Economist Intelligence Unit

The Economist

The means to compete
Benchmarking IT industry competitiveness

A report from the Economist Intelligence Unit

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Preface

The means to compete: Benchmarking IT industry competitiveness 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 built a benchmarking model, the "IT industry competitiveness index", comparing 64 countries in all regions of the world on the extent to which they support the competitiveness of information technology (IT) firms.
- We also conducted in-depth interviews with over 20 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.

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Executive summary

Producing information technology (IT) matters to an economy. In countries where software, hardware or IT services are generated in abundance, the contribution to gross domestic product is upwards of 5%.[1] In many countries, the IT sector has also been a major source of labour productivity growth. No wonder, then, that many governments have invested considerable energy in recent years to encourage the growth of local IT-producing industries.

Not all countries possess the factors necessary to support a thriving IT sector, however. As reflected in the Economist Intelligence Unit's IT industry competitiveness index, a domestic industry's growth potential rests on the existence of favourable conditions in several interrelated areas. These include the quality of the IT and communications infrastructure, the supply of local talent, the research and development (R&D) environment and the legal regime, not to mention the overall business environment. Countries which pay close attention to these "competitiveness enablers" reap the rewards in the form of highly efficient IT sectors: all but four of the top index tier of 22 countries are also among the world's top 22 countries in terms of IT labour productivity.

The index gauges the IT industry environment of 64 countries by assessing the enablers of competitiveness and determining their relative importance in IT sector performance. It is the centrepiece of a major programme of research, conducted by the Economist Intelligence Unit and sponsored by the Business Software Alliance, into the forces that drive the competitiveness of countries' IT industries.

Following are the key findings of the research:

- **The US boasts the most positive environment for IT firms in the world**. The US ranks among the top five in all index categories. Uniquely among countries, its IT environment combines scale and quality in the key areas that promote competitiveness, including education, infrastructure and encouragement of innovation, as well as solid legal protection. West European countries also rate highly, providing 11 of the top 20 in the overall index. Japan, South Korea, Australia and Taiwan provide the most positive competitive conditions for IT firms in Asia-Pacific. None of the leaders are without weaknesses, however, and they must work to ensure their advantages do not erode.

- **Few nations' IT sectors can compensate for major environmental weaknesses**. India and China have been able to parlay unique factors, such as workforce size, low wages or language attributes, into strong IT sector performance, compensating for glaring weaknesses in the industry environment. Few other countries will be able to use similar factors to replicate China's and India's success—improvement across all the enablers of IT industry competitiveness is required to build strong IT sectors. India and China will need to improve here as well, as their cost advantages will erode; greater innovation will be required of their IT firms to remain competitive on a global scale.

- **Skills-rich emerging markets will challenge today's established performers.** Future rivalry for India's and China's positions will come from the likes of Russia, Brazil, Malaysia and Vietnam, as well as smaller markets such as Estonia, Lithuania and Chile. Most perform respectably (in the upper half of the table) in at least one aspect of IT competitiveness, and the skills base of each is improving. Carving niches in software development and services represents their best chance of moving up the index table.

1. Economist Intelligence Unit estimates based on 2006 data from each country's national accounts.

● **Skills requirements are changing radically.** Talented IT employees are already in short supply everywhere, but the situation will get tougher, as the nature of skills needed is changing. In addition to technical knowledge, tomorrow's IT employee will require expertise in project management, change management and business analysis, among other areas. Educational systems in only a handful of countries—including the US, Singapore and Australia—have made a concerted start to adjust their training curriculums accordingly.

● **The legal regime is an important differentiator.** Open competition in IT must be supported by robust protection for intellectual property rights (IPR). The US and west European countries—thanks partly to the galvanising efforts of the European Union—stand heads above the rest in the degree of protection afforded and in enforcement. A vigorous IPR regime is not incompatible with an "open approach" to innovation in IT.

● **Eager governments must strike the right balance.** Governments can do much to help create an environment in which IT firms will thrive, but it is a delicate balancing act. By devising far-sighted foreign investment and competition policies, encouraging widespread technology adoption, providing strategic direction for the educational system, and also by spending wisely themselves on IT and on R&D, governments can help improve competitiveness. At the same time, they must avoid picking winners, among either IT firms or technologies—and also be wary of over-regulation. West European governments have so far been the most successful in striking the right balance.

Not all countries will choose to prioritise the the growth of their IT industries ahead of other economic sectors. Sweden and Finland, for example, which are strong performers in our index, have focused more heavily on developing excellence in telecommunications equipment and software. But all countries will gain from the growth of their IT industries, and the benefits will extend beyond the technology sector itself. As Duncan Tait, UK vice-president and general manager for global outsourcing and infrastructure services at Unisys, correctly observes, "An economy's growth is now impossible without IT. Whether you happen to be a retail bank or a trading institution, without IT nothing can get done."

The enablers of competitiveness

The index table on the page following reveals a top tier of 22 countries that boast strong environments for IT industry competitiveness. All possess the needed attributes to one degree or another, with one—the US—strong in all of them. A supportive environment by itself does not guarantee global competitiveness or commercial success for a country's IT firms—a handful of countries which perform well in competitiveness enablers, such as Sweden and Denmark, are not IT powerhouses on the world stage. It suggests, however, that the IT industries of such countries have the capacity to improve their performance markedly if they make better use of their attributes.

Top-ranked countries	Key attributes
Hong Kong US Ireland UK Chile	**A stable and open business environment that encourages competition**. It goes without saying that for the IT industry to thrive, private property must be sacrosanct, competition and investment from all quarters welcomed, and regulation transparent and well-balanced. The best performers are also striving to inject more flexibility into their labour markets, making it easier for firms to hire or fire workers.
Switzerland Canada US Australia Netherlands	**Advanced IT and communications infrastructure**. IT producers themselves need good technology to excel. A country's firms must be well-endowed with computer hardware and have reliable high-speed Internet access. US software firms, for example, make enormous use of the country's fast and secure network infrastructure to develop new applications with partners. IT firms are also pacesetters in the use of wireless and mobile technologies to improve productivity.
US Singapore UK Australia South Korea	**IT talent and skills development geared to the future**. The supply of talent for the IT industry is growing increasingly tight. Even firms in the US—which remains a magnet for talented science and engineering students from overseas—are feeling the pinch. This is because skill requirements for IT specialists are changing. Universities in only a few countries have begun to orient technology training to the new demands.
US UK Ireland (3 countries tied for 4th place)	**Robust protection of intellectual property rights**. Protection of IPR, and recognition of its importance to innovation, are entrenched in the legal regimes of the US, western Europe and other OECD countries. Their governments and courts also enforce IPR laws vigorously. Progress is more mixed in developing a legal framework for online business; as ardent users of the Web to conduct business, IT firms have much to lose if the right balance between protection and openness is not found.
Japan South Korea Taiwan US Sweden	**Strong support for innovation**. East Asian economies are prolific generators of patents, and along with the US they are noteworthy for high levels of private-sector investment in R&D, which is integral to product and service innovation in the IT sector. Strong university-industry ties in research, along with a culture of risk-taking, are also important elements of a supportive innovation environment for IT.
Denmark Norway Singapore US Canada	**Carefully calibrated government support**. Most governments desire a strong IT sector. Many provide direct and indirect forms of support, but few have found the right formula to encourage sector growth without picking winners or introducing market distortions. Nordic governments have so far done better than most in using procurement, e-government and other policies to encourage growth of local IT firms.

IT industry competitiveness index: Overall scores and ranks

Rank	Country	Score	Rank	Country	Score	Rank	Country	Score
1	United States	77.4	23	Italy	46.4	45	Argentina	30.0
2	Japan	72.7	24	Spain	46.1	46	India	29.1
3	South Korea	67.2	25 (tie)	Estonia	45.3	47	Philippines	28.7
4	United Kingdom	67.1	25 (tie)	Portugal	45.3	48	Russia	28.0
5	Australia	66.5	27	Slovenia	44.2	49	China	27.9
6	Taiwan	65.8	28	Hungary	41.5	50	Sri Lanka	26.0
7	Sweden	65.4	29	Czech Republic	40.7	51	Colombia	25.7
8	Denmark	64.9	30	Poland	40.0	52	Venezuela	25.6
9	Canada	64.6	31 (tie)	Chile	39.5	53	Ecuador	25.2
10	Switzerland	63.5	31 (tie)	Slovakia	39.5	54	Peru	25.1
11	Singapore	63.1	33	Greece	38.6	55	Egypt	24.3
12	Netherlands	62.9	34	Latvia	37.9	56	Ukraine	23.9
13	Finland	62.7	35	Lithuania	36.6	57	Indonesia	23.7
14	Norway	59.7	36	Malaysia	34.9	58	Kazakhstan	21.4
15	Ireland	58.6	37	South Africa	33.4	59	Algeria	20.7
16	Germany	58.2	38	Saudi Arabia	32.5	60	Pakistan	20.2
17	New Zealand	57.5	39	Turkey	32.3	61	Vietnam	19.9
18	France	55.8	40	Romania	32.1	62	Azerbaijan	18.8
19	Austria	55.3	41	Thailand	31.9	63	Nigeria	18.7
20	Israel	54.5	42	Bulgaria	31.6	64	Iran	15.7
21	Hong Kong	53.4	43	Brazil	31.4			
22	Belgium	53.3	44	Mexico	30.4			

Countries are scored on a scale of 1 to 100.
Source: Economist Intelligence Unit, 2007.

About the index

The IT industry competitiveness 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 individual correlation coefficients of each indicator against a measure of IT labour productivity to determine the indicators' relative importance. 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

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 competitiveness environment and performance

Understanding the relative performance of IT industries across different countries is a complex task. The success of an industry rests on the aggregate performance of the firms within it. And an individual company's performance is dictated by a diverse set of factors, ranging from firm-specific strategies and behaviours through to the broader competitive environment in which firms operate. It is this last area that the IT industry competitiveness index seeks to capture—how conducive is the business environment in individual countries to the success of IT firms?

Our contention is that a business environment rich in those attributes which are important to the IT industry should, in general, help promote the success of IT firms. Clearly, the correlation will not be perfect—firm-specific factors also play a crucial role in industry success. And the IT sector in some countries is less competitive than in others for reasons unrelated to the operating environment. But our work makes it clear that, in most cases, there is a strong linkage between the presence of IT industry competitiveness enablers and the IT industry's strength in a country.

This linkage can be seen from the table below, which compares the IT competitiveness index against one measure of IT industry success—labour productivity (hardware and software output per industry employee). Countries where high-quality competitiveness enablers exist seem to boast IT industries with higher levels of productivity. (Overall, our index has a correlation coefficient of 0.67 when measured against IT labour productivity, confirming a reasonably strong relationship between the two for the countries under evaluation.)

Of the world's top 22 countries according to IT labour productivity, all but four figure in the top 22 of the IT industry competitiveness index. The four exceptions—China, India, Brazil and Greece—are all in the bottom half of our index, suggesting that they are able to leverage other factors to achieve relatively high levels of sector output and productivity. China and India, for example, have glaring weaknesses in the industry environment—large parts of their population are without decent infrastructure, and protection of intellectual property is weak, among other problems.

China and India owe their success to similar factors. Both are large, with vast, relatively untapped domestic markets. Both turn out high numbers of skilled graduates who are, in developed-market terms, relatively cheap to employ (and many of whom, in India, speak English). Neither country's IT industry, however, can rest indefinitely on its success as a source of cheap labour. As wages and other operating costs rise, both will need to incorporate much greater levels of innovation in their products and services to remain competitive. This will require substantial improvements in the quality of the environment in which local and foreign IT firms operate. As their business environment, IT infrastructure, legal protections and other factors improve, so will their standing in our index.

On the other hand, the IT sectors of some countries which perform strongly in the index—namely Sweden, Canada, the Netherlands and Finland—do not figure among the world's leaders in terms of output or productivity. The inference is that they have not been able to parlay their environmental strengths into IT industry strength. Or, alternatively, they may have sought to pursue competitive advantage in other areas—the governments of Sweden and Finland, for example, have invested substantial resources to promote world-class telecommunications equipment sectors.

Ireland is another country which excels in IT labour productivity despite relative weakness in some enabler

IT industry competiveness index Overall rank		IT labour productivity Total output per employee*		
1	United States	1	Taiwan	$386,413
2	Japan	2	South Korea	$310,393
3	South Korea	3	Ireland	$278,451
4	United Kingdom	4	Singapore	$216,941
5	Australia	5	Australia	$208,014
6	Taiwan	6	Switzerland	$194,826
7	Sweden	7	United States	$154,173
8	Denmark	8	Japan	$148,560
9	Canada	9	New Zealand	$148,384
10	Switzerland	10	China	$136,506
11	Singapore	11	Denmark	$127,777
12	Netherlands	12	Norway	$119,481
13	Finland	13	United Kingdom	$107,184
14	Norway	14	Belgium	$96,593
15	Ireland	15	Germany	$82,255
16	Germany	16	Israel	$75,936
17	New Zealand	17	France	$70,564
18	France	18	Austria	$62,280
19	Austria	19	Brazil	$49,154
20	Israel	20	Greece	$44,037
21	Hong Kong	21	Hong Kong	$39,629
22	Belgium	22	India	$39,033

* Output includes the US$ value of 2006 hardware and software production.
Source: Economist Intelligence Unit, 2007.

categories. These include the availability and quality of IT infrastructure, in which it lags many of its European Union partners, and also the R&D environment. (It is not a prolific generator of patents, for example, a heavily weighted indicator in our model.)

For Ireland, the influx of large IT multinationals—partly the result of an aggressive inward investment strategy pursued from the 1980s—has been the catalyst for expansion of its home-grown technology businesses. Thanks also to a strong overall business environment, the Irish government's early vision has helped create an IT sector which contributes 10% of the country's gross domestic product. Small countries can also aspire to strong and competitive IT sectors.

The virtues of stability and transparency

An important prerequisite for the competitiveness of a country's IT sector is a stable and open business environment. Aside from political and macroeconomic stability, this means an entrenched government commitment to wide-ranging competition, protection of private property, the fostering of crossborder trade and inward foreign investment, and transparent and consistent regulation, among other factors. "Protectionism and overzealous rule-making stifle IT growth, free enterprise and, in turn, competitiveness," says Kevin Kettler, CTO of Dell. Assessment of the overall business environment of countries is the starting-point for the IT industry competitiveness index.

A winning combination

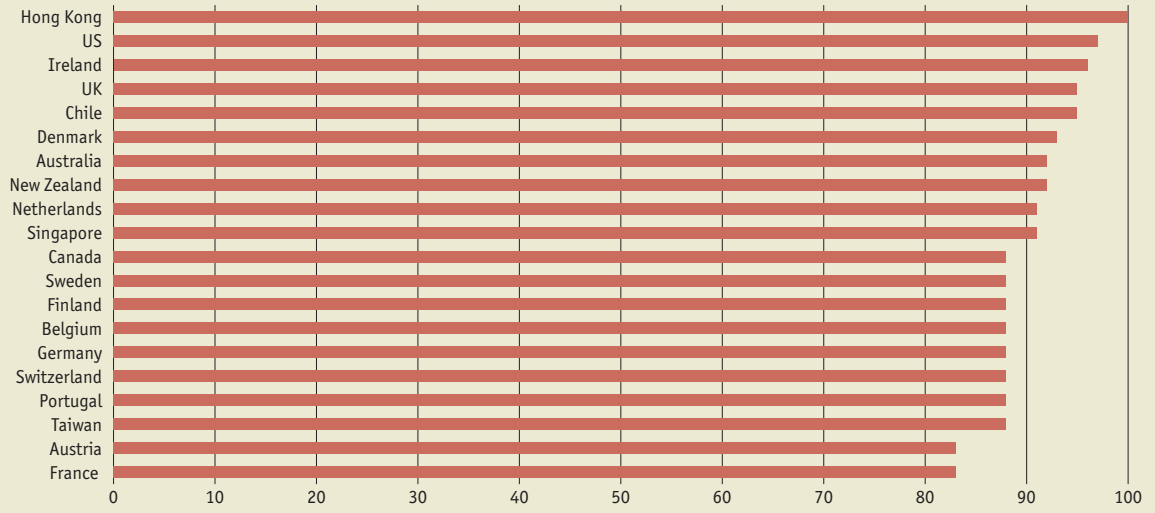
In a global economy, IT companies will set up operations in the most attractive environment they can find. The most successful countries in the index are those where favourable business, legal and investment conditions complement the other, more specific building-blocks for IT competitiveness (including technology infrastructure, IT skills and others).

Take Ireland, for example, which places 15th in the overall index and 3rd in business environment and, as discussed earlier, has successfully attracted foreign direct investment (FDI) from the major technology companies with the help of its favourable tax laws. It has the added advantage of being part of the EU, with its harmonised laws on doing business, and of being English-speaking, making it particularly attractive for US firms.

West European countries generally offer an attractive combination of good legal protection, transparent tax regimes and skilled workforces. When it comes to international competitiveness, however, a drawback for some is a restrictive labour market. Henning Kagermann, CEO of software producer SAP, notes that Silicon Valley's success in the US starts with an environment that is friendly for IT. "Europe's labour-market regulation," he says, "is made for steel and coal, not for high-technology IT companies."

Many economies in Asia-Pacific have been

Overall business environment: Top 20 countries and scores



Source: Economist Intelligence Unit, 2007. See Appendix 3 for a full list of scores.

outstandingly successful in developing their IT sectors. Singapore, for example (11th place in the index), performs strongly in terms of receptiveness to foreign investment and private property protection. It has used these and other strengths to good effect to encourage the growth of home-grown high-tech industries, including software and semiconductor manufacturing.

Hong Kong is not a major IT producer, but it boasts one of the world's most attractive business environments, and not only owing to the gateway it provides to China. The government's laissez-faire approach to economic management has created a policy environment that is pro-business, where regulations and red tape are kept to a minimum. Ranking 21st in the overall table, Hong Kong is the top scorer in the business environment category.

Many emerging economies have a long way to go to develop stable business environments for IT firms. Paul Mountford, president, Emerging Markets Theatre with Cisco Systems, points out, for example, that there is no land registry in many of the countries he is responsible for, so a global company that buys a piece of land may be forced to hand it over to the government at any point. Barriers can also be put in the way of domestic businesses: in some east European countries, it can take up to eight months to register a small business—a delay, says Mr Mountford, that can be "catastrophic" to the new firm's viability.

One emerging economy making rapid headway in this regard is Chile, one of the better performers in the business environment category. Trade liberalisation with the US and other countries is helping, but improved legal protection as well as general economic and political stability, and also improvements to physical infrastructure, are making Chile an attractive investment environment for IT and other firms alike.

Infrastructure for IT

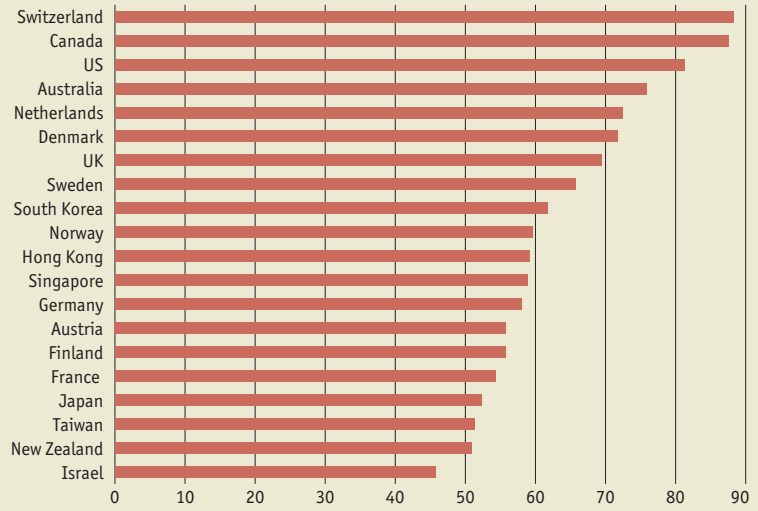
"Everyone wants to build an IT industry because it's one of the most productive sectors of an economy," says Mr Mountford of Cisco. "But developing an effective IT industry requires significant investment in technology to begin with."

Countries with a strong technology infrastructure—as reflected in our index by extensive personal computer (PC) ownership, high broadband penetration and good Internet security, as well as substantial levels of spending on IT—are in the best position to develop strong IT sectors. Without reliable infrastructure in place, companies struggle to do business with each other and to attract a home market. A large technology firm, for example, that wants to do business with smaller suppliers needs to be able to see suppliers' catalogues online. A small software start-up wanting to sell to consumers or other small businesses will need a website, and its customers will need Internet access. Without widely available and secure broadband access, none of this is possible.

Not surprisingly, the countries scoring highest in the infrastructure component of the index are developed economies that have been able to build on long-established telecommunications infrastructures, such as Switzerland, Canada, the US and Australia. Broadband penetration equals or exceeds 20% in most OECD markets, whereas in developing countries it is typically 5% or less.

The beneficial role that world-class infrastructure plays for the IT industry is readily apparent in the US. Spending on IT by businesses and households there dwarfs that of other countries; a large share—if not most—of the US$440bn that research firm IDC says was spent on hardware, software and IT services in the US in 2006 is likely to have gone to domestic suppliers. Online activity by businesses is also vigorous, thanks in part to high levels of PC and Internet penetration and relatively secure Internet infrastructure. The US accounts for the lion's share of global online spending; IDC expects online business-to-business (B2B) spending in the country to reach US$650bn by 2008, or two-thirds of the world total. Areas of relative weakness exist, however: US adoption of high-speed Internet is not keeping pace with that in other developed countries, and take-up of mobile phone and data services remains low in comparison to western Europe and East Asia.

IT infrastructure: Top 20 countries and scores

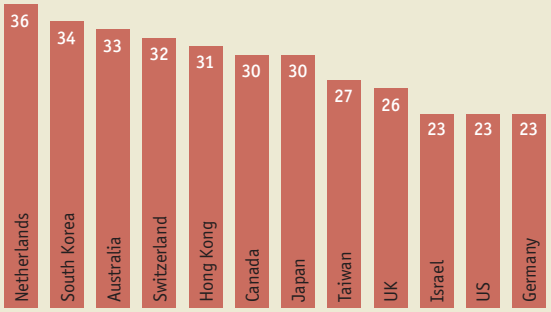


Source: Economist Intelligence Unit, 2007. See Appendix 3 for a full list of scores.

Vision helps

Given the national significance—and enormous cost—of deploying advanced communications networks, government vision and commitment is often required to encourage their spread. National infrastructure initiatives benefit the IT industry, of course, by providing businesses of all sizes with the ability to network easily with suppliers, partners and customers. But they also help IT firms in other ways. Taiwan's government, for example, has embarked on

Broadband penetration—selected countries (%)
Penetration of population with digital subscriber line (DSL), cable modems, fixed-wireless access, FTTx (fibre-optic), WiMAX (wireless broadband) and other broadband connections.



Source: Pyramid Research.

a four-year plan to deploy a national WiMAX network; beyond improving connectivity, the initiative is meant to spur the local development of related software and design services.

Leapfrogging

One of the benefits of globalisation is that it has helped to drive down at least some of the costs of creating a technology infrastructure. PC prices, for example, have been on a steady decline for several years. Unfortunately for emerging economies, says Mr Mountford, this does not offer many shortcuts for building a modern, high-tech infrastructure.

Yet for those countries willing and able to make the investment, the opportunities are enormous. Good technology infrastructure will not only help the IT sector to grow, but will improve the ability of organisations to do business with each other electronically, bringing efficiency gains across the whole economy. Says David Hendon, head of business relations at the UK Department of Trade and Industry: "The successful economies of the future will be the ones that harness technology. Most of the change that's happening in other industries is enabled by IT."

Sophisticated Sweden

Sweden ranks seventh in our overall index and eighth in IT infrastructure. Approximately 80% of households have a PC, and 75% have Internet access, one of the highest rates of Internet penetration in the world.

It is arguably easier for such a small, and relatively affluent, country to develop a good technology infrastructure. Nonetheless, it has consistently been ahead of the technology curve, even among countries with a similar profile.

Sweden benefited from early deregulation of the telecoms industry in 1993. It was also one of the first countries in Europe to develop a broadband strategy, and as long ago as 1999 the government provided funding of €600m (US$640m) to develop a national optical fibre network, to which nearly all 289 of Sweden's municipalities are now connected. Competition has also helped: there are currently about 100 broadband operators, although the market is dominated by four major players. Sweden also has 85% coverage of third-generation (3G) telephone networks, the highest in Europe. The country's robust wireless infrastructure has helped to attract foreign investors: Intel's first wireless competence centre outside California was built in Stockholm.

More recently, the government has spent €64m on making sure that broadband is available in all areas of the country, a programme that should be completed by the end of 2007. It is intended that broadband speeds of at least 2 megabits per second (mbps) will be available throughout the country by 2010.

Partly as a result of this investment, Sweden has a strong information and communications technology (ICT) sector: ICT products have made up around 15% of all Swedish exports in recent years. Producers of telecoms equipment, such as Ericsson, account for much of this, but the country also boasts a large number of software firms that compete in European and global markets for, among other products, data security, gaming, financial management, supply chain management and wireless applications. According to IDC, a research firm, Sweden is also among the fastest-growing software markets in Europe, with domestic spending on packaged software expected to expand by over 7% annually between 2006 and 2008.

Traditional agrarian economies starting from a blank sheet of paper may also be able to leapfrog stages of IT development, says John Brigden, senior vice-president EMEA of Symantec: "They're able to make purchases of solutions without being hamstrung by legacy infrastructure and move quite rapidly on the technology curve."

China provides a case in point. PC ownership is not widespread, although there are striking differences between urban and rural areas: in cities, one-third of homes have PCs, whereas the figure is only 1% in rural areas. Broadband penetration is no more than 5% of the population, but again is substantially higher in the coastal provinces and cities. Domestic spending on IT hardware, software and services is less than US$3,000 per 100 people, compared with around US$30,000 in Taiwan and US$85,000 in Japan.

Yet the size of the Chinese market and the growing appetite of its companies and individuals for IT, not to mention the opportunity for sourcing low-cost labour, are attracting foreign IT companies to invest in the country. Some executives see this as a double-edged sword for the long-term competitive outlook. Eilert Hanoa, CEO of Norwegian software firm Mamut, is one: "Many high-quality companies from Europe and the US are going to China to help local manufacturers skip 50 years of industrial revolution so they can out-compete us in five years."

Talent for the future

A skilled workforce is at the heart of any country's IT sector. Without skilled employees, technology firms cannot grow and flourish, and there is a strong relationship between the strength of a country's higher education system and that of its technology sector.

Yet the challenge posed by a global economy is that skills requirements change very quickly, as companies move their operations to cheaper economies. Countries need a flexible approach to skills development if they are to keep up. "The types of IT skills that are now in demand are changing radically," says Steve Gilroy, vice-president of international sales and marketing for CompTIA, an international association representing the IT industry. "In most economies, even in developed countries, the ability of supply to keep up with demand is the issue."

As reflected in the index, the US is a pacesetter in skills development for the technology sector's labour force. It has a high proportion of graduates (about one-third of the university-age cohort have a bachelor's degree), several world-class universities—many concentrated in the high-tech clusters of California—and a large number of science and engineering PhDs. Its technology institutes are also a magnet for talented foreign students, particularly from Asia. (A proposed tightening of immigration policy is cause for alarm, then, as it would restrict the flow of foreign students to the US.)

Other countries have also been investing strongly in their higher education systems to make them more competitive; in several EU member states, including the UK and Sweden, one-third of the university-age population now enter higher education. The Asian "tiger" economies of Singapore, Taiwan and South Korea have all seen rapid growth in their higher education sectors in recent years.

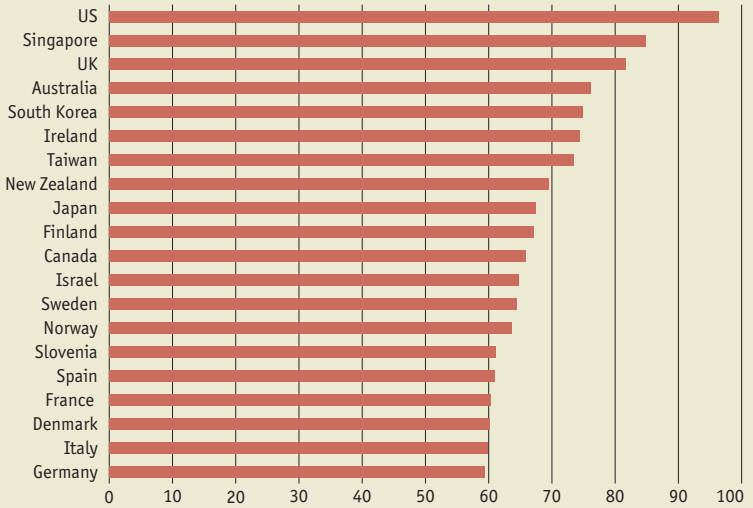
China and India, by dint of their size, produce far more graduates than any other country. Since 1998, when the Chinese government decided to increase funding for higher education and to reorganise its educational system, the numbers entering higher education have soared. Nearly 5m people will graduate from tertiary institutions in China in 2007, about 300,000 of them in the fields of science, technology, engineering and mathematics. In India, 2.5m students graduate each year, 200,000 of them in engineering.

Not just any skills

The bare facts conceal a more complex picture, however. Despite the growth of enrolment in higher education, most countries now report a shortage of skilled IT employees in a number of areas, and there are concerns that even India cannot produce graduates fast enough to keep up with demand.

The shortages are typically reported in what tend to be thought of as high-level IT skills: project management, technical architecture, change management and business analysis. "The skills we need to maintain a competitive IT industry are about

Human capital: Top 20 countries and scores



Source: Economist Intelligence Unit, 2007. See Appendix 3 for a full list of scores.

understanding how to automate processes so they can be enabled by IT," says Mr Hendon of the UK Department of Trade and Industry. There are also shortages in specialist technical areas, such as the ability to manage increasingly complex network infrastructures, says Mr Gilroy.

With lower-skilled software-development jobs increasingly outsourced to offshore locations, companies are finding that there are not enough people rising through the ranks to take the more skilled IT jobs. "It used to be the case that a business would recruit graduates, put them through a training programme and have them learn on the job in entry-level roles," recalls Karen Price, CEO of e-skills UK, an employer-led body that aims to increase the number of skilled IT professionals. "By the time they're 30," she says, "you've got a good business analyst or systems architect. Our issue is that a lot of those jobs aren't here in the UK any more."

Many firms will adapt by changing their approach to training and recruitment. Guy Warren, executive vice-president and general manager, Misys Banking, a UK-based software provider to the financial sector, argues that there is no reason why project managers, for example, have to start off as software developers.

The skills gap is also affecting India. Only about 30% of its graduates are employable in the IT industry, says Kiran Karnik, CEO of Nasscom, India's software industry body. He believes that by 2010, India's IT sector may face a shortfall of 500,000 professionals. The problem, he says, is the lack of "soft" skills among graduates: India's rigid methods of lecture-based teaching, which do not encourage questioning or critical thinking, tend to produce graduates who are unable to give presentations, engage with customers or articulate new ideas. In India, many larger firms now run six-month "finishing schools" for their graduate intake, honing technical skills and teaching them the soft skills required to work in global firms.

Phiroz Vandrevala, executive vice-president at Tata Consultancy Services (TCS), points out that India's IT sector is also facing increasing competition for the best graduates from other sectors of a fast-growing economy.

Hong Kong faces a slightly different challenge—making IT attractive as an occupation to young graduates. Says Anthony Wong, Hong Kong's commissioner for innovation and technology: "Much of our younger generation is seeking a career in financial services instead of pursuing a degree in science and technology. So we're trying to sell people on the good career prospects that IT offers."

Quality more than quantity

Although many Asian countries have strong higher education systems, their IT sectors have also benefited from opportunities offered elsewhere. In the 1990s, students from countries such as China, Japan, South Korea and India flocked to US universities to study, and, after a period working in the US, many returned home with the skills they had learned. "Those students have played a very critical role [in their firms]," asserts William Miller, professor of private and public management at Stanford University in the US. "They brought these missing skills in how to operate in a Western-type company," he says. Eva Chen, CEO of the Taiwan-headquartered security firm Trend Micro, confirms that her organisation has benefited enormously from a supply of good-quality graduates educated in the US.

The difficulty for many countries is that universities cannot always respond quickly to the changing demands of employers. According to Mr Gilroy, the economies most successful in adapting to changing needs are often those where governments have a direct influence over the higher education sector, such as Singapore, South Korea and Malaysia, and can set goals for universities that are rapidly met. Otherwise, good working relationships between business and universities make the difference. In the index, the US, along with Singapore, the UK and Ireland, are rated to possess the educational systems most capable of training tomorrow's well-rounded IT specialists.

Balancing openness with protection

The IT software and hardware industries have special requirements when it comes to the legal environment. Although all businesses need to have an environment in which competition is fair and open, IT, because of its particular nature, has extra considerations. Prime among these is the need to protect IPR, in the form of patents, copyright, trademarks and trade secrets. "Protection around innovation and IPR is critical to driving industry growth," says Mr Brigden. Robust enforcement of IP rights is not incompatible with an "open approach" to innovation in IT, in which companies and developers share elements of product design for the purpose of improving it.

No protection without enforcement

A vigorous framework to protect IP encourages both inward investment and homegrown innovation. It is an area where the US and west European countries have been successful both in passing strong legislation and in enforcing it. "The US has been successful in balancing IPR protection against other interests," says Mr Brigden, and he believes the EU has also helped to produce a legal environment conducive to growth and investment.

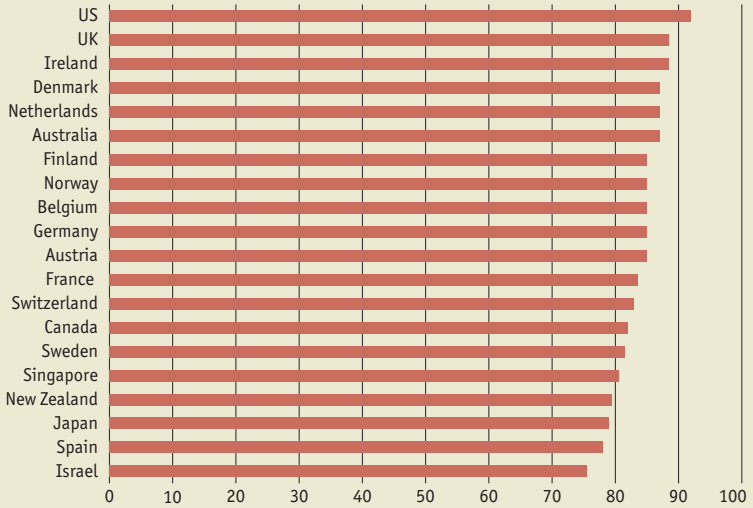
Indeed, the US has some of the strongest IP laws in the world, and practices an active approach to enforcement. In 1999, it created the National Intellectual Property Law Enforcement Coordination Council, which co-ordinates the country's IP enforcement activities at home and abroad. The Department of Justice created an IP task force in 2004 to review the government's approach to tackling IP infringements.

In developing economies, the picture is patchier. In the 1990s, Nasscom campaigned hard for the introduction of stronger IP laws in India, against the wishes of the pharmaceutical industry. "Our constant pressure was that if you don't do this, you will kill any hope of indigenous invention or innovation," says Nasscom CEO Mr Karnik. Eventually, in 2004, the government amended its Patents Act to make it compliant with the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPs), the World Trade Organisation's intellectual property regime.

In China, the situation gives cause for concern. "The laws in China are adequate, but it's the enforcement that's difficult," says Stanford University's Mr Miller. "Part of the problem is the courts," he adds. In contrast to Europe and North America, "courts in China have had little experience of understanding of how business works, so there is an unevenness in the way laws are applied."

Views vary on how much of a deterrent this is to foreign investors. Mr Hanoa of Mamut tells the story of a Norwegian company that initiated a joint venture with a Chinese firm, investing in a factory and training employees, only for the Chinese partner

Legal environment: Top 20 countries and scores



Source: Economist Intelligence Unit, 2007. See Appendix 3 for a full list of scores.

to set up in competition three months later. Yet China continues to attract outside investors, says Mr Miller: "Companies complain about IP a lot but they still go there, and they protect themselves. They compartmentalise information so no one person can walk out the door with the complete story."

The situation in China looks certain to change in the long term. SAP's Mr Kagermann argues that as China's homegrown companies begin to innovate, IP protection will be more rigorously enforced. There are already signs that this is happening. "China has made some significant strides in recent years in strengthening its IP regime," says David Miller, president of Asia-Pacific with PC-maker Lenovo.

Online protection counts, too

In most countries, IT firms have been ahead of those in other industries in adopting online methods of doing business. Legislation to support and protect electronic business and communications is therefore integral to the ability of IT firms to grow. With this in mind, the IT industry competitiveness index assesses countries on their approach to such areas as data privacy, spam, electronic signatures and cybercrime.

Thirteen of the 20 countries scoring highest in the legal environment category are from Europe. The EU has been influential in standardising the regulation of online activity in its member states, by, among other things, developing a common framework for electronic signatures and harmonised data privacy laws that ensure personal data can flow across borders. Combatting spam e-mail has been another focus of co-ordinated activity in Europe (as in North America and Asia). A European Commission anti-spam directive has become law in most EU countries, although local variations mean that spam restrictions in some member states are tougher than in others.

Another European body, the Council of Europe, has led efforts to co-ordinate international approaches to combatting illegal online activity. It authored the Convention on Cybercrime, an international treaty that came into force in most Council countries earlier this decade. It has also been ratified by the US and signed (but not yet ratified) by Canada, Japan and South Africa.

All in all, there remains a large gap between the gold standard of countries with the most effective legal regimes, such as the US and UK, and the approach of many emerging economies. Most countries in the Middle East, for example, have no data protection and spam laws at all. Other emerging markets have little tradition of enforcing IP laws, which is why some companies remain cautious about investing in them. This will need to change not only to reassure foreign IT companies considering investment, but also to help domestic IT firms grow and become competitive in global markets. To compete in the global arena, countries must ensure that the legislation they have in place is consistently and effectively enforced.

Research support for IT innovation

The manufacture of most types of IT hardware has long been a commoditised process, with cost of production the only differentiator. Software and IT services are increasingly subject to the same pressure. With their low-cost and good-quality capacity, China and India have been big beneficiaries of this trend. But no country will be able to compete on cost for ever. Indian service providers, for example, are beginning to face competition from Russian, Hungarian and even Vietnamese outsourcing firms. Says Unisys' Mr Tait: "For services that are more commodity-based there will always be somewhere cheaper. A service can be delivered anywhere as long as you have robust processes and a fast enough network."

Customer service is becoming an important differentiator for IT firms, but it is product and service innovation that will determine their ability to command higher prices and margins going forward. A supportive environment for R&D will help IT firms—particularly smaller ones—to develop or gain access to innovative solutions, and it therefore forms an integral part of the IT industry competitiveness index. (R&D data specific to countries' IT sectors are extremely limited, but the indicators used in the index—public and private expenditure on R&D, and the generation of patents, royalties and licence fees—provide a good picture of the overall R&D environment and innovation-oriented activity in countries.)

Japan, South Korea and Taiwan are clear leaders in this category, and the US, Finland and Sweden are also strong performers. Companies' prolific patent generation is the primary factor in East Asia's high R&D index scores. Buoyant private-sector investment in R&D is also an important contributor to this region's strong innovation environments, as it is in the US and Nordic countries. In the latter, the earning of healthy royalties and licence fees is another reflection of high levels of innovative activity.

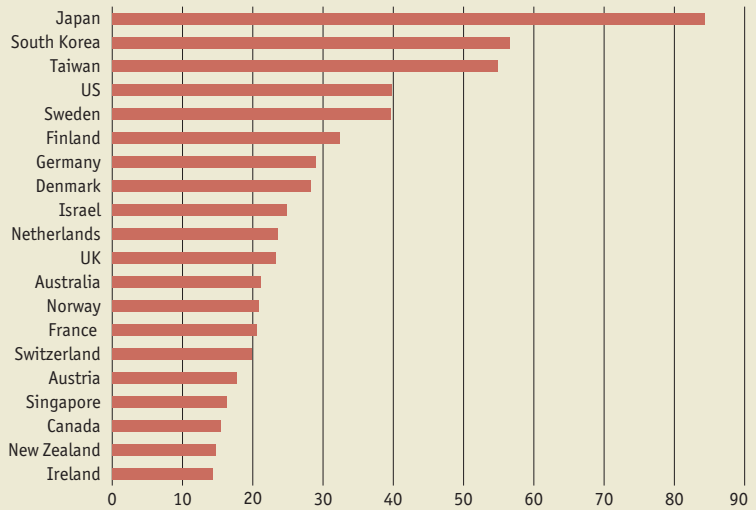
Finding the niche

The best approach for countries to encourage R&D in IT is to focus on a specialised niche, according to Chris Harrison, European technology sector leader for Ernst & Young. "This is one of the most global industries in the world, and it will go to very distant places to look for pockets of expertise," he says. "If you are a small country you have to find a niche; you cannot be a generalist."

It is a view shared by many. Mr Kagermann of SAP, for example, believes that Germany has an excellent opportunity in the area of software engineering to focus on embedded software used in manufacturing: "By starting early to focus on this field, we have a chance to be world-class. If we focus on something where others are already better, it is too late."

In some countries, special areas of technology expertise have developed largely organically; Finland's and Sweden's telecoms equipment sectors, which have spawned strong software providers to

R&D environment: Top 20 countries and scores



Source: Economist Intelligence Unit, 2007. See Appendix 3 for a full list of scores.

serve them, are examples. In other countries, notably in Asia, governments have taken the lead to develop specialised sub-industries. Mr Harrison cites the examples of Japan and South Korea, which have used the model of large government–backed companies to grow centres of expertise.

Academic pursuits

There is certainly an argument that innovation can flourish without substantial government support, provided the right conditions are in place. Nick Bolton, CEO of Oxford Metrics, a UK-based software company, argues that software is the ideal export because it costs nothing to manufacture and, since the Internet arrived, nothing to distribute.

One of those conditions is a strong university sector, where research can be carried out. Singapore and Taiwan, for example, have made huge strides by actively investing in higher education in IT fields. The Singapore government also gives nearly S$25m (US$17m) each year to the National University's engineering faculty to fund its projects. The faculty estimates up to 10% growth in the number of research projects being patented or companies started up over the past five years, according to Lenovo's David Miller.

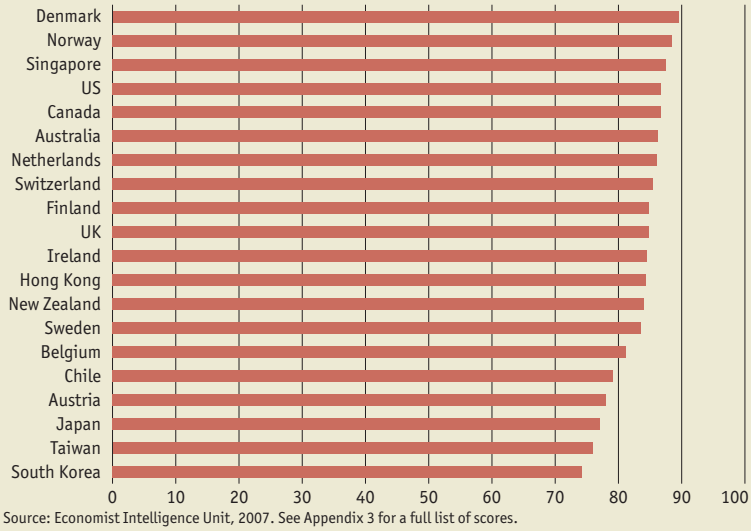
Countries such as the US and Canada, where relationships between industry and universities are encouraged, tend to have strong records in research and innovation. Yet other countries with vibrant universities—notably in continental Europe—do not thrive in innovation because university-based research is not regularly translated into products sold in the marketplace. Universities that insist on owning the IP in an invention hamper the chances of that invention seeing the light of day, argues Mr Bolton.

Keith Collins, CTO of SAS Institute, a US-based business intelligence software firm, agrees. His favoured model is that used by the Massachusetts Institute of Technology (MIT) and Stanford University: "They no longer try to take an up-front value out of the IP—they take the risk of whether that IP will succeed in the marketplace, which makes it more likely that an entrepreneur can pick it up and succeed with it. Many universities have tried to drive revenue from IP, and that's been a mistake."

Innovation can only happen in a culture of risk-taking. As Mr Brigden of Symantec points out, risk-taking goes hand-in-hand with economic prosperity, which is itself driven by the growth in higher education, creating a virtuous circle: "If you haven't got enough money to feed yourself and your family, it's harder to take risks. If you have greater prosperity and education and capital, that's the perfect storm that innovation is derived from."

The role of government

Support for IT industry development: Top 20 countries and scores



Source: Economist Intelligence Unit, 2007. See Appendix 3 for a full list of scores.

Governments seeking to promote a flourishing IT sector have a delicate balance to strike. They need to provide an environment in which companies can innovate and experiment, but they also need to avoid propping up unsuccessful companies or promoting one type of business or technology at the expense of another. As Stanford University's William Miller says of Taiwan: "The government learned how to get things started but also how to back away and let the private sector run it. That's a hard thing for government—if they've done something they think is important they like to keep control."

The index scoring criteria in this area reflect our belief that the most effective government efforts on behalf of the IT industry are those that focus on the supporting environment for company operations and investment, rather than the provision of direct financial assistance or efforts to champion some companies or technologies over others. Dell CTO Kevin Kettler states the belief that "governments should work to set the conditions that will enable companies to flourish, but they should not select which companies will succeed and drown them with subsidies or special treatment." This, he asserts, can lead private companies "to focus on securing government handouts rather than becoming competitive and winning customer support."

Governments can also provide an indirect impetus to domestic IT market growth through their own spending on software, hardware and services. Successful implementation of e-government programmes can have a similar effect, as well as provide examples to domestic businesses of effective IT use.

Europe provides six of the top ten scorers in this part of the index, with Singapore, the US, Canada and Australia also among the leaders. Although falling just outside the top ten, one European country that merits attention for its government's effective role in IT sector growth is Ireland. Irish policymakers decided back in the 1980s that attracting FDI from technology firms was the surest way to spur the growth of home-grown firms, and it cut corporate tax as one way of luring IT giants such as Hewlett-Packard, Dell and Microsoft to invest locally.

Beyond creating local IT jobs, these firms generated a knock-on benefit, as many employees used the business expertise gained within international firms to leave and start their own IT shops. Joe Peppard, professor of information systems at the Cranfield School of Management (UK), and a director of Fineos, an Irish software company, points out that expertise is more important than capital when it comes to starting a software company: "You don't need massive investment, unlike in manufacturing. In software, the main barrier to entry is knowledge."

Singapore gets high marks for its government's determined efforts to improve infrastructure and to create a positive environment for IT firms' growth (as well as its aggressive implementation of an

Liberalise and grow

India's IT success story is legendary, having grown from a US$60m industry in 1991 to one generating US$43bn in revenue today. Yet, according to Phiroz Vandrevala, executive vice-president of Tata Consultancy Services (TCS), the industry's early growth occurred in a regulatory environment that hindered rather than helped it. "This was a business that began to take shape in spite of the government," asserts Mr Vandrevala. "They did not allow firms to import technology nor did they allow free access to foreign exchange."

In the mid-1980s, when Rajiv Gandhi became prime minister, TCS was already doing some technical work for overseas customers. Mr Gandhi, understanding the need to develop a domestic IT industry that did not just service the outside world, removed many of the regulatory barriers to economic activity and also began modernising the telecoms industry. Another change of government in the early 1990s saw an expanded period of liberalisation. "The entire software industry began to explode," says Mr Vandrevala.

The formation in 1990 of Nasscom, a body representing the domestic software industry, played an important part in this liberalisation. Nasscom successfully lobbied for zero duty on software (previously there had been a 150% tariff on software imports) and for passage of the Information Technology Act, which provided legal recognition of electronic documents and digital signatures. Labour laws were also liberalised, allowing women to work at night, for example.

The government introduced tax breaks for multinational companies with business process outsourcing (BPO) subsidiaries in India, and encouraged the development of technology parks. A tax incentive put in place in 1998 that provided a ten-year tax holiday on profits that came from export was particularly important, says Kiran Karnik, Nasscom CEO: "It enabled companies to do long-term planning and it gave confidence to multinationals investing in India."

e-government strategy). One of the results, according to Lenovo's David Miller, "is that many homegrown technology firms have been engaged as OEMs [original equipment manufacturers] by major multinationals—a definite boon to the local IT industry." The government's involvement in the sector extends to taking direct and indirect ownership stakes in technology firms, mainly hardware producers. Its role as shareholder has generally been positive, although such direct involvement risks creating the perception of playing favourites.

There is always a danger that too much government help can make businesses complacent, and allow fundamentally weak businesses to stay in operation. Mr Hanoa of Mamut complains about the lack of support Scandinavian governments offer to the IT sector—ironically, given their high index scores in this area—but does acknowledge one benefit: "The good news is that you're obviously getting extremely strong companies because you're not being padded, you have a high-tax level and you need to have people working extremely efficiently to compete with Asian or central European companies. IT firms in Scandinavia run a pretty tight ship."

Making procurement count

In most countries, government is the biggest purchaser of IT, so government buying decisions can have a big effect on the domestic IT industry. "Such a large part of public procurement goes on buying IT or services that are enabled by IT," says Mr Hendon, "that if the government uses its purchasing power in the right way, it can influence things without spending more money." Procurement must be carried out intelligently, argues Mr Hendon, by "asking for things in a way that enables innovation to take place," for example by explaining the service a department wants rather than defining the software it needs.

John Higgins, director-general of Intellect, a trade association for the UK high-tech industry, praises the US practice of earmarking a proportion of the federal budget to be spent with small IT suppliers. A 2006 study by the Centre for Business Research at Cambridge University found that this policy, along with support from the Small Business Innovation Research (SBIR) programme, which provides 100% funding from the start of a business's life, put US start-ups at a global advantage. There are drawbacks with this model—particularly the exclusion of foreign firms from eligibility—but there is little dispute about its positive impact on small US suppliers.

Tomorrow's rising stars?

Given its consideration of a wide range of technology, industry and business environment factors, it is likely that our index's top tier of countries will remain unchanged over the next few years. Countries such as the US, Japan, South Korea and the UK possess most of the required attributes to support competitive IT services, software—and in some cases even hardware—sectors into the future. Each of the leaders has weaknesses, however, and they will need to ensure their advantages do not erode. At the same time, the emerging technology powerhouses currently in the lower third of the table, namely China and India, can be expected to make index gains—provided that improvements in infrastructure and their business and legal environments begin to complement their other IT strengths.

Looking ahead, two trends are likely to take shape that may affect the lower tiers of the index. One is that a number of emerging economies will compete more effectively with China and India on the availability of relatively low-cost IT skills. These will probably include Malaysia, Brazil and Vietnam, as well as east European countries such as Russia, Hungary and Poland. Smaller emerging markets such as Lithuania, Estonia and Chile will also develop niches in software development and services in which to compete successfully. Save for Vietnam, each of these countries performs respectably (in the upper half of the table) in at least one enabler of IT competitiveness; they can be expected to use these isolated strengths to their advantage, particularly in the area of software development.

Russia is one country well placed to manage this, despite glaring weaknesses in infrastructure, legal protection and the business environment. It is already a popular outsourcing destination for software development, an industry whose workforce is supplied by a tertiary education system that produces 200,000 science and technology graduates each year, many of them now English-speaking. Philip Oliver, group director of marketing at Fujitsu Services, describes Russia's technology schools as "phenomenal".

Vietnam is another, notwithstanding its currently low scores throughout the index. An influx of immigrants with business and IT skills—mostly refugees who fled the country after the communist takeover in 1975—is invigorating the labour force. And after many years of neglect, the government is now pouring money into creating an IT infrastructure. An outsourcing industry is growing, and Vietnam has also produced a sizeable number of home-grown software houses.

Indeed, all other factors being equal, including infrastructure and the legal environment, skills will increasingly be the basis of IT differentiation at the country level. Predicts Nasscom's Mr Karnik: "The world of tomorrow—three to five years from now—is going to focus increasingly on talent." The countries best able to nurture it will do their IT sectors an enormous service.

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 has built 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 on the next page, 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.

Correlation coefficients for each of the categories and indicators were calculated against our proxy variable for competitiveness, IT labour productivity. These values served as a guide to our team of internal experts in assigning the relative weights for each of the indicators in the index.

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.

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	2002-2006	Qualitative: assigned by Economist Intelligence Unit analysts
Degree to which private property rights are guaranteed and protected	40%	Economist Intelligence Unit: Business Environment Rankings	2002-2006	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	2002-2006	Qualitative: assigned by Economist Intelligence Unit analysts
Freedom of existing businesses to compete	20%	Economist Intelligence Unit: Business Environment Rankings	2002-2006	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	2006	Quantitative
Desktop & laptop computers per 100 people	60%	Pyramid Research	2006	Quantitative
Broadband connections (xDSL, ISDN PRI, FWB, cable, FTTx) per 100 people	10%	Pyramid Research	2006	Quantitative
Secure Internet servers per 100,000 people	10%	Netcraft, World Bank	2005	Quantitative
Category 3: Human capital	**20%**			
Total number of students in higher education, as % of gross university-age population	25%	UNESCO	2004	Quantitative
Enrolment in tertiary-level science programmes, as % of total tertiary-level enrolment	5%	UNESCO	2004	Quantitative
Employment in technology sector, as % of total workforce	10%	OECD, national statistics	2005	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	2002-2006	Qualitative: assigned by Economist Intelligence Unit analysts
Enforcement of IP legislation	35%	Economist Intelligence Unit: Business Environment Rankings	2006	Qualitative: assigned by Economist Intelligence Unit analysts
Status of electronic signature legislation	10%	National sources, European Commission	2006	Qualitative: assigned by Economist Intelligence Unit analysts
Status of national data privacy and anti-spam laws	10%	National sources, European Commission	2006	Qualitative: assigned by Economist Intelligence Unit analysts
Status of national cybercrime laws	10%	National sources, European Commission	2006	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	2004	Quantitative
Gross private sector expenditure on R&D (US$ at PPP), per 100 people	10%	UNESCO	2004	Quantitative
Number of new domestic patents registered by residents each year (per 100 people)	65%	WIPO	2004	Quantitative
Receipts from royalty and license fees (US$) per 100 people	15%	IMF, World Bank	2004	Quantitative
Category 6: Support for IT industry development	**15%**			
Access to medium-term finance for investment from domestic and foreign sources	25%	Economist Intelligence Unit: Business Environment Rankings	2002-2006	Qualitative: assigned by Economist Intelligence Unit analysts
Existence of a coherent national government strategy to achieve e-government objectives, aimed at improving both public service delivery and efficiency of back-office operations	30%	UN, European Commission, Economist Intelligence Unit analysts	2006	Qualitative: assigned by Economist Intelligence Unit analysts
Government spending on IT hardware, software and services (US$ per capita)	10%	IDC	2005	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	2006	Qualitative: assigned by Economist Intelligence Unit analysts

IT industry competitiveness index, 2007
Index scores by region

The Americas

Rank	Country	Score
1	United States	77.4
2	Canada	64.6
3	Chile	39.5
4	Brazil	31.4
5	Mexico	30.4
6	Argentina	30.0
7	Colombia	25.7
8	Venezuela	25.6
9	Ecuador	25.2
10	Peru	25.1

Western Europe

Rank	Country	Score
1	United Kingdom	67.1
2	Sweden	65.4
3	Denmark	64.9
4	Switzerland	63.5
5	Netherlands	62.9
6	Finland	62.7
7	Norway	59.7
8	Ireland	58.6
9	Germany	58.2
10	France	55.8
11	Austria	55.3
12	Belgium	53.3
13	Italy	46.4
14	Spain	46.1
15	Portugal	45.3
16	Greece	38.6

Eastern Europe

Rank	Country	Score
1	Estonia	45.3
2	Slovenia	44.2
3	Hungary	41.5
4	Czech Republic	40.7
5	Poland	40.0
6	Slovakia	39.5
7	Latvia	37.9
8	Lithuania	36.6
9	Romania	32.1
10	Bulgaria	31.6
11	Russia	28.0
12	Ukraine	23.9
13	Kazakhstan	21.4
14	Azerbaijan	18.8

Middle East & Africa

Rank	Country	Score
1	Israel	54.5
2	South Africa	33.4
3	Saudi Arabia	32.5
4	Turkey	32.3
5	Egypt	24.3
6	Algeria	20.7
7	Nigeria	18.7
8	Iran	15.7

Asia-Pacific

Rank	Country	Score
1	Japan	72.7
2	South Korea	67.2
3	Australia	66.5
4	Taiwan	65.8
5	Singapore	63.1
6	New Zealand	57.5
7	Hong Kong	53.4
8	Malaysia	34.9
9	Thailand	31.9
10	India	29.1
11	Philippines	28.7
12	China	27.9
13	Sri Lanka	26.0
14	Indonesia	23.7
15	Pakistan	20.2
16	Vietnam	19.9

Appendix 3: Index scores by category

The means to compete: Benchmarking IT industry competitiveness

IT industry competitiveness index, 2007
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	77.4	97.0	81.3	96.4	92.0	39.8	86.8
Japan	72.7	82.0	52.3	67.4	79.0	84.3	77.1
South Korea	67.2	80.0	61.7	74.8	66.0	56.6	74.3
United Kingdom	67.1	95.0	69.4	81.6	88.5	23.2	84.9
Australia	66.5	92.0	75.9	76.2	87.0	21.1	86.2
Taiwan	65.8	88.0	51.3	73.4	70.0	54.8	75.9
Sweden	65.4	88.0	65.7	64.5	81.5	39.6	83.5
Denmark	64.9	93.0	71.7	60.2	87.0	28.2	89.5
Canada	64.6	88.0	87.5	65.9	82.0	15.5	86.8
Switzerland	63.5	88.0	88.2	54.8	83.0	19.8	85.4
Singapore	63.1	91.0	58.8	84.9	80.5	16.3	87.5
Netherlands	62.9	91.0	72.4	59.1	87.0	23.5	86.1
Finland	62.7	88.0	55.7	67.2	85.0	32.4	84.9
Norway	59.7	80.0	59.6	63.7	85.0	20.9	88.5
Ireland	58.6	96.0	44.9	74.4	88.5	14.3	84.5
Germany	58.2	88.0	58.0	59.4	85.0	28.9	68.0
New Zealand	57.5	92.0	50.9	69.5	79.5	14.7	84.0
France	55.8	83.0	54.3	60.3	83.5	20.6	73.6
Austria	55.3	83.0	55.8	56.0	85.0	17.7	78.1
Israel	54.5	83.0	45.8	64.8	75.5	24.9	68.8
Hong Kong	53.4	100.0	59.1	49.2	74.5	6.3	84.3
Belgium	53.3	88.0	45.1	57.7	85.0	13.0	81.2
Italy	46.4	72.0	32.2	59.9	74.5	11.4	69.8
Spain	46.1	80.0	29.6	61.0	78.0	6.6	70.1
Estonia	45.3	83.0	38.5	54.4	73.0	2.5	69.9
Portugal	45.3	88.0	33.1	57.6	74.5	3.8	66.3
Slovenia	44.2	68.0	29.6	61.1	73.0	9.7	63.4
Hungary	41.5	83.0	24.0	54.9	74.5	6.9	55.1
Czech Republic	40.7	78.0	26.3	51.7	71.0	5.9	58.0
Poland	40.0	75.0	22.0	55.3	73.5	2.9	59.4
Chile	39.5	95.0	12.7	42.4	67.0	1.7	79.2
Slovakia	39.5	76.0	28.3	51.0	71.0	2.8	54.7

IT industry competitiveness index, 2007 (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%**
Greece	38.6	75.0	13.9	56.3	71.0	3.5	60.9
Latvia	37.9	72.0	19.3	55.9	69.0	1.9	55.4
Lithuania	36.6	68.0	14.4	54.7	71.0	2.3	55.4
Malaysia	34.9	73.0	16.5	43.7	53.0	1.8	65.5
South Africa	33.4	77.0	8.9	40.8	63.5	1.5	60.6
Saudi Arabia	32.5	68.0	12.3	43.2	49.0	0.2	64.4
Turkey	32.3	77.0	5.0	44.9	57.5	1.0	57.1
Romania	32.1	63.0	10.8	45.3	59.5	1.5	55.1
Thailand	31.9	76.0	6.4	47.7	39.5	0.5	62.6
Bulgaria	31.6	63.0	10.9	46.8	59.5	1.7	49.3
Brazil	31.4	67.0	12.9	39.6	46.0	1.6	61.2
Mexico	30.4	63.0	8.6	38.4	54.5	1.0	60.3
Argentina	30.0	60.0	8.6	47.8	60.0	1.5	42.1
India	29.1	60.0	0.5	49.6	48.0	0.7	54.0
Philippines	28.7	68.0	2.2	40.7	51.5	0.4	54.0
Russia	28.0	48.0	8.6	56.8	38.5	6.3	31.5
China	27.9	47.0	8.0	44.7	49.0	2.2	48.1
Sri Lanka	26.0	60.0	0.5	32.7	46.5	0.0	58.0
Colombia	25.7	67.0	5.2	25.7	54.5	0.1	49.1
Venezuela	25.6	52.0	6.2	42.0	44.0	0.3	42.1
Ecuador	25.2	60.0	8.3	27.1	46.5	0.3	49.1
Peru	25.1	58.0	7.7	27.5	48.5	0.3	49.1
Egypt	24.3	58.0	1.1	31.1	45.5	0.3	49.3
Ukraine	23.9	40.0	5.5	43.8	46.0	2.9	31.3
Indonesia	23.7	51.0	0.0	36.6	39.0	0.6	48.0
Kazakhstan	21.4	48.0	1.0	25.3	42.0	2.7	43.3
Algeria	20.7	45.0	4.8	30.1	38.5	0.2	35.3
Pakistan	20.2	59.0	0.4	19.4	41.0	0.2	41.0
Vietnam	19.9	48.0	0.6	22.4	39.5	0.4	43.0
Azerbaijan	18.8	43.0	1.0	16.5	38.0	2.7	43.3
Nigeria	18.7	39.0	0.8	21.6	29.5	0.3	48.4
Iran	15.7	32.0	7.1	25.2	32.5	0.3	18.3

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