans to make the milk richer and healthier.

But despite examples such as this, Mr Hidalgo expects the focus for most R&D in Asia to remain on the “D” for the time being. “Pure research is much harder and more expensive than product development,” he says. “In Asia, there is still so much opportunity around doing development that there is less need to pursue new science. It’s only when you run out of product ideas that you need to invest in new science.”

He also believes that Asia has some way to go before it is ready for deeper engagement in pure
science. “Asia’s growth is so phenomenal that the type of R&D it does is very practical. It’s about harnessing opportunities at great speed and capturing the growth opportunity through product development,” he explains. “The science side calls for much greater patience. You have to set out a hypothesis, create an experimental design, test the hypothesis, record the results, adjust and start again. It takes time and a steady, methodical approach and Asia’s pace of growth isn’t necessarily suited to that yet.”
Having recognised the need to perform R&D in Asia, how do companies choose where to locate their research centres? Many factors feed into such equations, but companies say the over-riding consideration is the availability of workers with the right skills and experience.

As Mr Dale at SAP puts it: “We set up R&D operations in places where we think they’ll be done best. That’s really all that matters. R&D is a knowledge-intensive activity, so we have to choose locations where the availability and quality of people is the best for the job.”

The number and quality of local universities largely determine local talent pools, so the scale of China and India mean that those two countries are attracting the lion’s share of new R&D investment. However, Australia, Japan, Singapore, South Korea and Taiwan are also proving popular, particularly for certain niche industries and sectors. For example, executives say that South Korea is gaining a reputation for strong research capabilities in areas such as materials science, optics and photonics.

Singapore is recording success in other fields. For example, Philips has chosen Singapore to be the global development centre for its garment care business, designing next-generation clothes irons that do away with the need for buttons or controls—the irons detect the nature of the material, be it silk or denim, automatically. Much of the country’s success in attracting R&D investment stems from the government’s Research, Innovation & Enterprise 2015 Plan, run by the Agency for Science, Technology and Research (A*STAR). One cornerstone policy under the plan is to grow Singapore’s community of scientists and engineers. Indeed, the number of such research workers has grown by an annual average of 6.9% between 2000 and 2010 and numbered 28,296 at the end of 2010.

Meanwhile, within China and India new R&D locations are emerging. Well-established centres such as Bangalore, Beijing and Shanghai have drawn so much investment in R&D that it is becoming tough to hire scientists and engineers there. According to one high-tech private equity investor, many MNCs are setting up in new emerging centres, including Chengdu and Dalian in China, and Hyderabad in India.

These cities have not traditionally been hotbeds of R&D investment, but companies are discovering that local universities in such places are producing graduates of a decent enough quality and in large numbers. What’s more, the pace of new investment in such centres is rapidly creating
exciting ecosystems that strengthen and reinforce the R&D landscape. Freescale Semiconductor, a US chip maker, set up its first R&D centre in India in 1998 in Noida—a city close to New Delhi that is now heavily populated with global MNCs running outsourcing and R&D services there. For its latest R&D investment, launched in February this year, Freescale decided to look elsewhere, choosing Hyderabad in order to tap into what it sees as an emerging pool of new talent. Freescale’s move to Hyderabad follows on the heels of similar investments from firms such as Hyundai, the Korean auto maker, and Honeywell, which increased its investment in the city sharply in 2011.

A related aspect to the quality and supply of local engineering talent is the wider industrial ecosystem. Places that have built up strong industries, with all the supporting infrastructure and suppliers, create virtuous circles as the growth of an industry attracts talent that in turns attracts more industry. Numerous examples of this dynamic exist across Asia, such as in Thailand which is today the world’s tenth-largest auto exporter, or Penang in Malaysia which has developed a deep pool of engineers with expertise in electronics and manufacturing.

Malaysia was an early leader in Asia in attracting R&D investment in electronics manufacturing. Over the past decade the country has lost some of its edge to other emerging centres of electronics excellence, notably China, Thailand and more recently Vietnam. However, say executives, Malaysia retains a deep pool of engineering talent, and scores more highly on its standards of intellectual property protection than many other locations. One R&D chief says Malaysia’s IP protection is markedly better than China’s.

Interestingly, most executives say the role of government incentives in choosing a location for R&D is relatively small. Of course, all else being equal, companies are happy to accept tax breaks and other government offers, but these factors are rarely a deciding factor. “Companies run by engineers make R&D decisions for the right reasons: they look for the talent,” observes one R&D director. “Companies run by operations specialists, who understand short-term financial performance but are often ignorant of the technology, tend to be more swayed by government incentives.”

Wim Elfrink, chief globalization officer at Cisco, a US telecoms equipment firm, notes that wider government policy towards technology and industry development is far more important than incentives or handouts. “We look for government interest in our sector, and the degree to which they cultivate a national appetite for the technology we do,” he stresses. “In China, for example, a commitment to cloud computing is driving investment in telecoms infrastructure. And support for national-level R&D programmes offers us opportunities for partnering with research institutes.”

Towards a “global brain”

Importantly, the best location for a research facility is not always in Asia. Indeed, many Asian firms are raising their R&D investments in the West just as Western firms are investing in Asia.

Consider Lenovo, a Chinese computer manufacturer. The firm has extensive R&D operations in its home market of China. But following its 2005 acquisition of the PC business of IBM, a US IT company, Lenovo inherited R&D centres in Japan and the US. Today, Lenovo thinks of these three countries as its “innovation triangle”, with Japan developing high-end laptops, China developing mass-market computers and handheld devices aimed at emerging markets, and the US focused on developing new consumer products, such as tablet computers.

“The US consumer drives a lot of new product development, so we need to have R&D on the ground there,” explains Mark Pinner, product communication director for Lenovo’s mobile internet and digital home division. “If the US consumer likes a new product, then it is highly
likely to succeed in Europe. If the US consumer doesn’t like it, the product is unlikely to be successful.”

In many senses, this multi-directional flow of R&D investment, with Asian companies going to the West, and Western companies moving to the East, is just a reflection of a maturing stage of globalisation at MNCs. These firms serve global markets, and they need to be as close as possible to their customers in as many markets as possible.

When viewed from a R&D perspective, some observers have likened this process to building a “global brain”, whereby companies draw on the full diversity of global R&D talent in all parts of the world. Increasingly, firms try to move their scientists around these new global R&D networks in order to mix different skills and experiences and foster new innovation.

Alcatel-Lucent, for example, has arranged for 20 engineers from China Mobile, its largest customer, to move to Stuttgart and engage in research alongside the firm’s own scientists working on wireless communication standards. Examples such as this show a new side to the “global brain” idea—not only sourcing R&D talent from anywhere in the globe, but finding it in places outside the company too.

**New organisational structures**

This pursuit of creating a global brain creates big organisational challenges for MNCs, especially for Western firms as they move rapidly into Asia, and rely ever more heavily on Asia for their growth.

“Companies are realising that their R&D landscape is much more dispersed than in the past,” observes Scott Anthony, managing director in Asia for Innosight, an innovation consulting firm. “The person who heads up R&D in China, for example, is becoming ever more important, so companies are having to build new organisational structures to make these dispersed R&D operations work.”

Cisco Systems is one company that has acknowledged this need. In 2007, the firm recognised the importance of getting closer to its growth markets in the emerging world and decided to add a second global HQ in Bangalore in India, alongside its main HQ in San Jose, California. The goal was to move significant numbers of Cisco’s senior management team to India, a location the company claims puts them not only within four hours’ flying time of 70% of the world’s population, but in close proximity to the world’s largest pools of emerging R&D talent.

“Setting up our second HQ was about getting access to the growth, talent and innovation that is coming out of emerging markets,” says Mr Elfrink, who was put in charge of creating the India campus. “From a R&D perspective, it is about globalising our corporate brain.”

Naturally, the company’s original HQ in the US is still home to a greater number of senior managers and is more important than the HQ in Bangalore for many functions. However, Mr Elfrink stresses that for Cisco’s R&D, “Bangalore is a partner with San Jose, not a subordinate.”

At National Instruments, Mr Nair believes such moves will become ever more widespread. “These days, there is much less desire to associate a company with its home market,” he says. “A German company is no longer really a German company. An American company is no longer really an American company. We’re all becoming global companies, and the location of R&D is part of that process.”
Great expectations: Is the reality of investing in R&D in Asia living up to the hype?

Having invested so much in Asia’s R&D landscape, are companies satisfied with the way those investments are working out? Are they living up to expectations? In general, most firms say their experience has been highly positive.

Xilinx, a US-based designer of semiconductors and programmable logic devices, was relatively late to the game, setting up its first R&D operations in Asia five years ago, with a hardware development centre in India and a software centre in China. However, says Vincent Tong, worldwide head of quality and new product introductions for Xilinx, in a short space of time the influence of those centres has risen markedly. “The fingerprints of our Asian research teams are all over our products these days,” he says.

But despite this success, Xilinx has experienced its share of challenges in running R&D in Asia. “When we first set up our R&D centres, things didn’t go as smoothly as we were hoping,” concedes Mr Tong. “We had issues with the stability of personnel, with staff attrition, and recruiting the people we needed.”

Indeed, many other companies report similar problems: high levels of staff turnover and difficulties in recruiting the right calibre of engineer. It is somewhat ironic that companies choose to set up in Asia to access the region’s rising supply of science and engineering graduates, only to find that the demand for those workers is rising at an equal, and sometimes greater, pace. What’s more, many companies have complained that, despite the huge supply of graduates in Asia, only a small percentage of them have the right type and quality of education. Of the graduates that do fit the bill, strong demand has caused many companies to resort to rapidly raising wages and aggressively poaching staff as a way to meet their hiring needs.

This type of recruitment behaviour has in turn made managing personnel even more tricky. Mr Lay at Emerson Electric says the supply-demand imbalance for good graduates in China has unleashed unrealistic expectations around career progression. “Because the supply of good quality graduates is tight, Chinese engineering talent is no longer willing to put in the years of rote process work that is really the core of R&D,” he sighs. “They want to move up into discovery and invention, and move up the seniority ladder in an unrealistically short time.”
Tackling turnover

And yet, while such problems are certainly serious, companies are learning how to live with the situation by deploying an armoury of personnel policies. “One of the problems we faced was that people didn’t know who we are or what we do. And if they did know, they didn’t think of Xilinx as a place to build a career,” says Mr Tong at Xilinx. The company thus made efforts to raise its profile through marketing and communications strategies in China and India.

At Symantec, Mr Ghosh says the R&D staff turnover ratio for his company in India is around 7%—half the industry average. When the Indian economy is strong, he says that attrition rates creep up a little, but fall again during periods of slower growth. Several factors help explain Symantec’s better-than-average staff retention, but chief among them, says Mr Ghosh, is the quality of the work being done in the company’s R&D centres. “In the early days, when India was about low-end coding work, staff turnover and retention were serious problems because the work was uninteresting,” he recalls. “But today we are working on high-end product development projects. It’s more challenging and satisfying, and that means that staff are much more excited and engaged.” Given that Symantec’s India operations now have global responsibility for certain products, workers also feel that they have good career prospects within the company and no longer need to jump ship to move up the corporate ladder.

At Yahoo!’s India operations, Mr Mukherjee sees the same forces at play. At a junior level, he notes, staff turnover is still higher than he would like it to be, but not at a senior level. As Yahoo!’s Indian operations have taken on more global responsibility, “decision-making rights and staff empowerment are much greater than in the past, and that has many benefits,” he says. “It raises our output of innovation and it makes workers want to stay.”

Depending on diaspora

The culture inside India’s R&D centres is also changing for the better. In the past, says Mr Mukherjee, Indian operations were hierarchical, stifling places, with little contact between different levels in the organisation. Today, they work with much flatter hierarchies, and corporate cultures that are much more Western in nature.

“This not only makes them more attractive for local Indians, it makes them more attractive for overseas Indians who want to return home,” says Mr Mukherjee, himself a returnee from the US.

In fact, he adds, when Yahoo! recruits for senior positions in India, these days they recruit globally. Of the firm’s 2,000 R&D staff in India, around 30% came from overseas, almost all of them returning Indians. Ten years ago, it would have been hard to lure so many of them back home. But these days, with India’s R&D centres moving up the value chain, and with a growing perception that emerging markets offer better economic opportunities than mature economies, recruiting internationally has become much easier.

This trend of luring back overseas nationals is apparent across much of Asia. At Honeywell, Mr Songukrishnasamy says in China it is relatively easy to find good quality engineers with five years of experience, but much harder to find them with 10 years under their belts. For these more senior roles, he says that Honeywell automatically looks to international markets to recruit its talent. “Finding skilled resources in a high-growth environment is always a challenge,” he says, “but the number of Chinese nationals overseas who want to return to China is growing quite quickly.”

This pool of overseas talent is still large. In the US, 60% of all engineering doctorates and 50% of all doctorates in engineering, mathematics, computer sciences, physics and economics awarded in 2008 went to foreign students. In the past, these highly educated people were keen to stay and pursue careers in the US. Today, many want to return home. The same study showed that
only 6% of Indians and 10% of Chinese graduates in the US wanted to stay permanently in the US after graduation.4 The main reasons for wanting to return home were a belief that their home countries offered greater opportunity, as well as a desire to be closer to their families.

Back to school

Another common strategy for dealing with worker shortages in emerging Asia is to build deeper relationships with universities and colleges. At one level, some executives build relationships by giving guest lectures, and so expose students to the possibility of joining their company. Xilinx, for example, has a schools programme that encompasses 2,500 universities and colleges across the Asia Pacific region.

Other companies set up formal internship programmes with colleges, whereby students spend between three and six months working at the firm, collaborating on research projects and being exposed to the company and its technologies. These internship programmes are often an important part of the recruitment process, with companies making offers to the most promising of the interns.

Another way of developing the talent pipeline with academia is to work with professors on shaping the curricula so that students graduate with skills that are relevant to what a company needs. Some companies also set up research partnerships with certain faculty, thereby not only exposing students to the idea of working with the partnering firm, but also harnessing the intellectual muscle of a university to work on company projects (see case study: National Instruments).

Addressing IP

Besides challenges in managing human capital, companies also raise concerns about the quality of intellectual property (IP) protection in Asia. Some worry that standards of protection are far lower in emerging Asia than in more developed countries, citing frequent instances of copycat products and IP theft.

Without question, the dangers of IP leakage and theft are ever present in Asia, and have been a source of disappointment and concern for many firms (see chart D). However, most executives calculate that the dangers of IP theft in countries such as China are outweighed by the dangers of not being in the market. What’s more, companies report that the situation is improving. In China, for example, the government has stated explicitly that it wants to develop a high innovation economy, and that this can only happen in an environment where IP is protected and IP rules are respected. Observers say that the country has good IP laws, and it is only a matter of time before enforcement of those laws is tightened to more acceptable levels.

Chart D: The Economist Intelligence Unit ranking of intellectual property protection, ranked from 1 to 5 (with 1 being very poor and 5 being very good)
In South Korea, the IP environment has become arguably even tighter than in the West. “Nobody in the world treats IPR as sensitively as Korean companies because it is so integral to their success,” says Charles Moon, principal analyst at Informa, a research and information group. “If you visit the HQ of Samsung, you not only have to surrender your laptops and any memory devices at reception, but you have to put black tape over the camera on your phone,” he recounts. “There is a lamppost outside the building which is completely covered in tabs of black tape from visitors leaving the building—and I think they leave it like that on purpose.”

One contrarian view of IP in Asia argues that the lack of protection in fact creates a more dynamic environment for innovation. Without protection for their ideas and designs, companies can only stay ahead of competitors by innovating at faster speeds rather than by sitting back and enjoying the proceeds of protected IP.

Given historically weak IP regimes, some Asian markets have developed a kind of copycat innovation. The Chinese in particular excel in shanzhai (“bandit” or “guerrilla”) innovation and continue to develop faster and more fascinating production processes to ensure their counterfeit goods reach the marketplace quickly. The quality of these (highly affordable) products is also rapidly improving, and many of the copycat iPhones, iPads and other high-tech gadgets are even fashionable enough for professionals to desire them.

Of course, these counterfeit products by themselves do not embody as much ingenuity as the original ones do. But the speed and organisation by which these knock-offs are brought to market requires the bandits to deploy innovation in their own way—China’s first fake iPad came out just 21 days after Apple unveiled it. Many shanzhai companies also aggressively develop new or customised features to differentiate their wares from the genuine product, increasing their coveted value—such as tablets or phones that support stylus input, which is in demand by Chinese users as Chinese characters are hard to imprint on a touch screen device. These little innovations, or derivatives of the origin, can put extreme pressure on global brands.

Another “benefit” of lax IP law enforcement is that it reduces the danger of unintentional IP infringement. “In the West, it is so easy to infringe patents that have lain dormant for many years, and the courts are so powerful that they can stop your R&D in its tracks. In emerging markets, those concerns of unintentional infringement are much less of a worry,” says Mr Anthony at Innosight Asia.
Helping students spot the flaws in their industrial designs helps National Instruments fill the gaps in its talent pipeline

National Instruments, a US company that makes equipment for testing and controlling industrial processes, is heavily committed to investing in R&D. Last year, for example, the firm invested 16% of its revenues—US$160m—in its research programmes worldwide.

These days, more and more of that R&D is carried out in Asia. Of the firm’s 2,000 scientists and engineers, around 30% of them are now in Asia—roughly in line with Asia’s contribution to the company’s global revenues—working in three centres in Bangalore, Penang and Shanghai.

Chandran Nair, CEO in South-east Asia for National Instruments, says recruiting engineers to join his expanding R&D programme is always a challenge. The quantity of engineering graduates in places such as China, India and South-east Asia is fine, he says, it is just that the quality is often lacking.

To tackle this issue, he and his colleagues have set up an academic programme that builds deep relationships between National Instruments and Asia’s leading universities. The engagement has many parts to it, such as helping to shape the curricula at universities so that students learn appropriate skills.

Just as important, the company also runs extensive internship programmes. Every year, National Instruments receives many more applications for its intern programme than it can absorb, and so interviews and vetting of candidates are extensive. And with good reason—around 20% of the interns that spend time with the company in Asia are eventually hired when they graduate.

In a further strand to its relationship building with academia, National Instruments also supplies its equipment for free to kit out university laboratories, under a programme it calls “doing engineering”.

“The top schools all have excellent simulation software tools, but students often get very little practical experience,” explains Mr Nair. “They can design a wonderful robotic arm in a simulated environment, but they get no experience building that arm in real life. We provide the tools to help them find out if their designs would actually work. We give them experience in fixing unexpected problems, such as if the gears don’t work exactly as the simulation said they would.”
Outlook: Asia’s role in R&D can only increase

Given the high economic growth rates in Asia, everything changes at an accelerated pace, and the character of the region’s high-tech R&D landscape is no exception. In just 20 years, emerging Asia has gone from producing very little of its own innovation to having centres of excellence taking the global lead in product development.

So what does the future hold? Certain trends are clear. First, Asia’s economies will continue to grow faster than others around the world. As a result, the region will become an ever more important customer base for global companies. These companies will keep investing in R&D in the region in order to get closer to this growing customer base.

Second, Asia as a source of cheap labour will continue to be important as a reason for investing in R&D, but this reason will become ever less significant. Already, the wages of top-end engineers and scientists match those of their peers in the West. For the parts of the R&D chain that require cheap labour, firms will move away from the tier 1 and tier 2 cities into less well-known centres.

Third, the work being done in Asia’s R&D centres will create centres of excellence for emerging market products and services. Global companies have recognised that it is no longer good enough to localise products developed in the rich world. Instead, they must develop products for low-income customers that start with a blank sheet of paper. Because Asia’s economies are still relatively low-income in nature, this will drive Asia to become the place that oversees global programmes focused on emerging markets. Many of these low-cost offerings will find favour in rich markets too as they struggle to reduce their debts.

Fourth, global firms will increasingly recognise that they have much to learn from emerging markets about the process of doing R&D, not just the products that come out of the process. Indeed, many global MNCs already have initiatives designed to emulate the best of Asia’s local R&D champions, notably pursuing R&D at much faster speeds, at much lower costs, with much greater flexibility, and with greater openness to pursuing co-innovation with external partners.

Fifth, Asia will not only focus on emerging market ideas. The region will also take the lead for many products and services designed for more developed markets too. Already there is much evidence of R&D centres in China and India taking the management role for developing products that are globally uniform, such as web applications. This trend will increase as the experience and skills in
Asia continue to grow.

Sixth, Asia will draw in ever larger numbers of foreign scientists to work in the region. While Asia is producing huge cohorts of its own engineers, the demand is such that talent in Europe and the US will continue to migrate to where the opportunities lie. Most of this talent will be returning Chinese, Indians and other Asians who attended university or found jobs in the West. But some of the talent will also be Western. Indeed, at Philips, Mr Hidalgo is currently based in the Netherlands, but believes there is a good chance his role as chief technology officer will relocate to Asia in the next three years.

Seventh, the coming years will see firms face giant organisational challenges as they move away from an R&D structure built on a few dominant centres to a much more distributed global form. This push towards a “global brain” that draws on R&D resources from all over the world – and especially from Asia – will require major surgery and reorganisation. One executive notes: “The biggest challenge will be managing the insecurity of scientists in the West as the global R&D investment portfolio rebalances to match the picture of global growth.”

This is not to paint an overly negative picture of R&D in the West. Companies will need to keep investing in R&D in mature markets too, and the quality of innovation in the West will remain more sophisticated than that practiced in much of Asia for some time. The challenge for firms is to create an integrated corporate brain that draws from the best R&D capabilities from around the world.
Whilst every effort has been taken to verify the accuracy of this information, neither The Economist Intelligence Unit Ltd. nor the sponsor of this report can accept any responsibility or liability for reliance by any person on this report or any of the information, opinions or conclusions set out herein.