Economist Intelligence Unit

The Economist

# How technology sectors grow

## Benchmarking IT industry competitiveness 2008

A report from the Economist Intelligence Unit

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# Preface

*How technology sectors grow: Benchmarking IT industry competitiveness 2008* is an Economist Intelligence Unit white paper, sponsored by the Business Software Alliance.

The Economist Intelligence Unit bears sole responsibility for the content of this report. The Economist Intelligence Unit's editorial team built the index model, conducted the analysis and wrote the report. The findings and views expressed in this report do not necessarily reflect the views of the sponsor.

Our research drew on two main initiatives:

- We updated our benchmarking model, the "IT industry competitiveness index", which compares 66 countries on the extent to which they support the competitiveness of information technology (IT) firms.
- We also conducted in-depth interviews with 15 senior executives of IT firms and independent experts knowledgeable about the drivers of IT competitiveness.

The author of the report was Kim Thomas and the editor was Denis McCauley. Mike Kenny was responsible for design and layout.

Our sincere thanks go to the interviewees for sharing their insights on this topic.

September 2008



# Executive summary

Tougher times lie ahead for information technology (IT) producers as an economic slowdown brings weaker IT spending in the US, western Europe and Japan. Even amid shifting market conditions, however, the fundamentals of IT industry competitiveness remain constant. Thanks to their established strengths in making skills, finance and infrastructure available to local IT producers and in stimulating innovation, the identity of the top 20 countries in the Economist Intelligence Unit's 2008 IT industry competitiveness index remains unchanged from last year.

However, this year's results show that there is no room for complacency among the front runners, with three new countries moving into the top five.

The US again ranks top of the index as the world's most supportive environment for IT firms, notwithstanding its current macroeconomic problems. As an incubator of high-tech start-ups and technology innovation and as a developer of talent, the US remains a pace-setter. However, the gap is narrowing as IT industry environments in Europe and Asia—including in emerging markets—are becoming more competitive.

Also through its strengths in research and development (R&D) and nurturing technology talent, Taiwan rises to second spot in 2008. The UK, Sweden and Denmark—west European countries with strong and open business environments, well-developed infrastructure and robust legal protection for intellectual property—round out the index top five.

Following are other highlights of the 2008 study:

- **Investing in people is mission-critical for domestic IT industries**. Sourcing talent—particularly employees armed with "soft" management and analysis skills—will be among the toughest challenges IT producers will face in the coming years. The US, Singapore and UK provide the best environments for human-capital development among our index countries, and the US in particular remains a magnet for foreign students. The brain drain of IT talent from emerging markets shows signs of slowing or reversing, however, as training opportunities expand in many markets and IT professionals return home—to India and Vietnam, for example—to work in established technology firms and start-ups.

- **Competitive broadband markets help cultivate strong IT sectors**. Without fast, reliable and secure Internet access, technology firms cannot interact effectively with partners and the research community, nor can they sell their services online. IT industries in the index top tier all derive substantial benefit from the high-quality networks developed through competition, but more telecoms liberalisation is needed in less developed regions to spur infrastructure development. Emerging IT outsourcing industries in countries in the middle and lower index tiers, such as South Africa, Bulgaria, Ukraine and Vietnam, would receive a significant boost with faster, competition-led infrastructure development.

- **Legal regimes are slowly improving**. The US, Australia and west European countries retain the world's most effective systems of intellectual property (IP) protection and the most developed bodies of e-commerce and cybercrime law. But progress in bolstering legal regimes is also being made in tough places. China, for example, has in recent years brought its IP and e-commerce legislation more closely into line with international norms, and gradual improvements are evident in IP enforcement.

● **East Asia boasts the strongest R&D environments.** Dynamic innovation, supported by a strong R&D environment, is a major contributor to IT industry competitiveness. East Asian economies—Taiwan, South Korea and Japan—remain the index leaders when it comes to the R&D environment for technology production. As well as the other category leaders, Sweden and the US, all are prolific generators of technology patents, and its firms are heavy R&D spenders.

● **Globalisation and the Internet will "liberate" R&D.** Entrepreneurialism and IT innovation are closely intertwined, as exemplified in the shining example of America's Silicon Valley. Similar ecosystems bringing together talent, technology, venture capital and good universities, supported by a risk-taking ethos, will remain the best incubators of innovation. Internet-driven collaboration will partly level the playing field, facilitating companies' access to skilled IT innovators and researchers wherever they are located.

Local production of hardware, software or IT services can offer major benefits to a country's economy; so policymakers, unsurprisingly, are tempted to promote its development. Governments' best results come from concerted efforts to improve education, skills development, and the financing and legal environments. E-government development and a proactive broadband strategy can also help, as can carefully calibrated support for innovation, such as in the selective financing of fundamental research.

Trouble usually comes, however, when public support extends to championing specific companies or technologies. North American, west European and some Asia-Pacific governments generally strike the right balance, but this is a challenge for policymakers everywhere. To them we commend a maxim: let the market forces operate.

## Who's up, who's down?

Although the identity of the index top twenty remains the same as in 2007, there has been some upward and downward movement of economies here and elsewhere in the ranks. Significant shifts—of more than two places—in the index include the following:

**Taiwan** has risen from 6th to 2nd in the overall index based primarily on its strong performance in the R&D environment category, and particularly in patents.

**Japan** has suffered the steepest drop among the index countries—from 2nd to 12th—also largely due to changes in its R&D and patents scores. This is also the case with **South Korea**, which fell from 3rd to 8th, and has much to do with a refinement of our methodology for assessing patents (see "About the index" below, and Appendix 1.)

Different factors lie behind the shift upward by three places of both **Sweden** and **Denmark**—to 4th and 5th respectively—including a more favourable business environment and improvements in IT infrastructure. Denmark's score has also risen in the human capital category.

**Canada** has risen from 9th to 6th place thanks mainly to improved performance in the area of human capital development.

**Israel** has advanced from 20th to 16th this year thanks to stronger scores in IT infrastructure and in the area of government support for the IT industry (including in the implementation of e-government strategy).

**Germany** has fallen from 16th to 19th place due primarily to the aforementioned change in measuring patents, as well as to slower growth of R&D funding.

In the lower tiers, **Sri Lanka** and **Algeria** have suffered falls in the ranks (by three and four places respectively, after factoring in the addition of new countries to the index) due less to deterioration in their performance in any one area than to the faster improvement of countries near them in the index.

## IT industry competitiveness index: Overall scores and ranks

| Country | Score | 2008 rank | 2007 rank | Country | Score | 2008 rank | 2007 rank | Country | Score | 2008 rank | 2007 rank |
|---|---|---|---|---|---|---|---|---|---|---|---|
| United States | 74.6 | 1 | 1 | Estonia | 45.7 | 24 | 25 | Philippines | 29.8 | 47 | 47 |
| Taiwan | 69.2 | 2 | 6 | Italy | 45.6 | 25 | 23 | India | 28.9 | 48 | 46 |
| United Kingdom | 67.2 | 3 | 4 | Slovenia | 45.5 | 26 | 27 | Russia | 27.7 | 49 | 48 |
| Sweden | 66.0 | 4 | 7 | Portugal | 42.2 | 27 | 25 | China | 27.6 | 50 | 49 |
| Denmark | 65.2 | 5 | 8 | Hungary | 40.6 | 28 | 28 | Venezuela | 25.7 | 51 | 52 |
| Canada | 64.4 | 6 | 9 | Czech Republic | 40.4 | 29 | 29 | Colombia | 25.4 | 52 | 51 |
| Australia | 64.1 | 7 | 5 | Chile | 39.6 | 30 | 31 | Egypt | 25.3 | 53 | 55 |
| South Korea | 64.1 | 8 | 3 | Slovakia | 39.5 | 31 | 31 | Sri Lanka | 24.9 | 54 | 50 |
| Singapore | 63.4 | 9 | 11 | Poland | 39.0 | 32 | 30 | Peru | 24.8 | 55 | 54 |
| Netherlands | 62.7 | 10 | 12 | Greece | 38.2 | 33 | 33 | Ecuador | 24.5 | 56 | 53 |
| Switzerland | 62.3 | 11 | 10 | Latvia | 38.1 | 34 | 34 | Ukraine | 24.3 | 57 | 56 |
| Japan | 62.2 | 12 | 2 | Lithuania | 37.1 | 35 | 35 | Indonesia | 23.1 | 58 | 57 |
| Finland | 61.5 | 13 | 13 | Malaysia | 34.2 | 36 | 36 | Kazakhstan | 22.9 | 59 | 58 |
| Norway | 59.7 | 14 | 14 | South Africa | 32.6 | 37 | 37 | Bangladesh* | 22.4 | 60 | – |
| Ireland | 59.4 | 15 | 15 | Turkey | 32.4 | 38 | 39 | Vietnam | 21.4 | 61 | 61 |
| Israel | 56.7 | 16 | 20 | Romania | 32.3 | 39 | 40 | Pakistan | 20.9 | 62 | 60 |
| New Zealand | 56.6 | 17 | 17 | Saudi Arabia | 32.3 | 40 | 38 | Azerbaijan | 19.5 | 63 | 62 |
| Austria | 56.1 | 18 | 19 | Croatia* | 31.6 | 41 | – | Nigeria | 19.0 | 64 | 63 |
| Germany | 55.4 | 19 | 16 | Thailand | 31.5 | 42 | 41 | Algeria | 18.5 | 65 | 59 |
| France | 54.3 | 20 | 18 | Brazil | 31.0 | 43 | 43 | Iran | 16.5 | 66 | 64 |
| Hong Kong | 54.1 | 21 | 21 | Mexico | 30.7 | 44 | 44 | | | | |
| Belgium | 53.4 | 22 | 22 | Bulgaria | 30.2 | 45 | 42 | | | | |
| Spain | 46.3 | 23 | 24 | Argentina | 30.1 | 46 | 45 | | | | |

*New to the index in 2008.
Note: Countries are scored on a scale of 1 to 100. A four-decimal score is used to determine each country's rank.
Source: Economist Intelligence Unit, 2008.

## About the index

Now in its second year of existence, the IT industry competitiveness index covers 66 countries, with Bangladesh and Croatia having been added to the ranks in 2008. As last year, the index is organised into six distinct categories of quantitative and qualitative indicators, numbering 25 in all. The category and indicator weights were formulated by the Economist Intelligence Unit's modelling team using, as a guide, individual correlation coefficients of each indicator against a measure of IT labour productivity. The result is an overall index score and category scores for each country. The categories and their weights are shown below:

| Indicator categories | Weight |
|---|---|
| Overall business environment | 0.10 |
| IT infrastructure | 0.20 |
| Human capital | 0.20 |
| Legal environment | 0.10 |
| R&D environment | 0.25 |
| Support for IT industry development | 0.15 |

The scoring methodology remains unchanged from last year, with one important exception. Country scores in the indicator covering patents, which are assessed in the R&D environment category, are now based on an estimation of IT-related patent registrations rather than using figures covering the entire economy, as was the case in 2007. This is a heavily weighted indicator in the model, and the change has resulted in some movement in ranks in both the R&D environment category as well as the overall index (particularly in the cases of Japan, South Korea and Taiwan).

Qualitative indicators are scored by Economist Intelligence Unit analysts on a 1-5 scale, according to specific scoring criteria. Quantitative indicators are normalised through the population set so that each country is measured from 0 to 1 by applying a formula to each data point. Each indicator is then converted into a score of 0-100 by applying a multiplier. As the weights sum to 1, the composite score for each country is also based on an index range of 0 to 100 (with 100 representing the highest and best possible score).

For a full description of the indicators, scoring methodology and definitions, see Appendix 1.

# The importance of openness

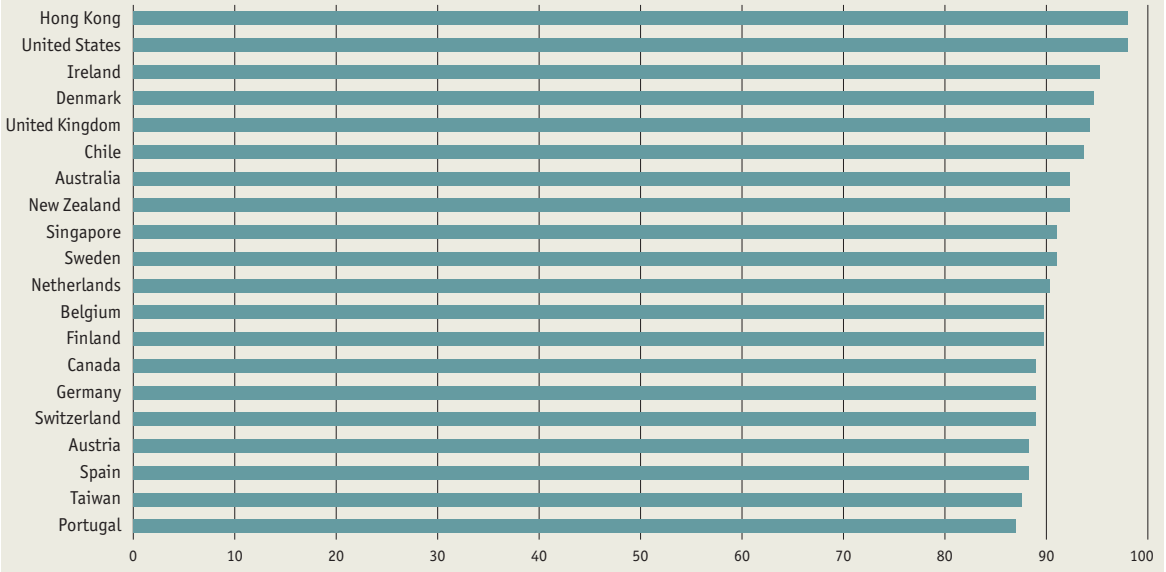
The IT industry is facing a very different demand environment in 2008 from that of previous years. The Economist Intelligence Unit expects world gross domestic product (GDP) growth to slow by a full percentage point or more this year. The downturn will be particularly acute in the US and western Europe, the world's largest IT markets.

Spending on IT will inevitably be affected: industry analysts have slashed their growth projections for 2008[1]. India's technology suppliers, according to Navi Radjou, a vice-president and principal analyst at Forrester Research, are already looking for new markets to export their goods in anticipation of a possible recession in the US.

But the global technology sector is not driven by macroeconomic performance alone. Multinational technology companies will continue to invest in economies with a favourable environment for doing business. Among other factors, that environment should ideally include a high level of government commitment to open competition and receptiveness towards foreign investment and trade; recognition of the sanctity of private property; and a light but consistent regulatory touch.

Jean-Hervé Jenn, international president of Convergys, a US-based software provider, argues that a solid higher education system and an attractive tax regime are the two key factors in creating a flourishing technology sector. The tax structure, he says, "should allow people to fulfil their dreams of being successful with their technology and benefit from it financially". He points to Ireland as the paramount example of combining a solid education system with attractive tax incentives to create a thriving IT sector.

**Overall business environment: Top 20 countries and scores**




Source: Economist Intelligence Unit, 2008. See Appendix 3 for a full list of scores.

1. Forrester, *Global IT 2008 Market Outlook*; Gartner, *Gartner Predicts 2008 and Beyond*; IDC, *IDC Predictions 2008: The Hyper-Disrupted IT Industry Takes Root*.

Ireland remains a strong performer in the IT industry index overall and in the business environment category, ranking 15th and 3rd, respectively. Hong Kong and the US are rated again this year as possessing the world's most positive overall business environments for the IT industry, thanks to their strong, long-established commitment to free enterprise and competition, complemented by a balanced and transparent regulatory touch. For similar reasons, Denmark, the UK and Chile are also high scorers in this category. The latter is unique in Latin America, having made an early start to economic liberalisation and long maintaining a favourable attitude to competition and a welcoming foreign investment regime.

**Foreign investment as a catalyst**

Foreign direct investment can kickstart a country's technology sector, particularly in the developing world. One of the reasons the IT industry has flourished in India, says Kris Gopalakrishnan, CEO of Infosys, one of India's largest IT services firms, is that the government has allowed 100% foreign ownership in the IT sector since the early 1990s. Openness, however does not extend throughout the economy, and regulation is not fully transparent, resulting in India's relatively low rank of 50th in this category.

For Dimension Data, a South African IT services firm, liberalisation has also been important to some of its larger foreign-investment decisions in regions such as central Europe. "The Czech Republic looked structurally good for us in terms of growth of the overall market and deregulation of the communications sector," affirms Brett Dawson, the firm's CEO. Many of its customers agreed: "Quite a few clients wanted us to set up data centres and European head offices there. It's a low risk strategy for us, because clients are pushing us to go there."

Governments must keep the doors open to foreign investment particularly when the benefits of protecting growing industries seem enticing. China is a case in point, according to Mr Radjou. There, he says, restrictions on foreign investment in the technology sector are emerging, owing to the official desire to cultivate the growth of domestic players. For this and other reasons, China's 60th place in the business environment category is no accident.

If companies are deterred from investing by high taxes, restrictive labour laws and a lack of skills, they can also be put off by a substandard regulatory environment. In China, hardware firms invested earlier than software firms because hardware is more difficult to copy. As the country's own software industry begins to take off, implementation of IP laws is becoming more rigorous (as discussed later in the report).

# The digital building blocks for IT production

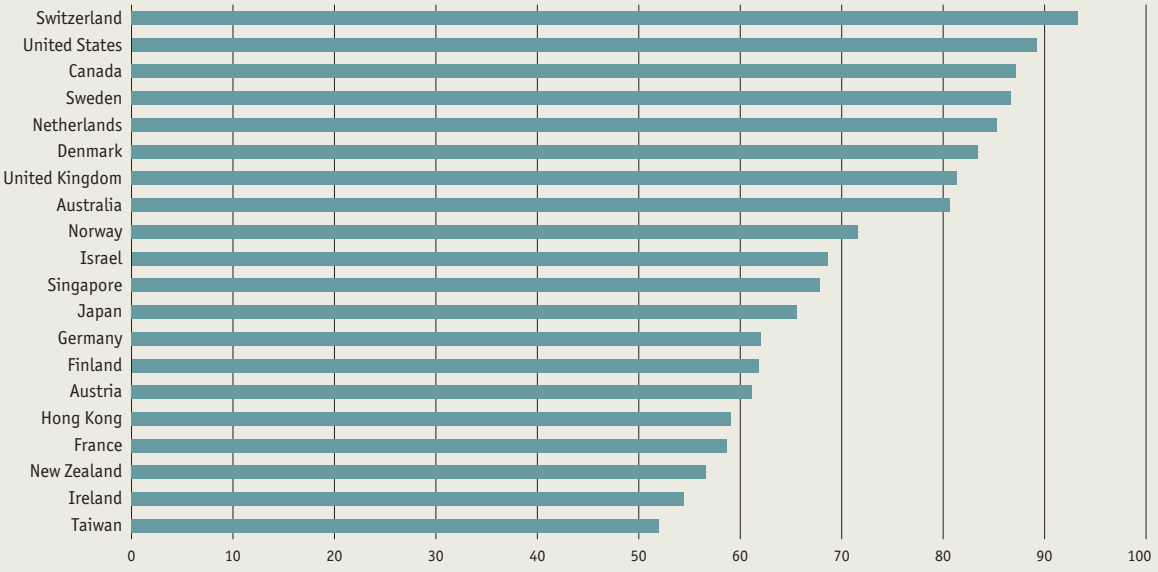
Companies need technology in order to produce it. An advanced and secure IT infrastructure—typified by, among other features, high levels of broadband access and hardware and software adoption by organisations and consumers—enables technology firms to do business effectively with customers, suppliers and partners, whether through online marketing, web-based collaboration or multi-channel customer relationship management (CRM). High-quality infrastructure is also a precondition for vigorous innovation by IT firms.

Good IT infrastructure is important to the technology sector in another way: in enabling people to freely access information and communicate with peers online, and to analyse, manipulate and create data using sophisticated computer devices and applications, students of all ages can develop and hone their IT skills. Graduates are then able to use their skills in the marketplace, either by working for businesses in the technology and other sectors, or by setting up their own firms, creating a virtuous circle.

It is no accident that seven of the top ten countries in IT infrastructure also figure in our overall index top ten. Switzerland, the US and Canada are the leaders again in this category of IT industry competitiveness, by virtue of widespread broadband adoption (over 30% penetration of the population, in the case of Switzerland and Canada) and strong IT spending by businesses and consumers, resulting in, among other things, high levels of computer penetration.

Switzerland, the US and Sweden also figure among the top five countries in the world in terms of both annual spending on IT goods and services and of computer ownership. Both are reliable

**IT infrastructure: Top 20 countries and scores**




Source: Economist Intelligence Unit, 2008. See Appendix 3 for a full list of scores.

indicators of the ability of a country's organisations and households to obtain advanced hardware and software, and to renew it.

The differences between developed and emerging economies are particularly stark in these areas. Annual spending on hardware, software and services in the top twenty countries in this category averages nearly US$115,000 for every 100 people, while in the next twenty countries the figure is just over US$31,000. In the lowest twenty countries, annual spend averages less than US$5,000 per 100 people. As a result, the divide is similarly wide in PC ownership, which averages close to 68% of the population in the top twenty countries, 25% in the next tier of twenty, and just 3% in the lowest tier.

A dearth of good technology in homes and organisations is detrimental, of course, to all economic activity in a country, not just that in the IT sector. Some governments in emerging economies are tackling this problem through initiatives to encourage take-up of personal computers (PCs) as well as broadband in homes and small businesses, often in public-private partnerships with commercial firms and non-governmental organisations (NGOs). In Chile's "My small business grows" programme, for example, the government works with IT suppliers and local banks to offer small firms PCs and Internet access (along with training) on preferential credit terms. Participating firms are also able to take part in public-sector tenders for services through the government's e-procurement portal.

**World leaders in IT spending, and their broadband penetration levels**


Sources: Economist Intelligence Unit; IDC; Pyramid Research.

## Vietnam takes some needed steps on a long road

Vietnam, like other countries in the lower reaches of the index (it ranks 61st in this category), suffers from long years of neglect of its IT and telecommunications infrastructure. Computer penetration is still very low—fewer than 2m people in a population of 86m own a PC—and less than 1% of the population enjoy broadband access. Like India and China before it, however, Vietnam aims to build on a literate, well-educated workforce to develop a local IT production sector, even if its infrastructure shortcomings take a long time to redress.

Some progress is being made. US chip-maker Intel, one of the first global technology firms to set up business in the country (in 1997), has invested in local IT and telecoms services businesses, and has worked with the government and local IT companies on several programmes to make PCs available to consumers, some with low-interest or interest-free loans. To spur broadband development, the government introduced competition into the Internet services market in the early part of this decade, which has helped reduce high-speed access prices.

The local software industry is beginning to develop and is attracting the attention of Western venture-capital firms. But Vietnam will need to maintain the impetus behind infrastructure improvement over the long haul, in order to provide the platform its fledgling IT sector will need to flourish.



**Broadband benefits for IT businesses**

Countries that have invested heavily in broadband have reaped the benefits in the form of flourishing online business activity, with companies able to reach new markets at relatively low cost. In Denmark, for example (6th in the IT infrastructure category), e-commerce now represents 20% of total turnover for domestic businesses[2].

In some parts of the world, however, development of an IT sector has been hindered by the existence of state telecoms monopolies. This is particularly true of Africa. "Early attempts to set up ISPs [Internet service providers] in most African states ran up against old post and telecoms monopolies that didn't want to open up the marketplace," comments Mark Thompson, a lecturer in information systems at Cambridge University's Judge Business School (in the UK). "They wanted to control what these ISPs were allowing to be visible over the web."

This is still the case even in South Africa, a country with many attributes that make it attractive to foreign investors, including good skills and the widespread use of English. Growth of local businesses is being hindered by lack of broadband, believes Mr Dawson of Dimension Data, and is also making South Africa a less attractive place for global IT companies to invest in. The country occupies 44th place in the infrastructure category.

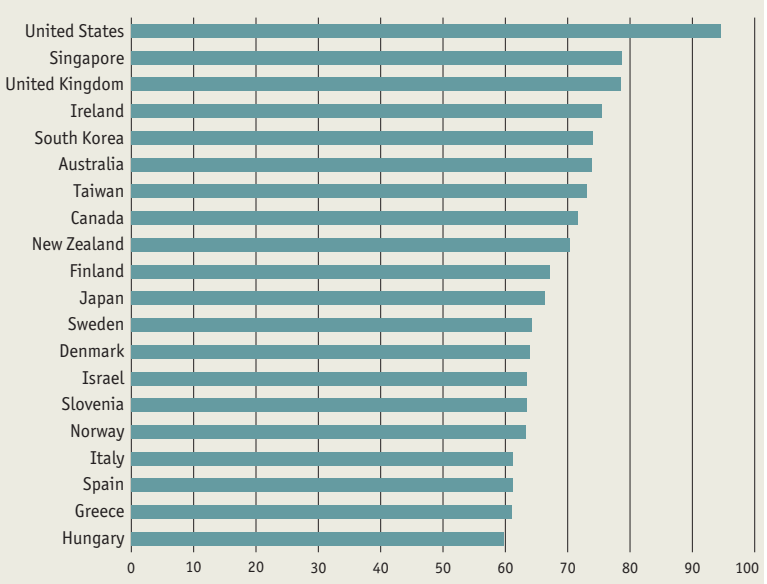
Mr Dawson points to the success of countries like Australia and New Zealand, which deregulated their telecoms industries early, making them much more competitive. "Making the telecoms industry more competitive would be a huge stimulus for the South African economy," he maintains. "In service-related industries like call centres, massive industries could be created that would make a huge difference to our country."

2. European Commission, *i2010 annual report 2007*.

# Developing human capital

The best-performing countries in developing talent for the IT industry—in our index these are the US, Singapore, the UK, Ireland and South Korea—have a number of things in common. They have vigorously pursued expansion of enrolment in higher education in recent years, including in science and engineering disciplines. Their tertiary educational systems are marked not just by quantity, in terms of enrolment, but also quality—with world-class universities or technology institutes. And their institutions are beginning to train technologists with business and management skills, not just technical skills.

**Human capital: Top 20 countries and scores**




Source: Economist Intelligence Unit, 2008. See Appendix 3 for a full list of scores.

### A burgeoning talent gap

Nonetheless, demand for IT talent continues to outstrip supply. "All the developed countries have a shortage of skilled resources, as well as the challenge of an ageing population. There are fewer young people and more older people: unless the demographic situation changes, these problems are going to become acute," acknowledges Mr Gopalakrishnan of Infosys.

In a recent global survey of senior executives conducted by the Economist Intelligence Unit, nearly 70% of respondents from the IT industry said they expect recruiting and retaining talent to become harder for their firms over the next three years, and one-third stated it would be "significantly harder". But it is not only the rich world that is facing a talent crunch: 50% of IT industry executives from emerging markets believe attracting and retaining talent will become "significantly harder" over the medium term[3].

Technology companies are recognising that they have a part to play in improving the skills base in the countries in which they are investing, whether it is through training staff or working directly with schools and universities. Says Eve Aretakis, CEO of Siemens Communications (based in the US): "We have centres of competency in the high-cost countries, and part of their objective is pushing up the level of expertise in the low-cost countries."

Ms Aretakis argues that, when it comes to choosing other countries in which to set up business, an apparently low-cost destination can have hidden costs. She recalls asking the firm's development centres in different countries to put in an estimate for executing a certain project. In a high-cost country with a lot of depth and experience in the area, the estimate was two staff years of effort; in a low-cost country with less experience, the estimate was ten staff years of effort.

India is well regarded as a source of skilled labour, producing nearly half a million technology

3. The survey is cited in two Economist Intelligence Unit reports—*Talent wars: The struggle for tomorrow's workforce*, which focuses on developed-country markets, and *People for growth: The talent challenge in emerging markets*. Both were published in May 2008, and both were sponsored by SAP.

and engineering graduates a year. But when the large Indian IT firms recruit new graduates, the new entrants typically spend a few additional months on training programmes. "At entry level we need to train them on software engineering, then on business knowledge, management principles and leadership skills," says Mr Gopalakrishnan. Infosys is now beginning to work with 350 of India's engineering colleges to improve training curricula and reduce the need for the company to train at entry level.

Russia too has become an outsourcing destination for software development, largely on the strength of its large pool of IT talent. Although ranked 49th in the overall index, it occupies 29th place in the human capital category, thanks to relatively high enrolment in higher education overall and in science and engineering programmes. Russia's system of technology training faces similar challenges to that of India and other markets, although Michael Friedland, executive vice-president of Luxoft, a Russian IT services firm, maintains that IT training in Russia is broader than elsewhere: "People are taught to resolve complex problems", he says, "and to be able to do not just programming but also analysis."

**Combatting the brain drain**

International applications to American MBA programmes from countries such as India, China and South Korea reportedly remain on the increase in 2008[4]. However, shortages of skilled graduates in fields such as advanced mathematics and engineering are becoming evident. In this context, the US government's toughening immigration stance is a cause of concern in the domestic IT industry. In particular, some executives fear that tighter restrictions on the issuance of temporary visas for guest workers—many of whom have traditionally stayed on after graduating from American universities—will hamper their firms' ability to grow.

Tighter visa controls may begin to discourage talented emerging-world students from applying to study in the US. But business and technology training programmes are also improving in Asia, as reflected in the high human capital scores awarded in our index to economies such as Singapore, South Korea and Taiwan. Students in emerging markets are gradually coming to enjoy better educational opportunities at home.

The Internet is helping to drive this development. Although some students may leave China to study

## Egypt invests in tomorrow's IT talent

Egypt's government is among the few in the Middle East and Africa to prioritise the development of IT skills. Along with strategies for encouraging PC ownership in business and at home, a government-supported education programme, the Egypt Education Initiative (EEI), launched in 2006, aims to improve the quality of education through a number of measures, which include providing children and students with access to a wide range of e-learning materials and equipping them with IT skills that will prove useful in the marketplace. But the government also believes it will create numerous support jobs for technicians and open up markets for private sector companies, as demand for IT hardware and educational software is generated in Egyptian schools.

The EEI, which is supported by the World Economic Forum (WEF), is a partnership between government, global technology companies such as IBM and Microsoft, and local businesses. Expected to run until 2009, it has equipped 2,000 schools with high-speed Internet connections, installed learning laboratories in all 18 of its universities and trained 80,000 teachers in information and communications technology (ICT) skills.

The country also hopes that its expanding pool of multilingual graduates will attract inward investment. The existence of German schools, for example, has proved attractive to companies wanting to set up call centres servicing the German market, reports Sherif Hashem, executive vice-president of Egypt's Information Technology Industry Development Agency (ITIDA).

4. "MBA students look to US", *FT.com*, 20 April 2008.

in the US, for example, there are many more who cannot afford to do so. The opportunities offered by distance learning make it possible for a much wider group of students to study with American or British universities. And while the open courseware programmes offered by MIT, the Open University and similar institutions are still in development, they may offer another route into higher education for less well-off students in developing countries.

If many students in Asia leave their native countries to study in the US or elsewhere, many also return, bringing their skills and experience with them to workplaces in their native countries. Research from Evalueserve, an India-based professional services firm, shows both that fewer graduates from the Indian Institutes of Technology are leaving the country (16% compared to 35% before 2001) and that many emigrants are choosing to come back to India.

The same may be true of Vietnam, notes Siki Giunta, the CEO of Managed Objects, a US-headquartered software and services provider: "A lot of Vietnamese people who went to study in Australia are coming back, and they're going to bring the skills Vietnam will need to challenge China." Although still in the lower tier of the index, Vietnam has risen five places in the human capital category this year (to 56th).

Still, many late entrants to the global technology market will continue to find it difficult to keep IT talent at home, as students and young professionals migrate to countries with better career-development prospects and higher pay scales.

Indeed, says Mr Dawson of Dimension Data, South African graduates are attracted to global companies for precisely this reason: "Our ability to place these youngsters in roles in other countries around the world is a significant advantage to them. The ability to work in the UK or US is highly sought after." For these economies, the challenge will be to improve the skills base of the population while giving them incentives to stay at home.

# The legal foundations for technology development

If technology companies—and national IT industries—are to compete on a level playing field, then a legal environment that protects intellectual property rights (IPR) and takes a robust approach to cybercrime is essential. Weak intellectual property protection makes it risky for foreign firms to invest in a country and for domestic technology entrepreneurs to create start-ups. Without rigidly enforced e-commerce and cybercrime laws to tackle electronic fraud and spam e-mail, using technology to do business online becomes difficult. Data privacy laws also facilitate trade because they make people feel more comfortable about providing personal details to companies they are doing business with.

The US legal environment remains the world's most effective when it comes to protecting and enforcing IPR without stifling the innovative activity of technology entrepreneurs. National laws combatting cybercrime and spam are also in place, as are guidelines governing the use of electronic signatures. No comprehensive data privacy law is yet in existence, however.

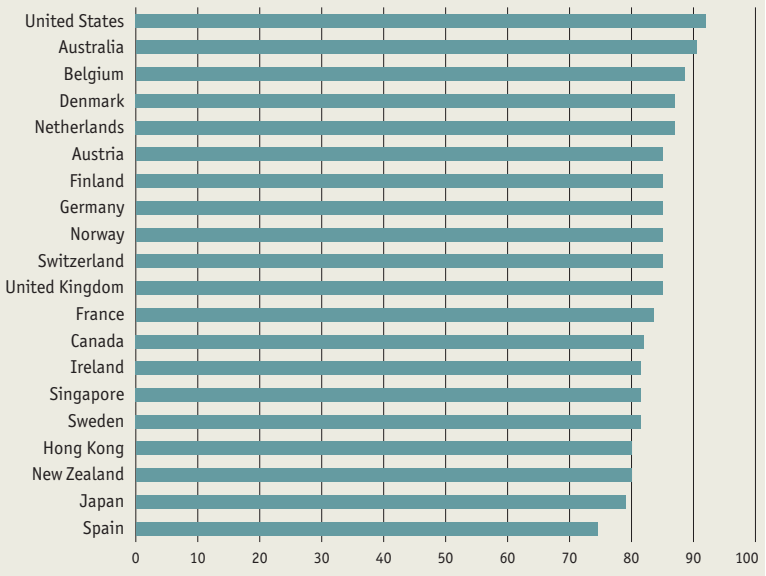
Australia occupies second spot in this year's index. Like the US, the country receives high marks for the comprehensiveness and transparency of its IP legislation and its relatively strong enforcement of IPR. In 2007 Australia also joined the ranks of countries that have ratified the WIPO (World Intellectual Property Organisation) Copyright Treaty (WCT) and WIPO Performances and Phonograms Treaty (WPPT), two key international agreements which standardise protection of digital activity across countries and are important differentiators in a country's level of IP protection in the digital age.

West European countries also perform well in this category of IT competitiveness enablers, as they did in 2007. Eleven of the 15 top-ranked countries in terms of the strength of their IT legal environment hail from this region.

One area where western Europe has taken an international lead is in addressing cybercrime. The Convention on Cybercrime, a treaty drawn up by the Council of Europe in 2001, aims to harmonise national laws on cybercrime and to improve co-operation between countries. The majority of European Union (EU) members are now signatories to the Convention, as are several non-EU countries, including the US, Canada, Japan and South Africa.

The EU's policy of creating harmonised laws has generally strengthened the attractiveness of member states as places to do business. Data protection is one area where such harmonisation has taken place, although views differ on its ultimate impact on

**Legal environment: Top 20 countries and scores**




Source: Economist Intelligence Unit, 2008. See Appendix 3 for a full list of scores.

business. Simon Briskman, a partner in Field Fisher Waterhouse, a law firm, argues that co-ordination here has been at least partly successful: "It means that there is a high degree of consumer confidence around privacy in Europe: consumer surveys regularly mention trust in online service providers as a big barrier to trade, and I think this overcomes one of the trust issues." He agrees it is open to question, however, whether harmonised data protection legislation has improved trade flows in Europe.

**Progress in tough places**

Historically, China has been known for a casual attitude towards IP protection that has led to some business caution about investing there. This has begun to change, however, and this year China has moved up seven places in the legal environment rankings, from 46th to 39th. This is partly through efforts by the government in recent years to bring IP legislation into line with international standards. For example, in 2007 China ratified the WCT and WPPT.

Progress, even if slow, is also becoming apparent in enforcement. Recent figures published by *China Daily* show a fifteen-fold increase in IP-related cases tried by Chinese courts since 2001, when the country joined the World Trade Organisation (WTO). The 668 cases reportedly tried in 2007 are still low given the vast scale of economic activity in the country, but this does suggest a more determined approach by the Chinese government to IP enforcement.

There has not only been a change in law enforcement, says Professor Anil Gupta of the Indian Institute of Management in Ahmedebad, but, crucially, a change in attitude: "In China, IP protection is poor but it is improving. And social behaviour is changing: people no longer talk with pride about having copied someone's design, which was the case less than two years ago."

Mr Jenn of Convergys agrees: "I think some people underestimate the pace of change in China. The starting point was the Wild West, but once they got into the WTO they knew they had to change the rules of the game, and they're serious about it; it's not just a facade."

Countries looking to boost the competitiveness of their IT industries increasingly recognise that they cannot do so without an adequate legal environment. Michael Friedland of Luxoft acknowledges that Russia's historically poor reputation for protecting IP has to change if domestic technology firms are to attract global customers and investment. Russia ranks a low 62nd in the legal environment category of the index.

Given its work with large customers in Europe, says Mr Friedland, Luxoft has to be very strict in ensuring legal compliance with its clients' processes. Bolstering domestic IP laws and improving their enforcement is essential to help Russian firms like Luxoft provide this level of assurance to their customers, as well as to make the local operating environment safer for foreign technology firms.

# The shifting landscape of IT innovation

India has long been the pre-eminent outsourcing destination for IT services, by virtue of its low labour costs and its large skills base. That pre-eminence is now being threatened by a host of other economies offering low-cost services, most notably China, but also Vietnam, the Philippines, Russia, Poland and others in eastern Europe.

Global companies wanting to outsource call centres or software development find it easy to switch investment from one country to another, or to spread the risk by siting centres in several different countries. Large Indian firms such as Tata Consultancy Services (TCS) and Infosys are themselves beginning to outsource low-cost development to China and the Philippines.

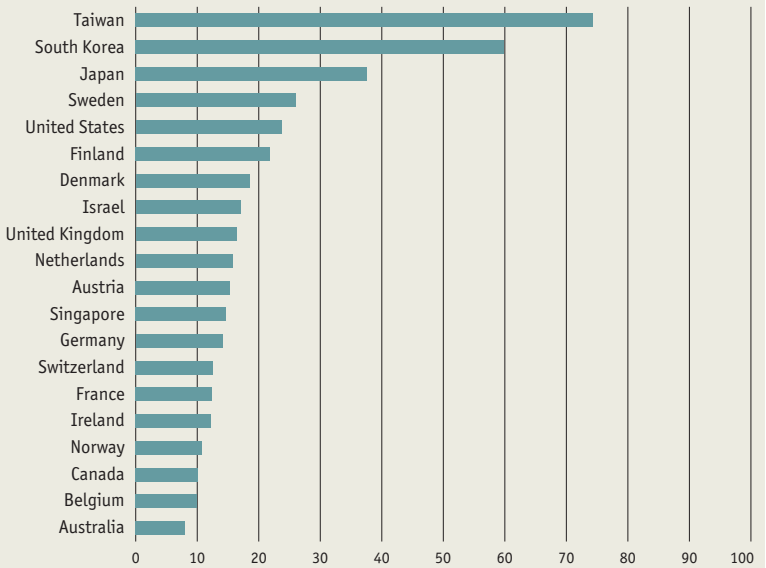
The implication for countries that have relied heavily on low-cost IT services to fuel growth is clear. Forrester's Mr Radjou believes that Indian firms, for example, must be competitive not only on price, "but they need to provide some value-added to what they offer in terms of IT services". This means investment in innovation as a way of moving up the IT industry value chain.

At least a few Russian IT providers also recognise that they will not be able to compete on cost alone. "We're good in the high-end type of development, and we're definitely not going to be the cheapest outsourcing destination," says Mr Friedland, speaking of his country's IT competitiveness.

For countries wanting to develop IT sectors that are sustainable in the long term, investment in local R&D is therefore essential. The leaders in our index category of R&D environment—Taiwan, South Korea and Japan, as well as Sweden and the US—are all heavy spenders when it comes to private-sector R&D. Companies in these economies are also prolific generators of patents in ICT and many other sectors.

In many countries, large IT firms account for the lion's share of R&D spending and patents in technology. Small firms and start-ups, however, are the source of most innovation in the IT industry. As we have argued throughout this report, innovative new businesses can only grow if certain factors are in place, including a pool of IT talent, available finance for start-ups and a culture that tolerates a degree of failure.

**R&D environment: Top 20 countries and scores**




Source: Economist Intelligence Unit, 2008. See Appendix 3 for a full list of scores.

### Challenging Silicon Valley

Silicon Valley in the US has long been the model for the kind of ecosystem that allows innovation to thrive, combining world-class universities, a strong venture-capital system and an acceptance that it is normal for an entrepreneur to have at least one start-

## Patenting changes

Patents are an important indicator of innovative activity in an economy, in technology as well as other industries. They are also a heavily weighted indicator in the R&D environment category of the index, as we found the patents data to be strongly correlated to our measure of IT labour productivity across all the countries. The existing bodies of patent data (such as that maintained by WIPO—the World Intellectual Property Organisation) make it difficult, however, to closely relate patents to specific industries such as IT, although efforts are under way to achieve this.

In the first year of the IT industry competitiveness index, we utilised patent figures covering the entire economy. In 2008 we have attempted to estimate IT-related patent registrations by applying a ratio to the economy-wide figure for each country that equates to the share of IT output (the value of hardware and software production) in gross domestic product.

The leading economies in this indicator, as well as in the broader R&D environment category, have changed as a result. Japan, for example has fallen back in R&D environment (to 3rd place in the category from 1st last year) largely because we estimate that IT-related patents in that country represent a far smaller share of total patents than in the category leaders of Taiwan and South Korea.

up fail. But Silicon Valley's dominance will come to be challenged as other countries, having successfully attracted foreign direct investment, set up their own ecosystems.

Says Mr Jenn of Convergys: "As an IT company, I've got to be looking for the brightest brains. For a long time the game was simple: the brightest went to Silicon Valley, and for very good reasons. The universities are great, it was easy to enter the US as they were relaxed with their immigration laws, and everybody could make money rapidly."

Mr Jenn maintains that cities such as Beijing, Shanghai and Dalian now provide a viable alternative to Silicon Valley: "The best brains are not necessarily going to be in the US any more. What fuelled the growth of Silicon Valley were engineers coming from China, from India, from eastern Europe. If I can create the same environment [in China], they don't need to come to the US."

How important is that ecosystem for innovation? Andy Mulholland, CTO of Capgemini, a Paris-based IT consultancy and service provider, believes that as the technology industry matures, it will no longer need the same framework of support that was previously required. He argues that Silicon Valley technology start-ups thrived in the past because of the variety of technical skills available locally to support any type of IT project. But now firms such as Autonomy (UK), a leader in "meaning-based computing" which has derived success from its effective use of information, are doing well in countries that lack the diverse skills base found in the US. His reasoning for this is that the kinds of products they make—which are about "collaboration, decision-making and interaction" of different technology systems and processes—do not require expertise in other areas of the technology stack, such as the operating system, because this information can be sourced from other specialists.

If Mr Mulholland is right, what may drive innovation in the future is not the physical ecosystem of technology parks, but simply the opportunity countries afford to skilled, talented innovators to develop and market their products. These innovators may need to collaborate with other skilled innovators, but they do not necessarily need to be in the same town, or even the same country.

Kim Jones, president and managing director of Sun Microsystems UK, a US hardware and software producer, agrees: "We have people from all over the world working and collaborating on projects. We'll develop a product or technology, and have people from India, China and the US, people from development centres all over the place, working on a project and bringing it to fruition."



The Internet should also help to create a more level playing field in technology innovation. Mr Gupta is convinced that much IT talent is wasted because it is not recognised and nurtured. He has proposed creating a portal that will give access to the projects produced by 500,000 Indian technology students every year—projects that may have commercial value but are forgotten once completed. Such a portal, he believes, would enable businesses to find solutions to existing problems and avoid reinventing the wheel, as well as allow students to showcase their ideas.

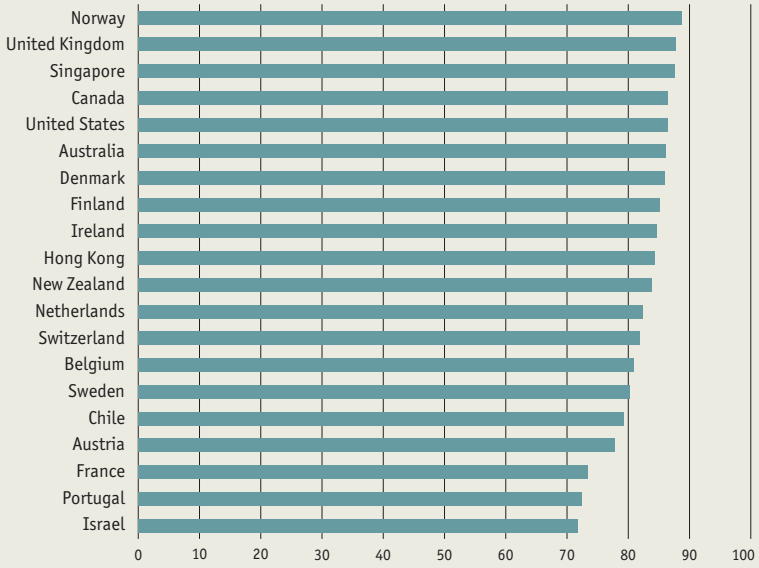
# Pulling the right policy levers

Governments have a difficult job when it comes to nurturing an IT sector. They need to do their best to encourage growth and investment, while avoiding the favouring of particular technologies or companies at the expense of others. As discussed earlier, they also need to consider a number of things in tandem: skills development (both at school and university level); foreign direct investment; a legal system that can protect innovation; employment laws that allow risk-taking; and a business environment that encourages start-ups and venture capital.

Governments can also influence domestic IT market growth—and the opportunities afforded by local technology firms—through the development of e-government services and their own procurement of IT goods and services. Our assessment of domestic support for the IT sector is focused on the above indicators, as well as the access that a country's IT firms enjoy to domestic and foreign financing (which is also heavily influenced by policymakers). Governments' technology neutrality—even-handed treatment shown to all technologies and IT firms—is another important criterion in our assessment.

The category leader in 2008 is Norway (ranked 2nd last year), by virtue of the high marks it receives in implementing e-government strategy and providing for local firms' access to investment capital. The UK, Singapore, Canada and the US also score well on these criteria. Another key to these countries' success is that they have successfully struck a balance between investing in technology, supporting sector growth and allowing market forces to work.

**Support for IT industry development: Top 20 countries and scores**




Source: Economist Intelligence Unit, 2008. See Appendix 3 for a full list of scores.

## Striking a balance

Where should governments intervene, and where should they hold back? Where they can clearly help is by putting the foundations in place that enable a technology industry to take hold, such as taxation, financial policy, security laws and education.

Some of the biggest success stories have been countries that offered attractive packages for foreign investors and then went on to develop a strong native industry. According to Ms Jones of Sun Microsystems: "One of the reasons Ireland boomed for so long is that its government was smart about creating tax advantages that gave corporations an incentive to set up business there. Companies such as Vodafone, Ericsson and eBay have all established big development centres in Ireland."



Helping to ensure that most schools, homes and businesses have broadband is also a role for central government, believes Ms Jones. "The more people they can get connected, the more the economy can develop, and the more access people will obtain to information and education, which will allow them to have jobs or create businesses."

Partnerships between government and the private sector are proving an attractive model in countries that are building up a technology sector from a low base, such as Egypt and Chile. The latter have worked with partners such as Microsoft, Cisco and IBM to provide packages of hardware, software and training to schools and small businesses. The model can work in more developed countries, too: Ms Jones cites the UK's Building Schools for the Future (BSF) programme, a public-private partnership to build new schools and equip them with state-of-the-art ICT, as an example of valuable government intervention.

Nathan Myhrvold, founder and CEO of Intellectual Ventures, a US-based firm which describes itself as an "investor in innovation", believes government also has a role to play in supporting fundamental research that lacks obvious commercial application: the US, he points out, gives more money to scientists for fundamental research than any other country in the world.

But unnecessary intervention risks distorting the market. "The problem with government procurement is that it winds up being a highly politicised thing; it's easy to be protectionist and nationalist," says Mr Myhrvold, citing Quaero, the project backed by the French government to develop a search engine to rival Google, as an example. France's relatively protectionist attitude is one of the reasons it has seen slower growth in its technology sector than other west European countries.

The balance governments need to strike—attracting inward investment while retaining local talent; giving incentives to local start-ups while allowing market forces to operate freely; pushing the adoption of technology without favouring a particular standard—is a delicate one, and easy to get wrong. The strongest countries in the global technology marketplace will be those that not only have the appropriate skills, infrastructure and legal environment, but those that get this balance right.

# No rest for the strongest

As a measure of enabling factors, the IT industry competitiveness index is heavily influenced by the fundamental strength of a country's business and educational environment, and by the degree of technology absorption by society. Few nations can hope to build strong IT production sectors without thriving markets, deep pools of talent and the widespread use of advanced technology.

It is therefore no accident that, in this year as in last year, the world's richest and most well-developed countries occupy the top tier of the index, middle-income countries predominate in the middle ranks, and the lower reaches are inhabited by less developed nations. For example, emerging and fast-growing IT-producing nations such as India, China, Russia and Vietnam remain in the lower half of the index owing to glaring weaknesses in their business, legal and innovation environments and to highly uneven patterns of technology proliferation.

This suggests a large degree of intractability in the ranks, but in fact considerable movement is likely in the future, if not between tiers then within them. India, China and Russia, and possibly Brazil, each of which already possesses a good IT skills and production base, may be expected to rise in the ranks as technology penetration rises nationwide and aspects of their business environments improve.

In the top tier, a deterioration in US performance is possible should tougher immigration controls have a negative impact on the pool of IT talent and the skills base (and which could ultimately affect innovation levels). And as the US and west European economies endure a downturn, the impacts of a heavier regulatory touch and slower growth of technology spending cannot be discounted.

But not all changes will be predictable. Because of its rising labour costs and high attrition rate, India may become less attractive as an outsourcing destination. More Western companies are likely to outsource to China, the Philippines, Vietnam, Russia, Brazil and a number of other countries. India's IT giants themselves, such as TCS, are already outsourcing basic processes to lower-cost countries and investing in new R&D centres in the West.

Talent remains a paramount asset for any country's IT industry. Those with a strong base of IT talent, such as Russia, India and China—will remain attractive to global technology firms. The brain drain that has taken some of the best science and engineering talent from developing countries to the US and elsewhere may be slowing or even reversing. There are signs that China, for example, with its large, educated population, may be able to set up its own ecosystems to foster innovation, as US-educated entrepreneurs return to set up businesses. Today's leaders in IT industry competitiveness cannot rest on their laurels.

The purpose of the IT industry competitiveness index is to compare countries in different regions of the world on the extent to which they possess the conditions necessary to support a strong IT industry. To achieve this, the Economist Intelligence Unit maintains a benchmarking model which scores individual countries on the key attributes of a competitive IT sector.

There are six categories of indicator used in the index; these are set out below, along with their weights in the index, and that of each indicator in the category. The main data sources for each indicator are also provided, along with an indication of whether the score is based on quantitative data (for example, US$ spend, number of students) or on a qualitative assessment made by Economist Intelligence Unit analysts.

Qualitative indicators are scored on a 1-5 basis. Quantitative indicators are normalised through the population set so that each country is measured from 0 to 1 by applying a formula ($Y_{ij}=[x_{ij}-min_{ij}]/[max_{ij}-min_{ij}]$) to each data point. Each indicator is then converted into a score of 0-100 by applying the appropriate multiplier (20 for the qualitative indicators, 100 for the quantitative indicators).

As the weights sum to 1, the composite score for each country is also based on an index range of 0 to 100 (with 100 representing the highest and best possible score).

When employing a normalisation method of scoring as we have, there occurs some score distortion in selected indicators at both the highest and lowest ends of the score range. This occurs when indicator scores are based solely on quantitative data, and explains why some countries' scores in certain categories shown in Appendix 3 are below 1 while others exceed 80 in the same category.

Normalisation is also the reason why some countries' scores in individual categories, or in the overall index, may be lower than in the previous year even though their actual performance may not have deteriorated. If the score of the global leader in a quantitative indicator is higher or lower than that of the previous year's leader, the scores of other countries in that indicator will be affected, possibly irrespective of their actual performance.

One refinement to the scoring methodology has been made in 2008. Country scores in the indicator covering patents, which are assessed in the R&D environment category, are now based on an estimation of IT-related patent registrations rather than on patent data that cover the entire economy, as was the case in 2007. This is a heavily weighted indicator in the model, and the change has resulted in some movement in ranks in both the R&D environment category as well as the overall index.

## Appendix 1: Index methodology and definitions

How technology sectors grow: Benchmarking IT industry competitiveness 2008

| Indicator | Weight | Main data sources | Year | Type of score |
|---|---|---|---|---|
| **Category 1: Overall business environment** | **10%** | | | |
| Government policy toward foreign capital; cultural receptivity to foreign influence; risk of expropriation; investment protection | 15% | Economist Intelligence Unit: Business Environment Rankings | 2003-2007 | Qualitative: assigned by Economist Intelligence Unit analysts |
| Degree to which private property rights are guaranteed and protected | 40% | Economist Intelligence Unit: Business Environment Rankings | 2003-2007 | Qualitative: assigned by Economist Intelligence Unit analysts |
| Level of government regulation (mainly licensing procedures) on setting up new private businesses | 25% | Economist Intelligence Unit: Business Environment Rankings | 2003-2007 | Qualitative: assigned by Economist Intelligence Unit analysts |
| Freedom of existing businesses to compete | 20% | Economist Intelligence Unit: Business Environment Rankings | 2003-2007 | Qualitative: assigned by Economist Intelligence Unit analysts |
| **Category 2: IT infrastructure** | **20%** | | | |
| Market spending on hardware, software and IT services (US$ per 100 people) | 20% | IDC | 2007 | Quantitative |
| Desktop & laptop computers per 100 people | 60% | ITU | 2007 | Quantitative |
| Broadband connections (xDSL, ISDN PRI, FWB, cable, FTTx) per 100 people | 10% | Pyramid Research | 2007 | Quantitative |
| Secure Internet servers per 100,000 people | 10% | Netcraft, World Bank | 2006 | Quantitative |
| **Category 3: Human capital** | **20%** | | | |
| Total number of students in higher education , as % of gross university-age population | 25% | World Bank | 2005 | Quantitative |
| Enrolment in tertiary-level science programmes, as % of total tertiary-level enrolment | 5% | UNESCO | 2005 | Quantitative |
| Employment in technology sector, as % of total workforce | 10% | Estimates, based on ILO, OECD, national statistics | 2006 | Quantitative |
| The educational system's capacity to train technologists with business skills (project management, customer-facing application and web development, etc) | 60% | Economist Intelligence Unit analysts | 2006 | Qualitative: assigned by Economist Intelligence Unit analysts |
| **Category 4: Legal environment** | **10%** | | | |
| Comprehensiveness, transparency of IP legislation; adherence to treaties | 35% | Economist Intelligence Unit: Business Environment Rankings | 2003-2007 | Qualitative: assigned by Economist Intelligence Unit analysts |
| Enforcement of IP legislation | 35% | Economist Intelligence Unit: Business Environment Rankings | 2007 | Qualitative: assigned by Economist Intelligence Unit analysts |
| Status of electronic signature legislation | 10% | National sources, European Commission | 2007 | Qualitative: assigned by Economist Intelligence Unit analysts |
| Status of national data privacy and anti-spam laws | 10% | National sources, European Commission | 2007 | Qualitative: assigned by Economist Intelligence Unit analysts |
| Status of national cybercrime laws | 10% | National sources, European Commission | 2007 | Qualitative: assigned by Economist Intelligence Unit analysts |
| **Category 5: R&D environment** | **25%** | | | |
| Gross government expenditure on R&D (US$ at PPP [purchasing power parity]), per 100 people | 10% | UNESCO, World Bank | 2004-2005 | Quantitative |
| Gross private sector expenditure on R&D (US$ at PPP), per 100 people | 10% | UNESCO, World Bank | 2004-2005 | Quantitative |
| Number of new domestic patents in IT registered by residents each year (per 100 people) | 65% | Estimates, based on WIPO, national statistics | 2005 | Quantitative |
| Receipts from royalty and license fees (US$) per 100 people | 15% | IMF, World Bank | 2005 | Quantitative |
| **Category 6: Support for IT industry development** | **15%** | | | |
| Access to medium-term finance for investment from domestic and foreign sources | 25% | Economist Intelligence Unit: Business Environment Rankings | 2003-2007 | Qualitative: assigned by Economist Intelligence Unit analysts |
| Existence of a coherent national government strategy to achieve e-government objectives, aimed at improving both public service delivery and efficiency of back-office operations | 30% | UN, European Commission, Economist Intelligence Unit analysts | 2007 | Qualitative: assigned by Economist Intelligence Unit analysts |
| Government spending on IT hardware, software and services (US$ per capita) | 10% | Estimates, based on IDC | 2007 | Quantitative |
| Existence of an even-handed public policy stance on technology or sector development (absence of preferential government support for specific technologies or sector) | 35% | Economist Intelligence Unit analysts | 2007 | Qualitative: assigned by Economist Intelligence Unit analysts |

## IT industry competitiveness index, 2008

Index scores by region

### The Americas

| Rank | Country | Score |
|---|---|---|
| 1 | United States | 74.6 |
| 2 | Canada | 64.4 |
| 3 | Chile | 39.6 |
| 4 | Brazil | 31.0 |
| 5 | Mexico | 30.7 |
| 6 | Argentina | 30.1 |
| 7 | Venezuela | 25.7 |
| 8 | Colombia | 25.4 |
| 9 | Peru | 24.8 |
| 10 | Ecuador | 24.5 |

### Western Europe

| Rank | Country | Score |
|---|---|---|
| 1 | United Kingdom | 67.2 |
| 2 | Sweden | 66.0 |
| 3 | Denmark | 65.2 |
| 4 | Netherlands | 62.7 |
| 5 | Switzerland | 62.3 |
| 6 | Finland | 61.5 |
| 7 | Norway | 59.7 |
| 8 | Ireland | 59.4 |
| 9 | Austria | 56.1 |
| 10 | Germany | 55.4 |
| 11 | France | 54.3 |
| 12 | Belgium | 53.4 |
| 13 | Spain | 46.3 |
| 14 | Italy | 45.6 |
| 15 | Portugal | 42.2 |
| 16 | Greece | 38.2 |

### Eastern Europe

| Rank | Country | Score |
|---|---|---|
| 1 | Estonia | 45.7 |
| 2 | Slovenia | 45.5 |
| 3 | Hungary | 40.6 |
| 4 | Czech Republic | 40.4 |
| 5 | Slovakia | 39.5 |
| 6 | Poland | 39.0 |
| 7 | Latvia | 38.1 |
| 8 | Lithuania | 37.1 |
| 9 | Romania | 32.3 |
| 10 | Croatia | 31.6 |
| 11 | Bulgaria | 30.2 |
| 12 | Russia | 27.7 |
| 13 | Ukraine | 24.3 |
| 14 | Kazakhstan | 22.9 |
| 15 | Azerbaijan | 19.5 |

### Middle East & Africa

| Rank | Country | Score |
|---|---|---|
| 1 | Israel | 56.7 |
| 2 | South Africa | 32.6 |
| 3 | Turkey | 32.4 |
| 4 | Saudi Arabia | 32.3 |
| 5 | Egypt | 25.3 |
| 6 | Nigeria | 19.0 |
| 7 | Algeria | 18.5 |
| 8 | Iran | 16.5 |

### Asia-Pacific

| Rank | Country | Score |
|---|---|---|
| 1 | Taiwan | 69.2 |
| 2 | Australia | 64.1 |
| 3 | South Korea | 64.1 |
| 4 | Singapore | 63.4 |
| 5 | Japan | 62.2 |
| 6 | New Zealand | 56.6 |
| 7 | Hong Kong | 54.1 |
| 8 | Malaysia | 34.2 |
| 9 | Thailand | 31.5 |
| 10 | Philippines | 29.8 |
| 11 | India | 28.9 |
| 12 | China | 27.6 |
| 13 | Sri Lanka | 24.9 |
| 14 | Indonesia | 23.1 |
| 15 | Bangladesh | 22.4 |
| 16 | Vietnam | 21.4 |
| 17 | Pakistan | 20.9 |

Note: Countries are scored on a scale of 1 to 100. A four-decimal score is used to determine each country's rank.

# Appendix 3: Index scores by category

How technology sectors grow: Benchmarking IT industry competitiveness 2008

**IT industry competitiveness index, 2008**
Category scores

| | Overall index score | Business environment | IT infrastructure | Human capital | Legal environment | R&D environment | Support for IT industry development |
|---|---|---|---|---|---|---|---|
| **Category weight** | | 10% | 20% | 20% | 10% | 25% | 15% |
| United States | 74.6 | 98.0 | 89.2 | 94.5 | 92.0 | 23.7 | 86.4 |
| Taiwan | 69.2 | 87.6 | 52.0 | 73.1 | 70.0 | 74.3 | 65.3 |
| United Kingdom | 67.2 | 94.3 | 81.4 | 78.5 | 85.0 | 16.4 | 87.8 |
| Sweden | 66.0 | 91.0 | 86.7 | 64.3 | 81.5 | 26.0 | 80.2 |
| Denmark | 65.2 | 94.7 | 83.4 | 64.0 | 87.0 | 18.5 | 86.0 |
| Canada | 64.4 | 89.0 | 87.2 | 71.6 | 82.0 | 10.1 | 86.4 |
| Australia | 64.1 | 92.3 | 80.7 | 73.8 | 90.5 | 8.0 | 86.1 |
| South Korea | 64.1 | 81.3 | 49.3 | 74.0 | 67.0 | 59.9 | 63.9 |
| Singapore | 63.4 | 91.0 | 67.9 | 78.7 | 81.5 | 14.7 | 87.6 |
| Netherlands | 62.7 | 90.3 | 85.3 | 58.1 | 87.0 | 15.7 | 82.4 |
| Switzerland | 62.3 | 89.0 | 93.3 | 53.9 | 85.0 | 12.6 | 81.9 |
| Japan | 62.2 | 84.9 | 65.6 | 66.4 | 79.0 | 37.6 | 66.4 |
| Finland | 61.5 | 89.7 | 61.8 | 67.2 | 85.0 | 21.8 | 85.2 |
| Norway | 59.7 | 82.6 | 71.6 | 63.3 | 85.0 | 10.8 | 88.7 |
| Ireland | 59.4 | 95.3 | 54.5 | 75.5 | 81.5 | 12.2 | 84.7 |
| Israel | 56.7 | 81.0 | 68.6 | 63.5 | 72.0 | 17.0 | 71.7 |
| New Zealand | 56.6 | 92.3 | 56.6 | 70.3 | 80.0 | 5.7 | 83.8 |
| Austria | 56.1 | 88.3 | 61.2 | 54.9 | 85.0 | 15.3 | 77.8 |
| Germany | 55.4 | 89.0 | 62.0 | 57.5 | 85.0 | 14.1 | 70.8 |
| France | 54.3 | 83.3 | 58.7 | 58.7 | 83.5 | 12.4 | 73.4 |
| Hong Kong | 54.1 | 98.0 | 59.1 | 56.1 | 80.0 | 2.6 | 84.4 |
| Belgium | 53.4 | 89.7 | 46.1 | 58.9 | 88.5 | 10.0 | 80.9 |
| Spain | 46.3 | 88.3 | 31.2 | 61.2 | 74.5 | 3.9 | 70.1 |
| Estonia | 45.7 | 81.0 | 45.4 | 53.6 | 69.5 | 1.5 | 69.8 |
| Italy | 45.6 | 73.3 | 37.3 | 61.2 | 71.0 | 4.1 | 69.7 |
| Slovenia | 45.5 | 68.6 | 38.1 | 63.5 | 73.0 | 4.4 | 66.3 |
| Portugal | 42.2 | 87.0 | 19.0 | 56.8 | 71.0 | 1.6 | 72.4 |
| Hungary | 40.6 | 80.3 | 17.0 | 59.7 | 71.0 | 5.8 | 58.1 |
| Czech Republic | 40.4 | 75.3 | 27.3 | 54.7 | 67.5 | 4.0 | 58.1 |
| Chile | 39.6 | 93.7 | 14.1 | 42.7 | 68.0 | 0.7 | 79.3 |
| Slovakia | 39.5 | 76.3 | 30.0 | 52.5 | 67.5 | 1.6 | 54.8 |
| Poland | 39.0 | 74.6 | 22.1 | 54.3 | 70.0 | 1.3 | 59.5 |
| Greece | 38.2 | 74.0 | 11.3 | 61.0 | 67.5 | 1.7 | 60.8 |

IT industry competitiveness index, 2008 (continued)
Category scores

| | Overall index score | Business environment | IT infrastructure | Human capital | Legal environment | R&D environment | Support for IT industry development |
|---|---|---|---|---|---|---|---|
| **Category weight** | | 10% | 20% | 20% | 10% | 25% | 15% |
| Latvia | 38.1 | 71.0 | 23.5 | 56.2 | 65.5 | 1.0 | 55.3 |
| Lithuania | 37.1 | 66.3 | 19.1 | 56.7 | 67.5 | 1.2 | 55.3 |
| Malaysia | 34.2 | 75.0 | 18.3 | 38.0 | 54.0 | 0.8 | 65.5 |
| South Africa | 32.6 | 76.9 | 8.4 | 39.9 | 63.5 | 1.1 | 57.5 |
| Turkey | 32.4 | 77.6 | 6.5 | 44.8 | 57.5 | 0.2 | 57.2 |
| Romania | 32.3 | 67.0 | 12.1 | 48.2 | 56.0 | 0.6 | 52.1 |
| Saudi Arabia | 32.3 | 69.6 | 11.2 | 43.5 | 45.5 | 0.8 | 64.4 |
| Croatia | 31.6 | 55.6 | 3.2 | 51.9 | 62.0 | 2.4 | 54.6 |
| Thailand | 31.5 | 78.0 | 6.0 | 43.4 | 43.5 | 0.2 | 62.7 |
| Brazil | 31.0 | 66.0 | 13.4 | 38.6 | 46.0 | 1.0 | 61.3 |
| Mexico | 30.7 | 62.6 | 11.3 | 37.9 | 54.5 | 0.5 | 60.3 |
| Bulgaria | 30.2 | 61.3 | 6.8 | 47.4 | 56.0 | 1.1 | 49.3 |
| Argentina | 30.1 | 59.9 | 9.0 | 48.1 | 61.0 | 1.0 | 42.1 |
| Philippines | 29.8 | 67.9 | 4.3 | 44.9 | 50.5 | 0.1 | 54.0 |
| India | 28.9 | 59.3 | 1.3 | 48.8 | 47.0 | 0.6 | 54.0 |
| Russia | 27.7 | 46.9 | 10.6 | 55.5 | 38.5 | 1.9 | 36.6 |
| China | 27.6 | 46.9 | 5.2 | 46.6 | 59.5 | 1.7 | 41.1 |
| Venezuela | 25.7 | 49.9 | 8.1 | 41.2 | 44.0 | 0.3 | 42.1 |
| Colombia | 25.4 | 65.3 | 4.3 | 25.7 | 54.5 | 0.1 | 49.1 |
| Egypt | 25.3 | 61.3 | 2.9 | 34.5 | 42.0 | 0.2 | 49.4 |
| Sri Lanka | 24.9 | 61.3 | 2.8 | 26.0 | 53.5 | 0.1 | 51.0 |
| Peru | 24.8 | 55.6 | 7.9 | 27.1 | 48.5 | 0.1 | 49.1 |
| Ecuador | 24.5 | 57.2 | 5.0 | 26.8 | 46.5 | 0.0 | 52.1 |
| Ukraine | 24.3 | 40.2 | 4.0 | 49.0 | 46.0 | 1.4 | 31.4 |
| Indonesia | 23.1 | 49.6 | 1.3 | 36.5 | 44.0 | 0.1 | 41.0 |
| Kazakhstan | 22.9 | 49.6 | 3.5 | 32.3 | 42.0 | 0.5 | 43.4 |
| Bangladesh | 22.4 | 50.9 | 0.4 | 24.8 | 40.0 | 1.2 | 53.0 |
| Vietnam | 21.4 | 47.9 | 1.4 | 28.9 | 41.5 | 0.1 | 42.5 |
| Pakistan | 20.9 | 55.3 | 0.7 | 24.9 | 41.0 | 0.2 | 41.0 |
| Azerbaijan | 19.5 | 40.9 | 3.3 | 21.4 | 38.0 | 0.4 | 43.6 |
| Nigeria | 19.0 | 37.6 | 0.9 | 21.5 | 29.5 | 0.3 | 51.4 |
| Algeria | 18.5 | 45.9 | 1.5 | 23.4 | 35.0 | 0.3 | 35.4 |
| Iran | 16.5 | 28.9 | 10.8 | 25.0 | 29.0 | 0.9 | 21.9 |

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