Cloudrise: Rewards and Risks at the Dawn of Cloud Computing

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Executives around the world are discovering ingenious ways to put cloud computing to work.

Reducing costs is just the start. Organisations are using cloud services and technology now to develop innovative new products, improve operations, share information with customers, partners and suppliers, and run important enterprise applications. Despite security concerns and other challenges, executives believe cloud computing can provide their company with lasting competitive advantage. This report reveals how companies in both the developed and developing world are taking advantage of this technology and provides specific steps business decision makers, IT leaders and governments must take to move forward.

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Cloud computing has entered a new phase in its brief history. Not just in the United States but around the world, firms like NASDAQ, 3M, the China Ocean Shipping Company and India's Future Group are shifting from investigating this new technology to exploiting it. Within the healthcare industry alone, cloud services are saving lives by saving time: shedding months off the time needed to develop new drugs and diagnosing tumours and identifying new outbreaks of infectious diseases more quickly than ever. In other industries, cloud computing and services are being used to shrink massive government data centres, build global logistics platforms, check bridge safety, enter new markets, devise ingenious new ways to promote products, reduce power consumption and carbon emissions, and a host of other purposes.

According to our research, 44 percent of large organisations in nine countries are already using clouds for a wide range of often critical applications. By 2012, that number will rise to 54 percent. (See Figure 1.) This doesn't include the many entrepreneurs who are seizing the opportunity to start their businesses with minimal up-front IT investment.

Right now, most attention is focused on how cloud computing can reduce IT costs and help companies meet pressing but often short-term computing needs. But wise executives will look beyond these short-term opportunities to determine how clouds can help their organisations become more competitive. Operational excellence will be a critical factor for success in coming years. Executives in both the developed and developing world will take advantage of cloud computing to run leaner, more agile operations and expand their businesses. And while not every company can be a leader in providing cloud services like Google, Amazon or Apple, clouds will undoubtedly change not just companies but entire industries as executives better understand how they can use this powerful technology.

To discover the diverse ways organisations in the Americas, Europe, Asia and Australia are making and saving money through cloud computing, the Accenture Institute for High Performance (with the help in China of the Chinese Institute of Electronics) surveyed business leaders from 669 large organisations in nine countries and over 20 industries, spoke to executives who have deployed the technology, and tracked reports on cloud deployments as they emerged. Besides the remarkably wide range of ways cloud computing is being used, some often surprising discoveries we uncovered include:
- Companies are especially eager to use clouds as technology platforms to support important business processes and information exchange, and as a means of making better decisions.

- Executives expect cloud computing will directly affect how they compete in the future and that it will have an important impact on innovation.
- The perceived benefits and risks from cloud computing vary more by country than by industry.
- Executives in Brazil and Germany are quicker to adopt cloud services than their counterparts in China, the United States and the UK.
- Companies that use virtualisation and outsourcing, and that have strong IT practices, appear able to move forward with cloud computing more quickly than others.
- Security concerns are not preventing organisations from starting to use clouds in most countries.
- Executives say their governments must help establish cloud security, privacy and technical standards, and take other steps if the technology is to be widely adopted.
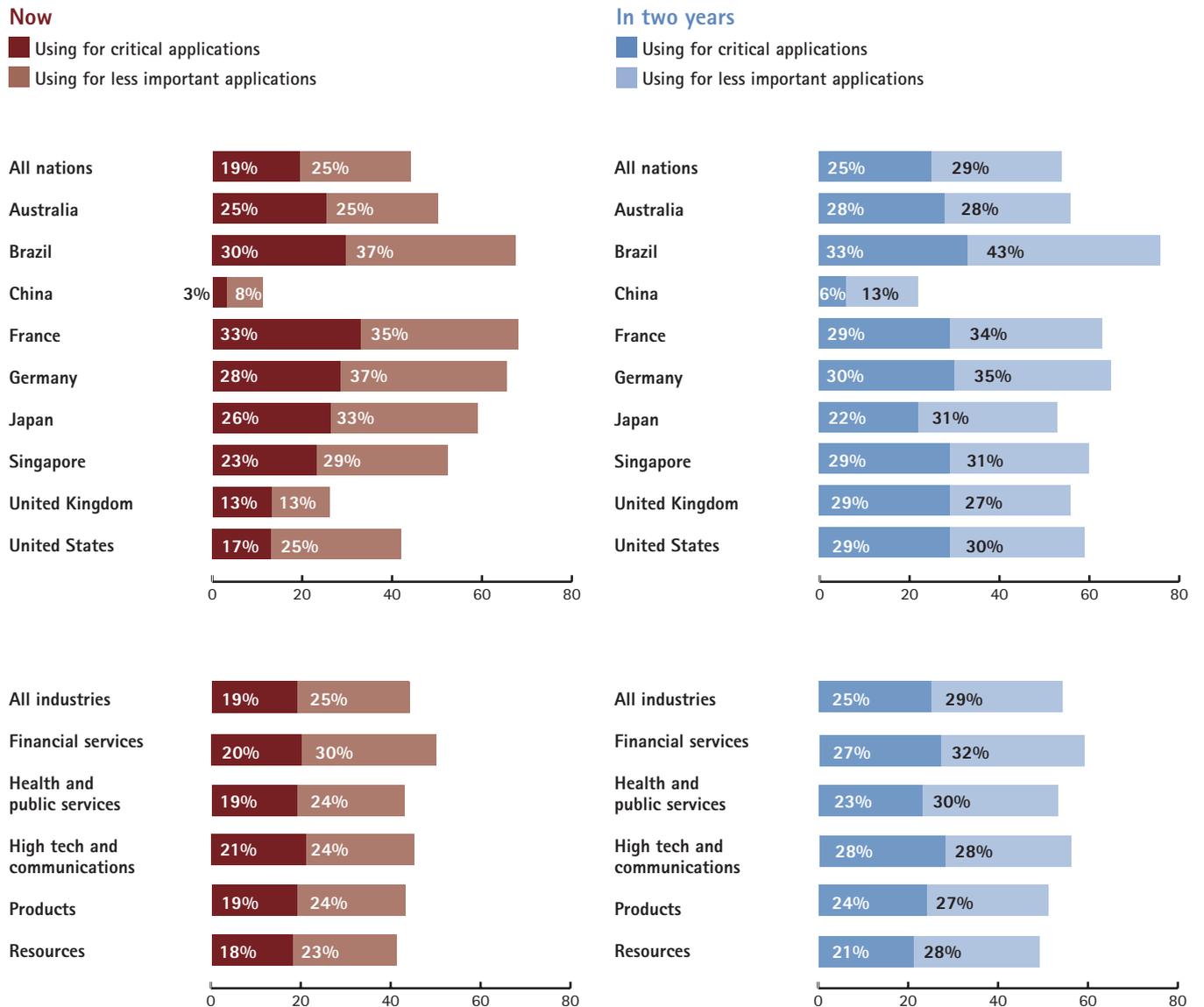
Cloud computing is moving ahead quickly, often in unexpected ways and locales. Still, we are in the dawn of the cloud computing era. Companies are experimenting with cloud services, and are in the first stages of implementation. It will take years to see how cloud computing will change or even transform how business is conducted and companies compete.

The good news is that executives have time to decide how they can use it and learn how to manage its risks. Now is the time for business and government leaders around the world to look to the future and seriously consider how their organisations can move forward with cloud computing. Otherwise, they risk missing the chance to save money, improve operations and, most critically, transform themselves into a more formidable competitor before their rivals do.

Figure 1: Cloud computing rolls up its sleeves
Organisations around the world are deploying cloud computing for critical applications and other uses. The differences in adoption rate are far greater between countries than between industry groups.

Now
■ Using for critical applications
■ Using for less important applications

In two years
■ Using for critical applications
■ Using for less important applications

	Now (critical)	Now (less important)	In two years (critical)	In two years (less important)
All nations	19%	25%	25%	29%
Australia	25%	25%	28%	28%
Brazil	30%	37%	33%	43%
China	3%	8%	6%	13%
France	33%	35%	29%	34%
Germany	28%	37%	30%	35%
Japan	26%	33%	22%	31%
Singapore	23%	29%	29%	31%
United Kingdom	13%	13%	29%	27%
United States	17%	25%	29%	30%

	Now (critical)	Now (less important)	In two years (critical)	In two years (less important)
All industries	19%	25%	25%	29%
Financial services	20%	30%	27%	32%
Health and public services	19%	24%	23%	30%
High tech and communications	21%	24%	28%	28%
Products	19%	24%	24%	27%
Resources	18%	23%	21%	28%

Average of private cloud platforms and software, infrastructure, process and platform services.

What is cloud computing?

At its most basic level, cloud computing allows users, wherever they are, to obtain computing capabilities through the Internet from a remote network of servers. (A server is a computer that provides applications to other computers.) But cloud computing is not a single, monolithic phenomenon. There are many variants, depending on the capability offered and who owns the servers. (See Figure 2.)

When provided as a service from other companies, cloud computing lets organisations bypass the expense and bother of buying, installing, operating, maintaining and upgrading the networks and computers found in data centres. Instead of licensing software, users tap into a service when it's needed for as long as it's needed. All that is required is a broadband Internet connection and a phone or personal computer with a browser. Organisations pay by the kind and amount of services used, plus any additional fees. (See Figure 3.)

At the other end of the Internet connection are computing clouds—supersized data centres containing tens of thousands of servers hosting Web applications. Some cloud providers even house them in cargo ship containers. Clouds are designed so that processing power can be added simply by attaching more servers; software can be run on any available server with excess capacity.

Figure 2: A guide to cloud computing

The term "cloud computing" originated as a twist on "computing cloud," an easy-to-draw way to portray a group of computers or the Internet itself in a diagram. Today, cloud computing has come to encompass several kinds of services, and is often confused with other technologies.

Synonyms
- **Internet computing:** seen by some as more fitting than "cloud" or "utility" computing
- **On-demand computing:** popularised by IBM
- **Utility computing:** popularised by author Nicholas Carr

Cloud services
- **Software as a service:** cloud-based applications
- **Infrastructure as a service:** processing and storing data
- **Process as a service:** business processes built upon cloud applications
- **Platform as a service:** developing, testing and running applications on clouds or for clouds

Cloud providers
- **Public cloud:** a cloud made available to the public by a company
- **Private cloud:** a cloud maintained for a single organisation
- **Community cloud:** a cloud shared by groups of businesses or organisations
- **Government cloud:** a cloud maintained by a government agency for public use

Foundation technologies
- **Virtualisation:** a way to run more applications or store more data on fewer computers
- **Grid computing:** divides processing among computers; enables speed and scalability
- **Broadband Internet:** enables vast amounts of data to quickly travel over the Internet
- **Web 2.0:** applications and technologies that make the Web a vehicle for collaboration
- **Service-oriented architecture:** designs systems to act like interconnected services

Antecedents
- **Time sharing:** how companies shared mainframes in the early days of computing
- **Application service providers:** the first software services accessed via the Web

The basic technologies can be duplicated by any company. That makes it possible for organisations that possess a very large number of servers to build "private clouds" for their own use. Already, 60 percent of executives claim to use a private cloud, often in tandem with public clouds. By 2012, the total using private clouds will rise to 77 percent. In addition, governments can provide cloud services to other agencies or businesses, as is being done in the United States, Japan and other countries, and consortia of companies can build members-only industry or community clouds.[1] Clouds as vast as those run by Microsoft, Amazon and Google—which power both their "public cloud" services for businesses, and the "consumer cloud"
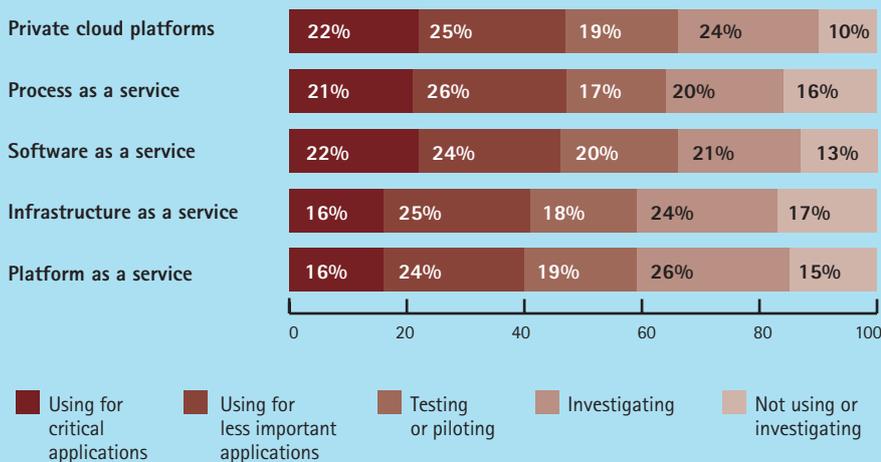
of social networks, video, mobile apps, etc. that people use outside the workplace—require additional technologies.

This description barely skims the surface of the underlying complexities. But for business leaders, it gets at two crucial points: cloud computing combines extraordinary power with flexibility, and in the case of public cloud services, the major burdens and expenses of IT power are shifted to another organisation.

Figure 3: Adoption of cloud computing
Public process and software services, along with platforms for creating private clouds, are used by nearly half of surveyed executives.

Which best describes your organisation's use of the following paid cloud computing services now?

	Using for critical applications	Using for less important applications	Testing or piloting	Investigating	Not using or investigating
Private cloud platforms	22%	25%	19%	24%	10%
Process as a service	21%	26%	17%	20%	16%
Software as a service	22%	24%	20%	21%	13%
Infrastructure as a service	16%	25%	18%	24%	17%
Platform as a service	16%	24%	19%	26%	15%

Operational excellence: Advantages from the cloud

Clouds, like mainframes, servers and personal computers, are only platforms for running applications. But clouds are far speedier, more powerful, flexible and accessible than any previous computing platform. Our research found that executives are eager to explore the possibilities the technology offers, not just focus on a few features. (See Figures 4, 5, 6.) Executives are looking for ways to reduce costs, as they always do, but they are not stopping there. Many are also finding ways to achieve more flexible business processes. A smaller but still significant percentage seeks to use clouds to innovate and improve decision making. Cloud computing is already changing how organisations conduct business in a multitude of ways.

Saving money

The top reason organisations initiate cloud computing is to save money. Bargain prices on cloud services are a big part of their allure. Add the savings from eliminating the cost of servers, software licences, maintenance fees, data centre space, and the benefits of replacing a large up-front capital expense with a low, pay-for-use operating expense, and the financial appeal of cloud computing is obvious. To date, they are pursuing at least six ways to reduce IT costs by using clouds:

Substitution savings: Organisations are switching their server-based applications to less costly cloud services. For example, New Zealand Post, the state-owned postal service, expects

to save NZ $2 million by migrating email and messaging applications to the cloud.[2] Rexel, a French electrical equipment distributor, expects to reduce its email costs by one-third.[3]

Infrastructure avoidance savings: Companies, especially start-ups, are choosing to use cloud services to provide their IT infrastructure instead of buying equipment or licensing conventional software. SmugMug, a start-up photo-sharing company with annual revenues of around US $12 million, estimates it has saved roughly $500,000 by using clouds as its IT infrastructure.[4]

Figure 4: Drivers of cloud computing activity
Reducing capital expenditures and recurring IT costs are just two of the many reasons organisations pursue cloud computing and services.

Please rate how important the following benefits are to your organisation's decision to use or explore cloud services

Benefit	Very important	Important
Reducing up-front IT costs / capital expenditures	35%	35%
Reducing/avoiding cost of maintaining own IT infrastructure	36%	34%
Improving communication and collaboration between individuals	26%	41%
Providing platforms for standardised, efficient business processes	29%	37%
Providing new ways to engage and interact with customers	27%	37%
Providing IT services where IT infrastructure, resources or labour is limited	28%	36%
Developing new or improved services / products more quickly	26%	38%
Changing business processes more rapidly	27%	37%
Improving analytical capabilities	24%	39%
Enabling processes that are not otherwise cost-effective or feasible	23%	40%
Exchanging data more efficiently with outside organisations	25%	37%
Establishing uniform processes in different regions	26%	36%
Developing products or services that were not feasible before	21%	40%
Reducing energy consumption	25%	31%

■ Very important   ■ Important

Infrastructure consolidation savings: Organisations running some of the largest data centres in the world are converting to a cloud architecture and consolidating those centres. The U.S. Department of Defense reduced the number of data centres it operates from 194 to 14 when its cloud computing platform went into effect in early October 2009. The DoD expects the move to save hundreds of millions of dollars.[5] Similarly, the UK government estimates establishing a "Government Cloud" will save £300 million a year by consolidating its IT infrastructure into 10 to 12 data centres.[6] Large companies are also uncovering large savings. Bechtel's CIO benchmarked the company's internal data centre and storage against those of Google, Amazon and Salesforce.com, and concluded he could greatly reduce his per unit costs by creating an internal cloud.[7]

Savings on scarce IT resources: Cloud services are an attractive option when skilled IT labour or equipment is difficult and expensive to come by. Nearly two-thirds of executives asserted they pursued cloud services at least partly for this reason.

Energy savings: Cutting energy costs is a common motivator for pursuing clouds, especially in Australia, Brazil, France and Japan where it is cited by at least 7 out of 10 executives. Corus Automotive Engineering Group expects to cut power consumption and cooling requirements by 40 percent by running a private cloud, and cut its carbon footprint by designing and testing materials components against product requirements in a virtual environment.[8]

Efficiency and productivity improvements: Compared to conventional technologies, cloud services provide even more opportunities to save money when they are used to improve productivity and lower the cost of conducting business. Over half of executives say cloud computing has great potential for permanently and significantly lowering operating costs. For example, the UK government further estimates the Government Cloud will enable £3.2 billion in operational savings across the public sector. An in-depth study by the Automotive Industry Action Group (AIAG) found the U.S. automobile industry would save $1.7 billion if it implemented a pilot software service that followed its recommendations for managing long-distance supply chains.[9]

Figure 5: Putting clouds to work
Now and in the immediate future, organisations will primarily use cloud computing and services to provide shared IT platforms, manage and store data, run enterprise applications, improve productivity and collaboration, and analytics.

For what purposes will your organisation use cloud computing during the next 18 months?

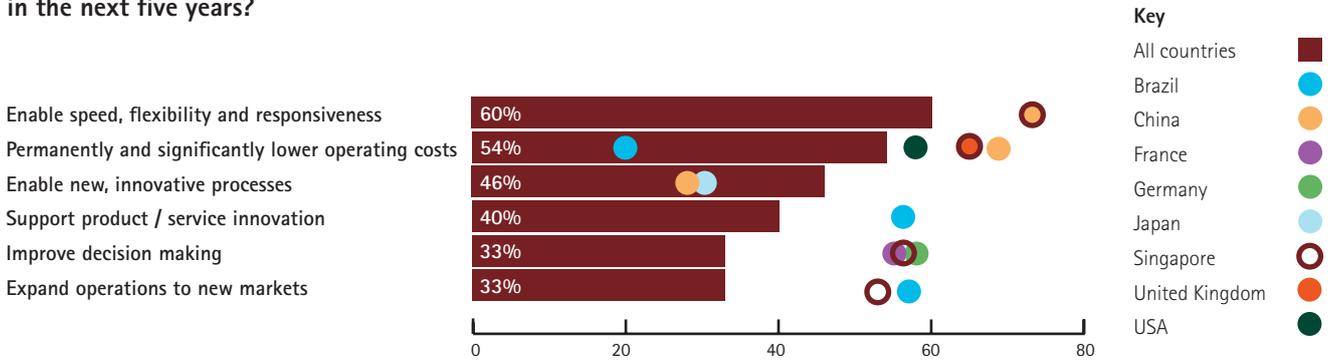| Purpose	Percentage
Providing an IT platform for business processes involving multiple organisations	43%
Backing up data	42%
Running CRM, ERP, or supply chain management applications	39%
Providing personal productivity and collaboration tools to employees	38%
Developing and testing software	35%
Storing and archiving large files (e.g., video or audio)	34%
Analysing customer or operations data	33%
Running e-business or e-government web sites	32%
Analysing data for research and development	30%
Supporting projects (e.g., conducting surveys, developing engineering prototypes, etc.)	30%
Meeting spikes in demand on our web site or internal systems	30%
Processing and storing applications or other forms	29%
Running data-intensive batch applications (e.g., data conversion, risk modelling, graphics rendering, data cleansing)	24%
Sharing information with the government or regulators	20%
Providing consumer entertainment, information and communication (e.g., music, video, photos, social networks)	18%
None of the above / Not applicable	2%
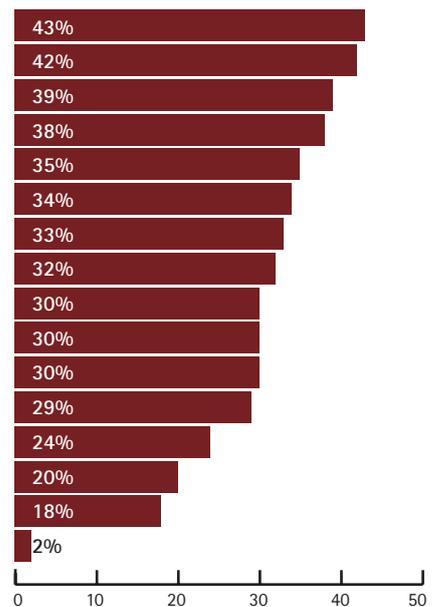
Figure 6: The long-term benefits of cloud computing
Executives expect cloud computing will boost agility and innovation while lowering operating costs. Business leaders in Singapore, Germany and France are almost twice as likely to expect clouds will aid decision making.

What do you see as cloud computing's greatest potential for your organisation in the next five years?

Key
- All countries
- Brazil
- China
- France
- Germany
- Japan
- Singapore
- United Kingdom
- USA

Enable speed, flexibility and responsiveness	60%
Permanently and significantly lower operating costs	54%
Enable new, innovative processes	46%
Support product / service innovation	40%
Improve decision making	33%
Expand operations to new markets	33%

0   20   40   60   80

One organisation that has already experienced productivity savings is the American Occupational Network, a healthcare provider in California. It found that by using cloud services for health records and appointment scheduling, it cut transcription costs by 80 percent and reduced the time to create a bill from seven days to under 24 hours while improving accuracy.[10]

A caveat is in order: not all organi-sations report that they are saving money as expected. In one study of software-as-a-service users, only about half of the executives reported a positive return on investment from SaaS, while a quarter found the cost was greater than they had budgeted.[11] And while many executives vouch for savings, others have expressed doubts. IT executives are concerned that the low cost of quickly accessing cloud services, and savings from avoiding up-front IT purchases, can be overwhelmed by the cost of increased usage. Pricing models for cloud computing, which sometimes require long-term contracts, can make the technology's vaunted flexibility financially impossible even if tech-nically feasible. Clouds have great potential for savings, but the only way

executives can know for sure that they will reduce costs is to conduct a rigorous cost analysis.

Greater agility

Clouds offer extraordinarily flexible resources. They are scalable because of their technical design. Clouds can be summoned quickly when needed, grow by assigning more servers to a job, then shrink or disappear when no longer needed. That makes clouds well suited for sporadic, seasonal or temporary work, for finishing tasks at lightning speed, processing vast amounts of data, and for software development and testing projects.

While executives are eager to use clouds to save money, our research found they value cloud computing's potential to improve business operations even more. Sixty percent of executives think that speed, flex-ibility and responsiveness will be one of the cloud's greatest benefits to their organisation over the next five years —a larger percentage than any other benefit. The figures are significantly higher in China and Singapore.

IT executives tout the agility cloud computing provides them. As one German leader noted, "Cloud computing enables faster implementation of systems, helping businesses remain competitive." Consumer mobile applications, such as those available on Apple's App Store, provide a model for swiftly developing and delivering applications. Businesses also want to use clouds to meet spikes in traffic on web sites or systems while maintaining fast response times. Kelley Blue Book, a publisher of automobile price informa-tion to car buyers, found it would take six weeks to put conventional servers in place to handle the extra traffic on its web site due to the U.S. "Cash for Clunkers" programme. The company decided soon after to host its web site on the cloud.[12]

Our research found another reason executives are drawn to cloud services: they believe they can enable processes that were not otherwise cost-effective or feasible. A prime example is the New York Times, which had no practical way to make its archive of 15 million news stories available to readers until it used a public cloud service to convert articles to PDFs.[13] These one-off tasks and single company systems are providing real business value, but

organisations seem especially eager to use clouds to support ongoing processes, especially when they link together different organisations.

Integrating operations

The real surprise is that despite the widespread concern over how to secure and integrate clouds with older systems, and the risk of slow response times when data has to run over the Internet, the most commonly cited use for cloud computing is to integrate different organisations. The advantages of clouds as platforms—their ability to scale as usage increases, and the convenience of providing a single system and uniform processes that can be accessed by people in many organisations, whether at their desk or on the road—have spurred strong early interest.

More executives say they are going to use clouds as a platform for processes that span multiple organisations—suppliers, customers, affiliates and partners—than for any other purpose. We expect even more will use private and public clouds as a platform for operations in the future, since so many also say they are pursuing cloud computing to create standardised business processes in different regions. That's particularly true in Brazil, where 83 percent are exploring cloud computing's potential as a platform for process standardisation.

Among the platforms we have identified are:

Logistics platforms: Any enterprise at the centre of a supply chain—be it a shipping and transportation company, a leading manufacturer or a major retailer—supports information exchange and common processes among its suppliers, customers and units. Clouds offer a less expensive way to provide

a global, scalable logistics platform, one that establishes uniform processes across the supply chain, and common, accessible methods for entering data. China Ocean Shipping Company, the world's second largest sea shipping business, is one organisation that is creating such a platform (see "Case Study: China Ocean Shipping Company").

Franchise operations platforms: Franchisors need IT to track and manage their relationships with franchisees, and some are turning to cloud services to do it. Papa Murphy's Pizza, a U.S. chain with 1,100 stores, has used cloud platform services to build a system that began as a tool for selling franchises, and is being expanded to store operations. The cloud-based system provides data on franchisee inquiries, contract status, store construction and store operations. Field operation directors can report and review store data on their smartphones to determine which stores require marketing support or operational help.[14]

Media distribution platforms: Movies, television shows and music require enormous amounts of computer storage. The media industry is using cloud platforms to store and distribute content. Walt Disney is designing a cloud-based system to provide consumers with instant access to films or TV shows on cable, computers and smartphones.[15] Warner Bros. is developing a fully integrated "digital supply chain" for storing and distributing movies and TV shows.[16]

Patient information platforms: Patient information platforms: Clouds offer the speed, capacity and accessibility needed to share data among patients, care providers, insurers and government. An early example is NewYork-Presbyterian Hospital, which has developed a medical information platform. MyNYP.org, as it is called, provides patient data to both physicians and patients. The Mayo Clinic

and Kaiser Permanente are also using cloud services where patients can store and access medical information. And in the United Kingdom, the National Health Service has set up a private cloud-based service for storing and sharing medical images.[17]

Better decisions

Most executives are interested in using clouds to make better decisions, but they appear divided over its importance compared with reducing costs and supporting processes. In France, Germany and Singapore, as well as in the health and public service sector, over half say improved decisions will be one of the most important long-term benefits they receive from the technology. In most other countries and industries, no more than a third concur. However, some companies have already put cloud computing to important and noteworthy uses as a decision-making tool:

Analytics: One way to use cloud-powered analytical tools is to quickly derive insights from vast quantities of data and images. Clouds provide a means to quickly analyse the huge collections of customer, operational and scientific data they accumulate on a pay-as-needed basis. Already, a third of executives are using or will soon use cloud computing to analyse customer or operations data. 3M's marketers are using Microsoft cloud services to mathematically analyse promotional images and evaluate how visually effective they are to customers. The company's scientists have developed algorithms for predicting what a person will notice in a visual scene.[18] The medical field has been quick to take advantage of the technology's ability to quickly sift through data. The U.S. Department of Veterans Affairs has launched a small internal cloud that analyses data from VA clinics

Cloud adds research flexibility and improves IT efficiency at global pharmaceutical company.

Pharmaceutical researchers have 100 times more data at their disposal now than they did a generation ago due to rapid advances in human genome science. But more data also means more demand for storage and network capacity, occasionally to a point that pharmaceutical companies cannot accommodate.

In recent years, one of the world's largest research-based pharmaceuticals companies has concentrated IT resources on high-priority projects that require large-memory, large-capacity computers. This could involve the analysis of the final stage in a clinical trial, or an evaluation of a new molecule that the company is considering buying. Doing so, however, sets back other research by days or weeks.

To resolve the issue, the pharmaceutical company's research and development department began using public cloud computing resources when internal servers were at capacity. The solution provided considerable flexibility to research scientists. "In the cloud, I can get 10,000 hours of server time in a wall-clock hour," says an IT executive who works closely with the R&D department. To get 10,000 hours on the company's internal network, by contrast, might take days or even weeks.

Not all of the company's R&D work is suitable for clouds. For example, some research involves proprietary experiments that the company would rather not run on foreign servers; other work involves patient data subject to national privacy rules. In some cases, the pharmaceutical firm has made room for this data and research on its internal network, and has transferred less sensitive work to the public cloud. Before the R&D department began using cloud computing for bursts in computing demand, the IT department created a cloud blueprint, including hardware, storage and operating system specifications. This ensured that if the company ever needed to bring a job back to its internal network, it would come back seamlessly.

In the year or so since their initial pilot, IT executives at the company have spent most of their time figuring out how to make the most of their cloud strategy, which they describe as "infrastructure as a service." They cannot yet offer a dramatic example of ROI, but an IT executive at the firm says cloud computing has clear potential "as a sheer capacity play," and gives the company's scientists greater flexibility.

More broadly within this global company, the executive sees the cloud helping to reduce costs and increase the efficiency of IT operations. At the moment, the Windows servers in the company's data centres are utilised

only about 15 to 20 percent of the time; the Unix servers are utilised only 40 to 45 percent of the time. "Ideally, we want to increase utilisation and at the same time decrease our footprint," he says.

To increase utilisation, the pharmaceutical company is now building an internal cloud, which it plans to be operational in 2011. The private cloud would be employed for disaster recovery, data mining and industry-specific applications. In contrast, the company intends to use public cloud networks for less-sensitive computing needs, such as Web conferencing, storage and as a site for handling work when its data centres are overloaded.

and hospitals to spot outbreaks of infectious diseases at an early stage.[19] Pathwork Diagnostics runs tests to diagnose hard-to-identify cancer tumours, a data-intensive process that in the past would take months. Using cloud computing, the company can delivers results to oncologists within a week.[20]

Future Group, India's largest retailer, is using cloud computing to support data warehousing and analytics for its multi-format chain of retail stores. The cloud—which is at the core of its customer loyalty programme—allows the retailer to store and analyse millions of gigabytes of data. As data under management increases, executives expect they will be able to make more intelligent decisions about customers, products, pricing and promotions.[21]

Collective intelligence: Another way to become more intelligent is by gaining insights from your customers and employees. Blogs, social networks and prediction markets running on the consumer cloud can all be put to this use. Ideastorm is Dell's social networking site in which consumers are included in the development of new products and services. By engaging online, the company can identify areas that need improvement, and involve individuals in the development of new products and services.[22] Some organisations are also trying out microblogging services like Twitter. Seven thousand Nationwide Insurance's employees, including the company's president, use Yammer, a microblogging service, to share information about their work, link to articles of interest and ask questions.[23]

Cloud computing's benefits don't end with saving money, supporting cross-functional and cross-business processes, and decision support. Organisations use clouds for data-intensive technical tasks such as backing up and cleansing data, rendering graphics, operating heavily trafficked web sites, as well as many business and scientific applications. (See Figure 7.) Of course, there are many concerns that must be managed; more on that later. But the list of benefits, when clouds are managed well, is already extensive and will certainly increase as experience grows and technical speed bumps are navigated.

Figure 7: Beyond savings, agility, integration and decisions

While organisations are focusing on saving money, enabling more flexible processes and making better decisions, they have also found other important uses for clouds

Benefit	Example
Support scientific research	NASA is processing telemetry data coming from the rovers on Mars on a public cloud service.[24]
Answer queries	New York City's Department of Education used a cloud-based CRM system to support a new 311 telephone system. Parents of the city's 1.1 million school students can now call just one number whatever their query may be, instead of multiple departments.[25]
Create alerts for quality control	Hotel chains such as Marriott use electronic tools that scan the public cloud for customer feedback. If a customer posts a complaint about a particular service, the local hotel is alerted to address the problem.[26]
Establish uniform processes	Bechtel uses its private cloud to establish common processes, applications and work flows for partners, employees and contractors working on projects.[27]
Free up management	Automatic Data Processing, a payroll services provider with over 500,000 customers, has placed its CRM environment and expense reporting system into the cloud. The rationale is to free up management from the burdens of managing a large system so it can focus on core competencies.[28]

Strategic reach: Using the cloud to win customers and enter markets

Helping a company expand and compete is among the greatest business benefits cloud computing provides Entrepreneurs certainly recognise the advantages of using cloud services when they launch, whether their company is a new consumer technology firm or a more traditional business. One example is a three-year-old children's apparel retailer with the unusual name "Peek...Aren't You Curious." Cloud services are providing Peek with the low-cost transaction management and other applications it needs to operate its eight stores and web site. Peek's founders say it allows them to devote their limited resources to other needs besides technology, knowing they won't have to rip and replace systems as the company grows.[29]
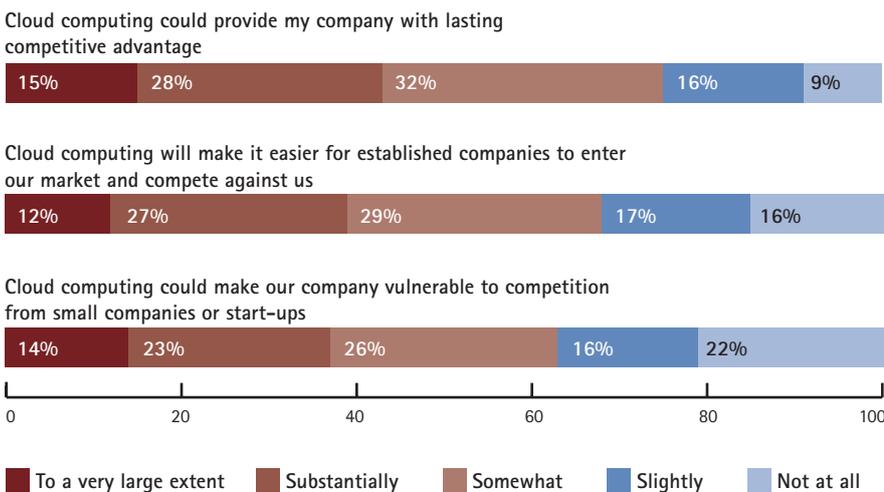
Our study found executives at large established organisations are also aware that cloud services can provide them with new ways to compete, as well as threaten them with new entrants like Peek. (See Figure 8.) These organisations are beginning to roll out new cloud-based products, services and features, often delivered though consumer devices such as smartphones and Apple's iPhone and iPad. And as Peek has done, only at a much larger scale, they are using back-end cloud-based systems to enable them to enter new regions and markets.

Delivering new products and services

Executives are enlisting cloud services in their push for product and service innovation. Sixty-one percent of executives say their organisation is pursuing clouds, at least in part, to develop products and services that were not feasible before. Platform services provide a means to quickly develop new systems, test how well they operate when the number of users or amount of data spikes, and then make new software services available to customers, internal users, and partners over the Internet. Forty percent say that clouds have great potential for their company as a tool for product and service innovation. We are already seeing new services that were previously unimaginable or impractical:

Financial services: Financial organisations are using the cloud to provide new financial information products that require speed, intense analytical capabilities and near-instantaneous scalability. NASDAQ, a pioneer in using the cloud to store market data, is launching a new "Data-on-Demand" service that will provide investors with quick access to historical data on stocks and funds, and allow clients to test their trading strategies.[30]

Media: The cloud is providing new delivery mechanisms for both video and traditional print publishers. Many organisations use YouTube to post training, marketing and product videos. Best Buy has partnered with Sonic Solutions to deliver newly released DVDs directly to consumers' television sets, Blu-ray players, personal computers or smartphones.[31] The Washington Post, Financial Times and other publishers are selling iPhone and iPad

Figure 8: Executives recognise the strategic potential of cloud computing
Nearly half state with confidence that clouds can provide competitive advantage

Please indicate the extent to which the leadership of your organisation who are knowledgeable about cloud computing agrees with the following statements:

Cloud computing could provide my company with lasting competitive advantage

| 15% | 28% | 32% | 16% | 9% |

Cloud computing will make it easier for established companies to enter our market and compete against us

| 12% | 27% | 29% | 17% | 16% |

Cloud computing could make our company vulnerable to competition from small companies or start-ups

| 14% | 23% | 26% | 16% | 22% |

0   20   40   60   80   100

■ To a very large extent ■ Substantially ■ Somewhat ■ Slightly ■ Not at all

apps—allowing users to consume content online from anywhere. Hewlett Packard has launched a print-on-demand cloud service called MagCloud that automates magazine publishing.[32]

Automotive: Car companies are hard at work developing new features that connect passengers, and even cars, directly to the consumer cloud. For example, Ford is experimenting with new ways for drivers to learn about delays and road conditions ahead of them from other motorists. One idea is to receive tweets from other drivers. Since it is unsafe for people to send messages while driving, Ford is investigating how the vehicles themselves can do it. In one trial application, called the "'Auto'matic Blog," Ford has added software to a car that enables it to generate data on its location, speed, braking and windscreen wiper use. The software then correlates the data with live information from the Web about traffic congestion and weather forecasts, and sends brief messages about road conditions via Twitter to other motorists in the area. [33]

High technology and communications: Executives in this sector recognise that cloud computing presents them with an extraordinary opportunity. Verizon, for example, is one of many telecoms that are offering new cloud services this year.[34] Cloud computing can also open the door for innovative, industry-specific offerings. Fujitsu is launching a service that will help local governments conduct safety checks on ageing bridges. The cloud service will allow governments to share digital images and other data obtained during bridge inspections with construction companies. These companies will then be able to quickly provide assessments of a bridge's condition, at lower cost to the government than traditional methods.[35]

Engaging with customers

The near-ubiquity of high-speed Internet, smartphones and personal computers gives businesses ample opportunities to reach customers through the consumer cloud. Organisations like the Indianapolis Motor Speedway are engaging fans with exciting live video feeds of races. Many companies are following Starbucks' early lead in connecting with consumers and franchisees on social networks. For example, Outback Steakhouse created a fan page on Facebook that granted the first 500,000 visitors a coupon for a free appetiser sent via email. Outback designed the application to run in a cloud environment so it could handle the sudden demand.[36]

Expanding to new markets

A third of executives – but more than half in Brazil and Singapore – expect clouds will be especially useful for helping their organisation expand into new markets. The speed, scale, cost and accessibility of cloud-based applications makes them a solution for providing back-office applications to growing businesses. Clouds are enabling expansion in at least four ways:

Small and medium enterprises: Multinational companies can use the cloud to provide affordable, accessible IT services to small and medium enterprises. GE Healthcare has launched a software service that allows small physician groups to manage the medical side of their practice: obtain and share data with other caregivers, access decision support tools and compile quality of care reports. The service also enables their patients to schedule appointments, request prescriptions and obtain their lab results.[37]

Adjacent markets: Xiwang, a Chinese food-processing company that supplies sugars, cornstarch and other grain-related products to food manufacturers, is using clouds to support its expansion into the consumer market without large upfront investments in IT. It is now using a cloud-based CRM solution that analyses customer data uploaded by employees in its stores, warehouses, distribution centres and delivery routes across China. Besides helping the company expand into new markets, the service has proven far less costly. It spends 60,000 to 80,000 RMB annually for the service, less than the cost of maintaining the in-house alternative.[38]

New acquisitions: Companies that grow by acquiring other firms must excel at integrating them into the fold. The faster they acquire, the harder it can be for IT to keep pace. Brady Corporation, a $1.3 billion manufacturer that has acquired 30 companies in recent years, found it took too long to replace, integrate and standardise systems with server-based software. Brady turned to CRM, human resources and collaboration software services to help it assimilate its acquisitions at the necessary speed.[39]

Expansion: MOTECH Automotive, a chain of automotive service centres in the Philippines, has used cloud services to help open two new physical branches. According to the company's president, the quick access to back-office systems means the company can now set up a new centre in only a few weeks, instead of the months needed previously.[40]

The lesson: a company need not be named Google, Microsoft, or Amazon to use cloud computing for competitive purposes. Large and small organisations can find ways to deploy the technology that will help them expand and attract business from rivals. Executives should expect their competitors to do the same.

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Cloud computing integrates a global supply chain for China Ocean Shipping Company

China Ocean Shipping (Group) Company (COSCO) is the world's second largest ocean shipping company, specialis ing in global shipping, modern logistics services, and ship building and repairing. The company owns or operates a fleet of more than 800 modern merchant vessels, which sail to over 1,500 ports in 160 countries and territories across the globe. The group includes more than 1,000 business subsidiaries in over 50 countries and territories around the world.

To support its employees, distributors, subsidiaries and customers, COSCO operates a logistics transport and shipping system. But as operations expanded, so did the number of users, from 4,000 to more than 10,000. The company's servers, scattered through- out China, were not able to handle the rapid increase of users and data processing. Instead of adding servers, top management has decided to make better use of the computing resources it already had.

COSCO has turned to virtualisation to integrate its data processing capabilities. With virtualisation, people throughout the supply chain draw on a cluster of servers dispersed in the network. This architecture makes more efficient use of its servers, thereby reducing energy consumption, while adding additional server capacity automatically when needed.

Having virtualised many of its servers, one COSCO unit is now looking to use them to support a cloud computing service. In 2009, COSCO Logistics Network Information Technology Co., Ltd, the arm of COSCO that provides IT services inside the group and to other companies, began to re-establish its supply chain management system upon a cloud computing architecture. "Our goal is to provide SaaS service to all our customers, subsidiaries and distributors. This will allow them to avoid the huge investment and risk of establishing and maintaining their own logistics management software," said Huang Dalei, the senior consultant of COSCO Logistics Network.

This service will reside on an enterprise private cloud that will be built within the group. It will include shipping, transportation, order management, billing and payment applications that will improve business processes and take COSCO's customer service to a

higher level. All these applications will be integrated through the use of a services-oriented architecture, a way of designing systems that makes it easier to share data and information. Security is ensured through the system's identity management capabilities, including member log-in and access management. "We have a confidenti- ality agreement in the contract with COSCO, specifying rigorous rules on data safety," Huang said. "We can't afford to accidentally release data to the wrong employees." He added that there has been no record of data exposure in past years.

The transformation of COSCO's supply chain systems into a set of software services is still in the trial stage, but Huang expects they will complete the move within a year.

Security: Responding to cloud risks

Executives who want to succeed at cloud computing must be able to manage its risks as well as spot its opportunities. Leaders worldwide appear well aware of these issues. Roughly three-quarters or more expressed concern about each of the 15 risks assessed. (See Figure 9.) These range from legal and technical issues to concerns about vendor lock-in and internal resistance. As we expected, security was the top issue. But the surprising finding from our research is how inconsistent and moderate its impact has been. The severity of concern over security fluctuates from country to country, and has had a limited impact on adoption.
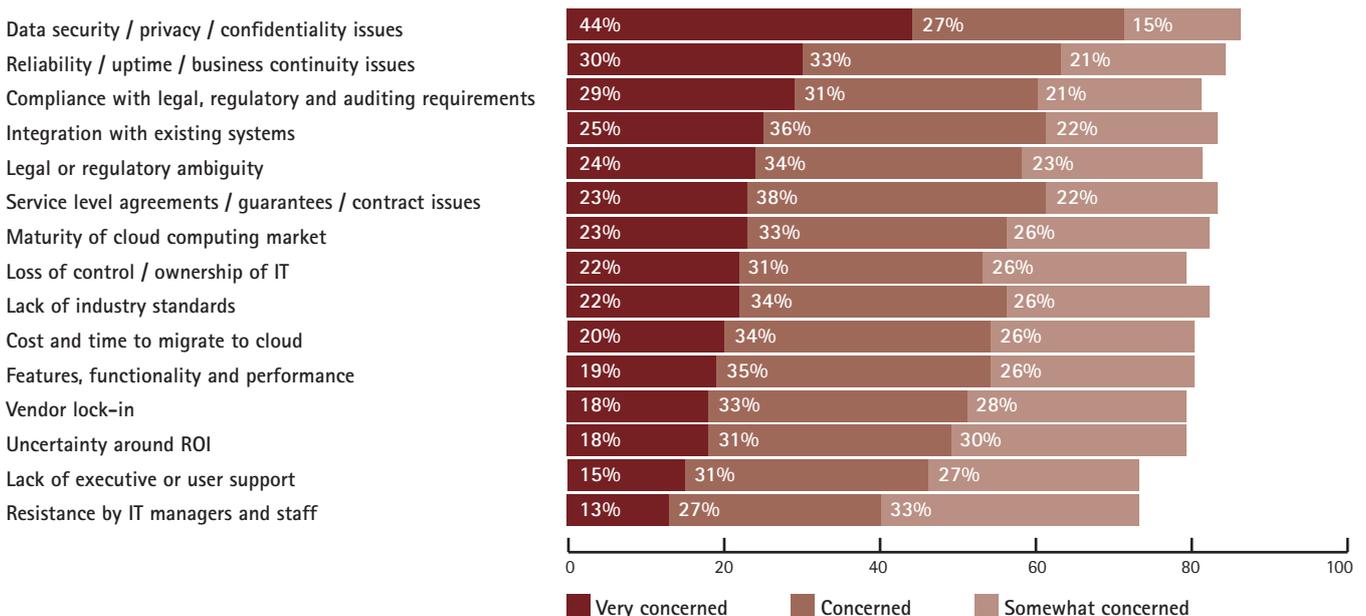
A German executive noted, "Here, security is the alpha and omega— serious mistakes can cause a quick end to your company." Executives, particularly those in the health and public services sector, are especially concerned about data security, privacy and confidentiality issues. Security concerns have caused some organisations, such as the Los Angeles city government, to suspend or postpone planned implementations of cloud-based email.[41] Other technical concerns include the integration of cloud computing technology with existing systems, and a lack of industry standards on cloud computing. "Whether cloud computing can work reliably, fast and flexibly is still hard to know. Cloud computing is still in its infancy," said Zhu Dong, director of the

information and technology department, China National Aero-Technology Import & Export Corporation.[42]

A lower percentage of executives, but still a majority, are concerned about the features, functionality and performance of cloud services. The sticking point is control and integration of data, rather than the actual features of the service. "The ability to migrate one's data from a cloud provider, such as Salesforce.com, either back to one's own or another provider's infrastructure is very important," said one UK executive. "One must have guaranteed access for migration to all data." Service level agreements—more precisely,

Figure 9: Security, reliability, and legal issues top list of concerns
But executives are also concerned about technical, vendor and contractual matters.

Please rate how concerned your organisation is about the following issues when it comes to using public cloud services:

Issue	Very concerned	Concerned	Somewhat concerned
Data security / privacy / confidentiality issues	44%	27%	15%
Reliability / uptime / business continuity issues	30%	33%	21%
Compliance with legal, regulatory and auditing requirements	29%	31%	21%
Integration with existing systems	25%	36%	22%
Legal or regulatory ambiguity	24%	34%	23%
Service level agreements / guarantees / contract issues	23%	38%	22%
Maturity of cloud computing market	23%	33%	26%
Loss of control / ownership of IT	22%	31%	26%
Lack of industry standards	22%	34%	26%
Cost and time to migrate to cloud	20%	34%	26%
Features, functionality and performance	19%	35%	26%
Vendor lock-in	18%	33%	28%
Uncertainty around ROI	18%	31%	30%
Lack of executive or user support	15%	31%	27%
Resistance by IT managers and staff	13%	27%	33%

the lack of adequate service level guarantees and clear provisions over where data is located—are also an area of concern for three out of five executives.

These data security and control concerns have made executives less willing to use start-ups or foreign providers of cloud services. Only about 30 percent are likely to use start-ups, while about twice as many are willing to use cloud services from the vendors they already use. And nearly half are unwilling to use foreign cloud providers that do not have data centres in their home country.

These risks help to explain why adoption of cloud computing for critical applications will grow to only 25 percent, on average, in the next two years. However,

our study has revealed other important—and surprising—findings about attitudes toward security and vendors:

Data security concerns have a modest impact on cloud use. There is little difference in cloud usage today between companies with higher and lower levels of cloud security concerns. The percentage using software services is the same, whether executives show a relatively high or low degree of concern. For infrastructure services, the difference is just six percentage points (45 percent modest or low concern, 39 percent among those who express more concern). Security concerns are not the main factor preventing companies from using clouds, and are a poor predictor of cloud adoption in the future. UK and American executives tend to be more concerned about cloud security than most others, yet they expect

to dramatically scale up the use of Infrastructure as a Service (IaaS) for critical applications over the next two years: by 365 percent total in the United Kingdom, and 240 percent in the United States.

Companies are being careful about what data they entrust to public clouds. However, executives should not think that security worries will keep their rivals from exploiting cloud technology and services. In fact, they would be misguided to use security as an excuse for not pressing forward with clouds.

Countries are not equally worried about cloud security. German executives were more knowledgeable about cloud computing than any others. Yet the level of concern over security is lowest in Germany—just 13 percent of executives said they were very con-

Figure 10: Security and privacy concerns are not equally shared
While half of UK, Chinese and American respondents are "very concerned," German and Brazilian executives are less fearful.

Please rate how concerned your organisation is about data security, privacy or confidentiality issues when it comes to using public cloud services:
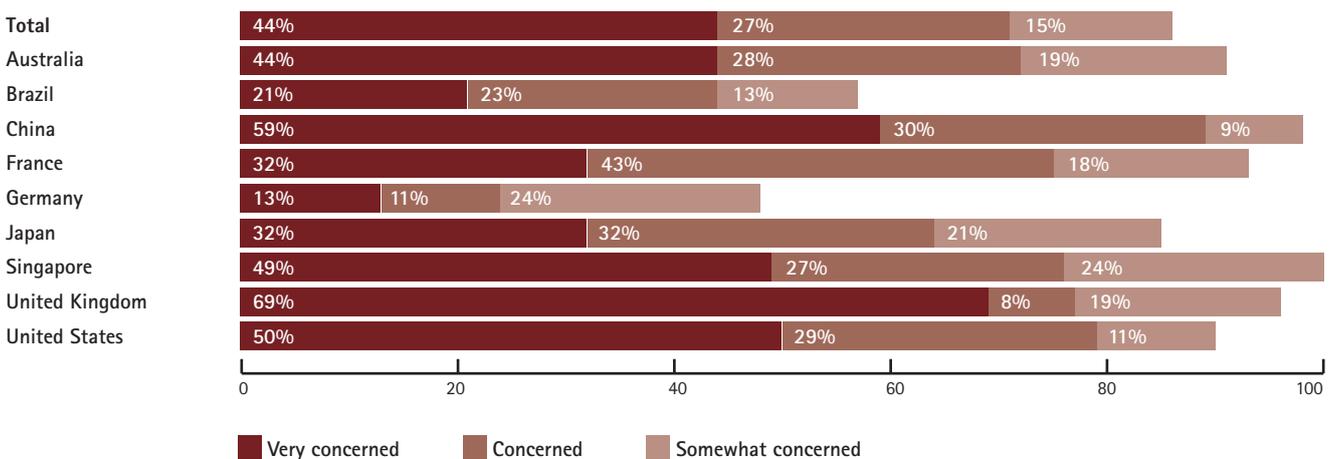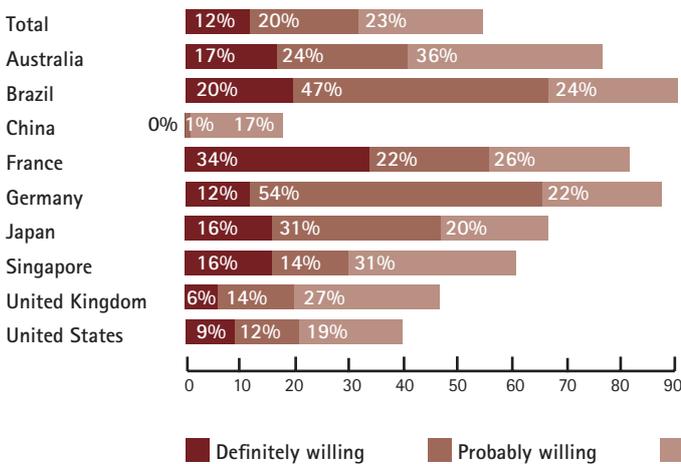
cerned about cloud security, compared to 44 percent worldwide. (See Figure 10.) On the other hand, security is a much greater concern in the United States and United Kingdom, and extraordinarily high in China. Executives at Chinese enterprises—many of which are partially or entirely state-owned—view the possibility of losing confidential data as a national security risk. As with security risks, companies also vary by location in their willingness to use foreign cloud providers. Most companies in China, the United States and the United Kingdom are unwilling to entrust their data to cloud providers that use data centres outside their borders. (See Figure 11.) Other countries—especially Brazil, France and

Germany—are more willing to consider using cloud services from foreign firms. Executives in multinational organisations must be aware not just of local laws, but local attitudes. They should not assume others are as anxious, or calm, about cloud security as they are. (For more on the differences between countries, and what it means for executives and government leaders, see "Clouds, countries and competitiveness.")
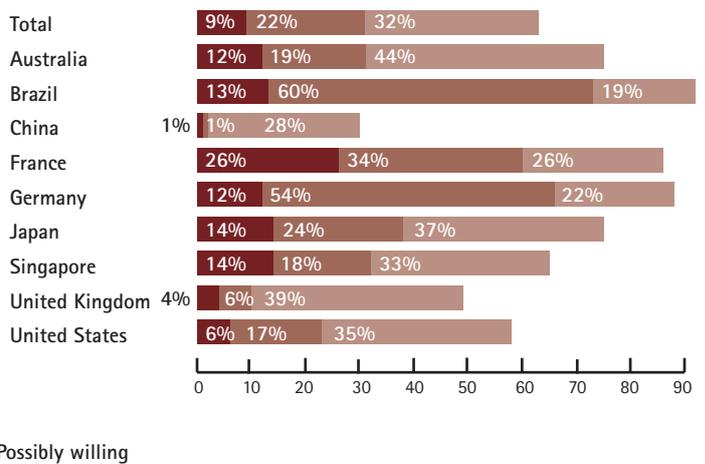
Figure 11: Most organisations are willing to use start-up cloud providers and foreign cloud providers
Organisations in China, and to a lesser extent the United Kingdom and the United States, tend to be reluctant.

To what extent are you willing to obtain cloud services from foreign providers with data centres outside your country?

	Definitely willing	Probably willing	Possibly willing
Total	12%	20%	23%
Australia	17%	24%	36%
Brazil	20%	47%	24%
China	0%	1%	17%
France	34%	22%	26%
Germany	12%	54%	22%
Japan	16%	31%	20%
Singapore	16%	14%	31%
United Kingdom	6%	14%	27%
United States	9%	12%	19%

To what extent is your organisation willing to obtain cloud computing services from start-up companies?

	Definitely willing	Probably willing	Possibly willing
Total	9%	22%	32%
Australia	12%	19%	44%
Brazil	13%	60%	19%
China	1%	1%	28%
France	26%	34%	26%
Germany	12%	54%	22%
Japan	14%	24%	37%
Singapore	14%	18%	33%
United Kingdom	4%	6%	39%
United States	6%	17%	35%

■ Definitely willing   ■ Probably willing   ■ Possibly willing

Leadership: Turning potential to impact

In business, success always requires commitment, planning and careful execution; success with cloud computing is no different. Business and IT executives must lead if their organisations are to convert the technology's potential benefits into actual business value and competitive impact. (See Figure 12.)

Business executives

Ask hard questions and demand data-based analyses regarding cost savings. Senior executives should perform a comparative ROI analysis with their CIO that distinguishes the differences

in cost structure between different kinds of clouds, considers costs over the entire life cycle of a system or service (including conversion, ongoing and termination costs), and compares cloud-based systems to both conventional systems and outsourcing. The analysis should also account for the labour costs that remain after adopting clouds, and whether it is possible to reduce the costs of using conventional systems by re-purposing old equipment. They should also run experiments or pilots to test their assumptions on costs and savings.

Establish a clear governance structure for cloud computing. Many organisations have rules and structures in place that govern how IT decisions are shared between IT executives and

other executives. Business executives should use these structures to decide who inside and outside the IT organi-sation should be engaged in decisions on cloud computing, and what deci-sion-making rights and responsibilities they have.

Keep cloud efforts on track. The organisation's leaders must ensure cloud computing receives the focused thinking, planning and follow-up it requires. They should identify and address immediate business needs and longer-term opportunities for clouds, develop a plan for using public and private clouds, and track the impact

Figure 12: Top 10 ways to speed up cloud computing adoption

To what extent would the following factors speed up your organisation's adoption of cloud computing?

Factor	Greatly	Somewhat	No impact
Evidence cloud computing significantly lowers business or IT costs	37%	48%	15%
Evidence cloud computing provides important benefits besides lower costs	28%	59%	13%
Stronger guarantees or protections in contracts and service level agreements	27%	54%	19%
Stronger executive support for cloud computing initiatives	27%	52%	21%
Establishment of standards for cloud-related technologies	26%	56%	18%
Adoption by leading companies in your industry	25%	50%	25%
Creation of industry clouds (a cloud built by a consortium of companies in an industry)	25%	49%	26%
Better understanding by executives of what is cloud computing	24%	53%	23%
Effective governance practices for making decisions on cloud computing	24%	52%	24%
Growing availability of cloud services from well-known IT vendors and service providers	24%	54%	22%
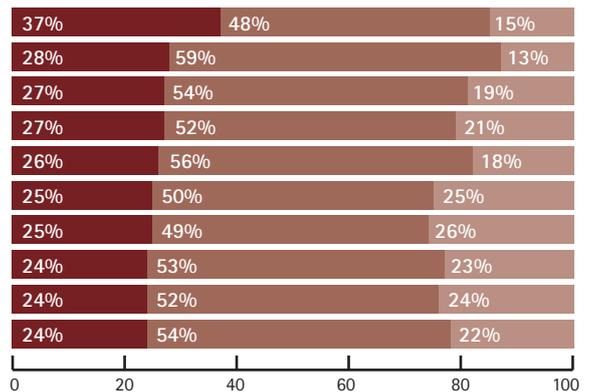
■ Greatly speed up adoption ■ Somewhat speed up adoption ■ Have no impact on adoption

of clouds on their industry. Business leaders must also set the standards for success, determining which quantitative and qualitative benefits are sought, including skills developed, partnerships established and risks addressed.

Buy cautiously, appraise frequently. It's too early to predict who the major cloud providers will be down the road. So when selecting cloud providers, business leaders must carefully consider whether they have the potential to be desirable partners in the future. Once selected, they should be evaluated regularly on their financial stability, as well as their ability to improve functionality and service levels, to integrate data across technology platforms and cloud services, and to deliver on their promises.

Broaden the cloud strategy team to include non–IT specialists. Widening the membership of the cloud computing team beyond IT people is critical to getting a broader range of perspectives on what consumer and business cloud computing can do for you or to you. Experts on consumer technology, consumer needs and opportunities, experts on data privacy and transfer laws, and managers adept at fostering innovation can make valuable contributions. Organisations may also benefit from a community of practice or a cloud programme office to develop the skills and share the experiences of people engaged in cloud projects.

Engage in the regulatory and industrial policy process. Cloud computing will inevitably be subject to regulation and industrial policy. Consumers and businesses alike want governments to take actions that will

mitigate the risks of cloud computing. (See "Clouds, countries and competitiveness," below.) We can also expect governments to take steps to modernise their IT and telecommunications infrastructure, and support the use of IT for local economic development. Executives should help educate lawmakers and regulators in order to shape and support regulations that will help improve cloud security and reliability within a clear, consistent legal environment.

IT executives

Become experts on cloud computing, its requirements and benefits. Companies further along in adopting cloud computing tend to have executives who have advanced—or expert-level knowledge of it. More than 50 percent of

Figure 13: Getting ready for cloud computing
Organisations that adopt new technologies quickly, have effective IT practices, and possess virtualisation and outsourcing experience put cloud computing to work more quickly.

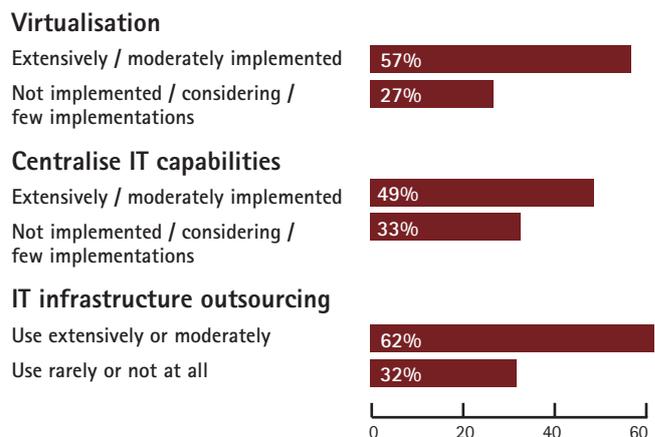**Which best describes your organisation's approach to adopting information technology?**

Early adopters / fast followers	53%
Average / late adopters	22%

0   20   40   60
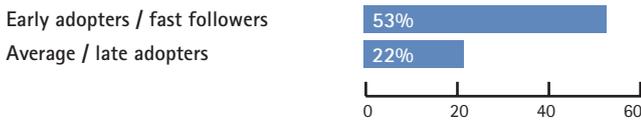
Overall, how effectively do your organisation's IT capabilities meet its business needs?

Extremely / very effective	50%
Somewhat / slightly / not effective	32%

0   20   40   60

Average use of private cloud platforms and software, infrastructure, process and platform services.

To what extent has your organisation implemented or carried out the following activities?

Virtualisation

Extensively / moderately implemented	57%
Not implemented / considering / few implementations	27%

Centralise IT capabilities

Extensively / moderately implemented	49%
Not implemented / considering / few implementations	33%

IT infrastructure outsourcing

Use extensively or moderately	62%
Use rarely or not at all	32%

0   20   40   60

executives with advanced knowledge of clouds are using them for critical or less important applications, compared to the roughly 30 percent of executives without that basic knowledge.

Master the facts necessary to win executive support. CIOs need to educate senior executives on cloud computing. They can start by presenting evidence that cloud computing significantly lowers business or IT costs, and provide examples of cloud computing use by leading companies. To win support, they should prepare an ROI analysis, keeping in mind that the costs and returns from cloud computing will rapidly change as the market matures.

Prepare your organisation and technology infrastructure for cloud computing. Server and storage virtualisation is a requirement for companies building private and hybrid clouds. Organisations that have not extensively implemented virtualisation are far behind in using the technology. (See Figure 13.) Our study found other common characteristics among organisations that have already adopted cloud computing: They are quicker to adopt new technologies and tend to have effective IT organisations, so they are both more willing and capable of moving ahead with new technologies. These firms also tend to have outsourcing experience and the knowledge of how to manage service providers that goes with it. CIOs must also develop a plan to address data integration, security, networking and other technical issues. They should add IT architects to their staff that have

or can master the details and requirements of the technology, and put them to work developing a transition plan from conventional to cloud computing.

Continually explore the business potential of cloud computing. IT leaders should continually seek and develop innovative new services, and uncover how cloud computing can be used to improve and even transform how business is conducted. They must watch how other organisations are using cloud computing, conduct experiments with the technology, and track potential futures and scenarios for cloud computing use. (See Figure 14.)

Figure 14: Recommendations for moving forward with cloud computing

Business executives	**Analyse:** Conduct a careful analysis of costs, savings and benefits. **Assign:** Decide who should be involved in cloud computing decisions, and what their responsibilities are. **Lead:** Make sure cloud computing receives focused thinking, planning and follow-through from IT and business executives. **Choose:** Carefully select and evaluate cloud providers. **Diversify:** Include non-IT specialists in your cloud strategy. **Engage:** Educate officials involved in regulations and industrial policy.
IT executives	**Learn:** Become experts on cloud computing, its requirements and benefits. **Influence:** Win executive support by presenting evidence about cloud benefits and ROI. **Prepare:** Get your organisation and technology infrastructure ready for cloud computing. **Innovate:** Seek out and develop innovative ways to use clouds.
Government leaders	**Improve:** Increase the speed and availability of the broadband infrastructure. **Regulate:** Establish clear guidelines and standards for cloud security, privacy and certification. **Support:** Establish local cloud computing centres and partnerships. **Use:** Set an example for industry by using cloud services in government.

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Clouds, countries and competitiveness

Business leaders in certain countries are primed to compete using cloud computing. But policymakers must act to ensure widespread adoption.

We have noted elsewhere a few of the country variances that turned up in our data: the uneven adoption of cloud computing around the world, China's special sensitivity to cloud security, and the greater interest in France, Germany and Singapore in using cloud computing to improve decision making. Our study has spotted other important country differences that matter to the future of cloud computing.

The leading names in the cloud computing industry are American firms, yet U.S. organisations have been slower to adopt clouds than most other countries. American users are catching up, but will only be slightly above average in two years. We expect to see a higher rate of implementation in Germany and especially Brazil, where 76 percent of our sample will use cloud computing within two years.

Brazilian, French, German and Singaporean executives appear particularly alert to the competitive uses of cloud computing. They are more likely to view cloud computing as a potential competitive threat than their peers in other countries. In addition, a high percentage of executives from these countries think it will be important for their country's economic competitiveness. Singaporean organisations also stand out for using clouds for more purposes than other countries. Singapore ranked first for half of the uses we inquired about.

So while Chinese firms are likely to move cautiously into the cloud computing era, at least until a strong domestic industry is created, companies in Germany, Brazil and Singapore appear primed to start competing using cloud computing. The next innovative cloud-based analytical application could well come out of Stuttgart or Singapore; vulnerable American companies could find themselves competing against cloud-enabled Brazilian upstarts. Any foreign company competing in these countries must be especially alert to how local firms apply cloud services.

Besides executive attitudes, government policies will determine how rapidly cloud computing is adopted in each country. Among the steps government leaders should take to aid the adoption of cloud computing and establish a local cloud computing industry:

Improve the broadband infrastructure: The cloud services industry, its customers and consumers all require reliable and accessible high-speed Internet. Governments should take steps to provide their country with a world-class IT infrastructure, including direct investment if necessary. For example, South Korea's Communications Commission is aiming for Korean firms to capture 10 percent of the global cloud services market by 2014. To achieve this goal, the Commission is investing $500 million in cloud computing infrastructure for the use of South Korea's communications and high-tech industry and government. The Commission is also boosting broadband speeds to one gigabyte per second and wireless broadband to ten megabytes per second. South Korea expects these steps will create 120,000 new jobs.[43]

Develop regulations and guidelines to improve cloud security, reliability and business practices. Executives, especially where the state plays a strong role in guiding the economy, say governments should establish cloud security, data privacy and

Figure 15: Business executives say government regulation and engagement is necessary to ensure cloud adoption...

What next steps should governments take if cloud computing is to be widely adopted?

	Necessary	Helpful	Not needed at all
Establish cloud security and data privacy standards	56%	39%	5%
Establish technical standards for clouds	50%	41%	9%
Certify cloud service providers	47%	42%	11%
Establish and enforce minimum requirements on uptime, recovery time, etc	44%	44%	12%
Collaborate with other governments and reduce the complexity of compliance requirements	35%	56%	9%
Provide incentives for replacing existing systems with cloud-based systems	31%	55%	14%
Offer an accessible national cloud (built by the government for use by companies and agencies)	30%	55%	15%
Subsidise cloud infrastructure build-out	30%	54%	16%
Loosen restrictions on customer or employee data crossing borders	30%	53%	18%
Provide free access to broadband Internet	29%	55%	16%

■ Necessary ■ Helpful ■ Not needed at all
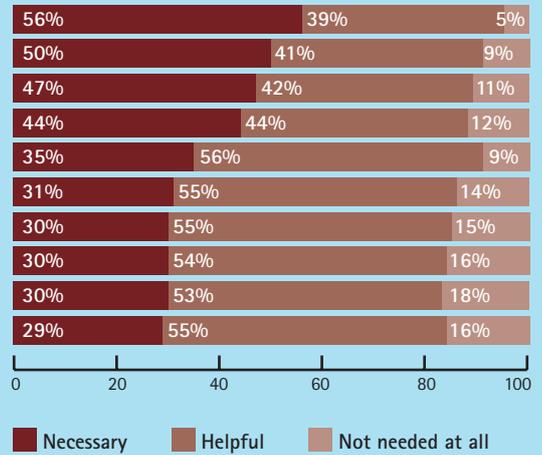
...even in free-market oriented economies like the United Kingdom and the United States.

Steps considered necessary, by country

■ Establish cloud security/privacy standards
■ Establish technical standards for clouds
■ Certify cloud service providers
■ Establish/enforce minimum requirements
■ Collaborate to simplify compliance requirements

■ Provide incentives for replacing systems
■ Offer a national cloud
■ Subsidise cloud infrastructure build-out
■ Loosen restrictions on data crossing borders
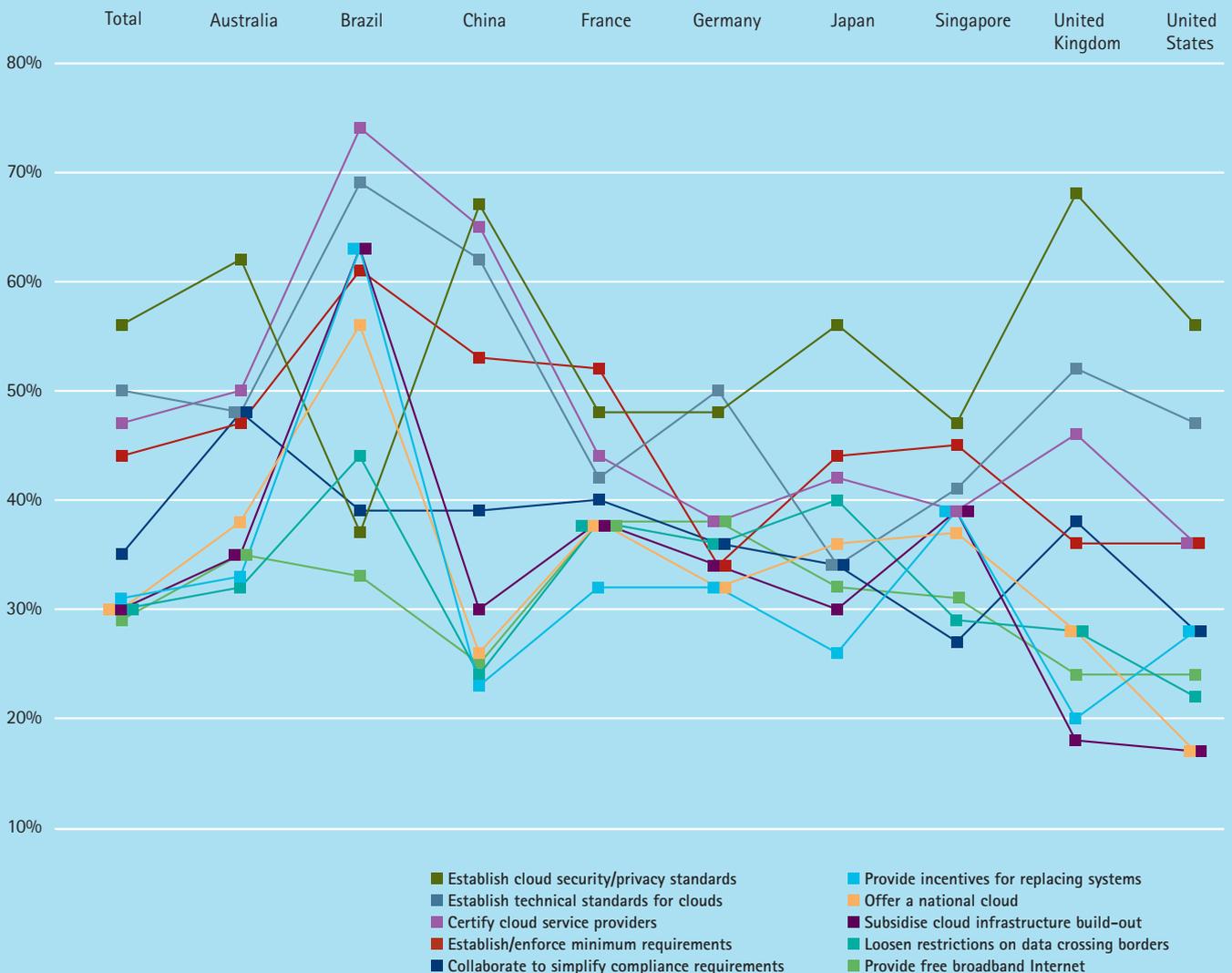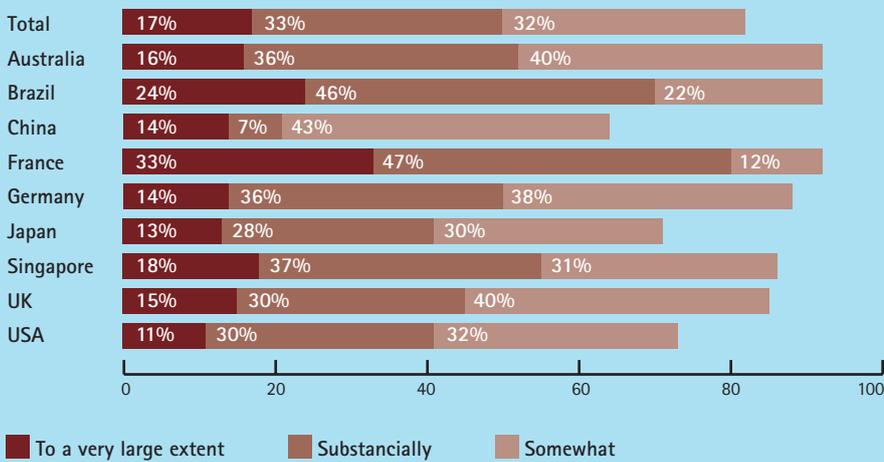■ Provide free broadband Internet

Figure 16: Cloud computing is considered important for national competitiveness, especially in Brazil and France

How important is cloud computing to your country's future economic competitiveness?

	To a very large extent	Substancially	Somewhat
Total	17%	33%	32%
Australia	16%	36%	40%
Brazil	24%	46%	22%
China	14%	7%	43%
France	33%	47%	12%
Germany	14%	36%	38%
Japan	13%	28%	30%
Singapore	18%	37%	31%
UK	15%	30%	40%
USA	11%	30%	32%

■ To a very large extent ■ Substancially ■ Somewhat

technical standards, and support the certification of cloud service providers. (See Figure 15.) Such steps, which should be done in close consultation with the IT industry, cloud users and international standards bodies, will clarify the rules by which organisations must operate and enable them to move forward. The startling differences in the rate of adoption and anxiety over cloud security between Germany and China are in part due to the presence of clear privacy and security regulations in Germany and the lack of them in China. Subsidies, incentives and the establishment of government clouds may also be helpful, but most executives do not consider that to be necessary.

Support local cloud computing centres: Forward-thinking governments are offering cloud services to local businesses, supporting the establishment of a local cloud industry, and upgrading their country's IT infrastructure. The government of Singapore is working with a consortium of companies, including Accenture, to create a cloud-based data centre hub to serve businesses.[44] Local governments can also take action. In China, local development agencies and municipalities have worked with foreign and domestic high-tech firms to set up local cloud computing training and service centres. Similarly, the state of Michigan is preparing to launch public-sector clouds. Besides serving local agencies and schools, this initiative will allow businesses to host and store applications in its cloud.[45]

Set an example by using cloud computing: Local and national government bodies can boost confidence in the security and viability of the technology by adopting it. For example, the U.S. federal government is providing cloud-based services to federal agencies via Apps.gov, where they can buy cloud computing applications and services, including productivity software and social media applications which meet government security standards.

Worldwide, about half of executives believe that cloud computing is important to their country's future economic competitiveness. (See Figure 16.) If they are right, governments that help to minimise the risks of cloud computing will also be helping their economies grow in the 21st century.

Transforming the future of business

An important question has yet to be answered: How will cloud computing transform how businesses compete, operate and manage IT?

Few executives have begun to consider this question. While many believe the technology is capable of providing competitive advantage, only 13 percent of executives indicated that clouds will transform industries. (See Figure 17.) That is entirely understandable. It will take years for the full impact of this new technology to become clear, and issues like integration and security to be worked through. Besides, other technologies have been lauded as transformative before, only to disappear from the scene. Perhaps the real surprise is that just nine percent of executives think cloud computing is only a fad.

However, there are sound reasons to suggest that cloud computing will, in time, usher in new ways of conducting business that will disrupt old business models:

Cloud computing is a major architectural shift in enterprise computing, similar to the shift from mainframes to departmental minicomputers, client/server (which made PCs part of enterprise computing), and network computing (which made powerful applications and data integration possible). Each previous phase unleashed a new wave of applications and capabilities. This next phase is likely to be a greater one, because it supports not just PCs but mobile phone apps, and connects both devices to far more processing power than previously available.

Organisations will be able to rapidly implement these powerful tools once they are satisfied they can manage the risks. Cloud applications, once developed and running, can be implemented, replicated and upgraded quickly. That means new advances and innovations can be put to work more rapidly than with previous generations of software.
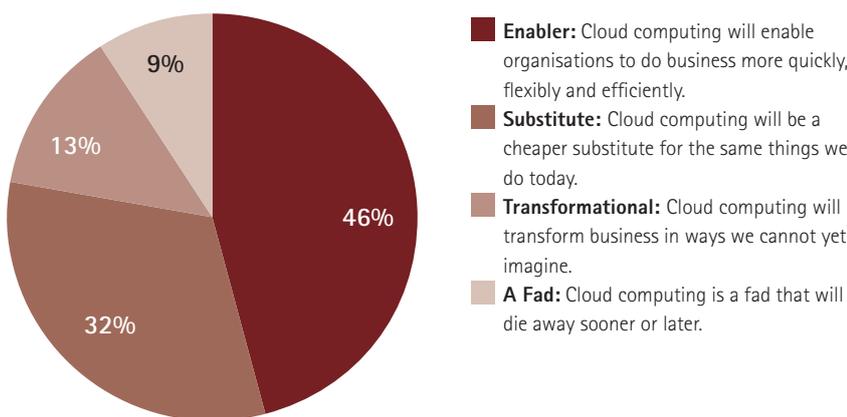
The consumer cloud of Google, Facebook, Baidu and Twitter is changing everyday behaviour and spurring rapid technological innovation. Private clouds, which usually have no more than 5,000 to 10,000 servers, cannot match the sheer power of public clouds. Google alone is estimated to have over a million servers, and is preparing to manage up to 10 million servers.[46] These enormous clouds will introduce capabilities that were impossible before. For example, Google and Yahoo's Babel Fish are bringing us close to the day when simultaneous translation between speakers of different languages is possible. How businesses around the world will use and be changed by these new capabilities will be among the most important developments in coming years.

Strategists shouldn't limit their interest in cloud computing to saving money and process improvement. The technology is too powerful and widely available now that the implementation phase in computing has begun. It is time to look for ways in which clouds can transform business and entire industries, develop the management and technical skills cloud computing requires, and take advantage of the opportunity.

Figure 17: Few executives see cloud computing as a transformational force in business
Most see clouds' main benefit as a way to improve business processes and tasks.

In your opinion, which best describes the long-term impact of cloud computing?

Enabler: Cloud computing will enable organisations to do business more quickly, flexibly and efficiently.

Substitute: Cloud computing will be a cheaper substitute for the same things we do today.

Transformational: Cloud computing will transform business in ways we cannot yet imagine.

A Fad: Cloud computing is a fad that will die away sooner or later.
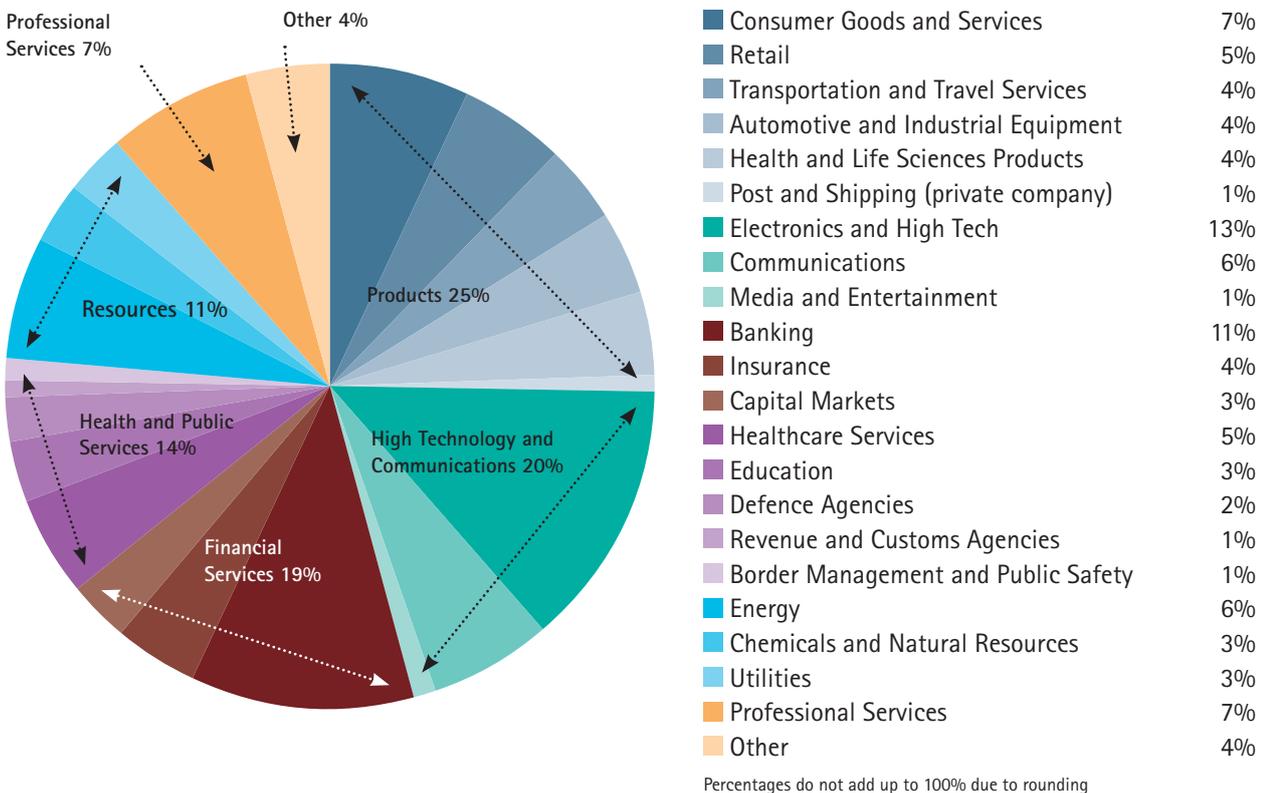
Appendix:
Industry use of cloud computing

Each industry has its own motivations for adopting cloud computing. Here is a closer look at some of how five major industry sectors are approaching the technology.

High technology and communications

Ninety-four percent of organisations in the high technology and communications (HT&C) sector are using or experimenting with some form of cloud computing, especially private clouds. They show above-average interest in using the technology to develop and provide their own cloud services to clients. But IT firms are often burdened with large IT infrastructures, and that has led this sector to be the one most interested in using cloud technology to reduce up-front costs and the costs of maintaining IT infrastructure. Sixty-one percent of these companies cite

savings as the technology's greatest potential benefit to their company in the long term. HT&C companies are also exploiting the versatility of the technology, putting it to many different uses. They include data backup (47 percent); providing a platform for processes involving multiple organisations (47 percent); running CRM, ERP or supply chain applications (42 percent); developing and testing software (39 percent); and improving employee productivity (38 percent).

Figure 18: Respondents, by industry

Consumer Goods and Services	7%
Retail	5%
Transportation and Travel Services	4%
Automotive and Industrial Equipment	4%
Health and Life Sciences Products	4%
Post and Shipping (private company)	1%
Electronics and High Tech	13%
Communications	6%
Media and Entertainment	1%
Banking	11%
Insurance	4%
Capital Markets	3%
Healthcare Services	5%
Education	3%
Defence Agencies	2%
Revenue and Customs Agencies	1%
Border Management and Public Safety	1%
Energy	6%
Chemicals and Natural Resources	3%
Utilities	3%
Professional Services	7%
Other	4%

Percentages do not add up to 100% due to rounding

Financial Services

No industry is adopting cloud computing faster than the financial services industry. Bankers and brokers have been quick to see how the technology can increase revenues by enabling new financial products and services. Financial service firms are also the ones most eager to use clouds for analytics (72 percent), and to use clouds to meet spikes in demand on web sites or internal systems over the next 18 months (34 percent)—a must for days when trading volumes or credit card purchases soar. Executives in this sector express keen interest in the technology's potential to improve their operations. Seventy-five percent say clouds can provide platforms for standardised, efficient business processes; 72 percent say clouds enable processes that are not otherwise cost-effective or feasible. Financial services firms are also the ones that most frequently use cloud computing to improve employee productivity, at 47 percent.

Health and Public Services

Nearly 83 percent of health and public services organisations currently use cloud computing. Government entities have huge quantities of data to manage and analyse, for everything from economic forecasting to crime prevention and tax collection. Many governments also run their country's healthcare. As such, the top three uses for cloud all support data storage and analysis: backing up data (47 percent), storing and archiving large files (41 percent), and analysing data for research and development (38 percent). However, the sector is also the most mindful of data security, privacy and confidentiality issues, with 78 percent of executives concerned or very concerned about this issue. These organisations see cloud computing's potential to improve collaboration (66 percent citing it as important) and enabling new processes (65 percent). Over a third of these organisations plan on using cloud platforms to connect multiple organisations (37 percent).

Products

Products firms—retailers, consumer and industrial goods manufacturers—are not fast adopters, but they are looking to clouds to support future innovation and a number of core business needs. The top two uses for clouds among products firms are providing a platform to work with other organisations (43 percent) and running CRM, ERP or supply chain management applications (41 percent). The products sector is the one most likely to use cloud computing for analysing customer, operations and R&D data; four in ten products companies see improved decision making as the greatest potential for cloud computing in the next five years. They are also most likely to use clouds to run web sites—which increasingly involve social media and mobile apps—with 40 percent of companies planning to do so in the next 18 months. In the long run, businesses in this sector most often cite product and service innovation as cloud's greatest potential for their organisation, at 45 percent.

Resources

Utilities, energy, chemicals and natural resource companies are the least likely to use cloud services, and spend a lower portion of their IT budget on clouds. Nevertheless, to the extent they use it, resources firms are deploying cloud computing to create flexible, scalable IT infrastructure. The top two uses of cloud in this industry are providing IT platforms for processes involving multiple organisations (42 percent) and running supply chain, ERP or CRM management applications (40 percent). They are also using cloud services to manage the large amounts of data generated in the course of their operations. The top benefit sought when deciding to use cloud computing is reducing or avoiding the costs of maintaining IT infrastructure (73 percent). Developing new or improved services and products more quickly (69 percent), and developing products or services that were not feasible before (66 percent) are the second and third most sought benefits.

About the research

The report draws upon an 18 month research effort by the Accenture Institute for High Performance. It is based on original survey research, conversations with more than 40 executives and experts both in and outside of Accenture, and a thorough review of articles, studies and blog postings published by academic, business and technology journals, web sites, and research organisations.

The data in the report comes from the Accenture Institute for High Performance's Global Cloud Computing Survey. The Institute surveyed 669 IT executives and other senior executive

decision makers, including 201 in the United States, 103 in China, 60 in Australia, 54 in Brazil, 51 in Singapore, and 50 each in France, Germany, Japan and the United Kingdom. The executives came from 23 different industries as well as government and nonprofit sectors, primarily from organisations with revenues of $1.5 billion or higher. (A total of 59 organisations with revenues below $1.5 billion were included in Australia, Brazil, China and Singapore.) The survey was conducted in October and November of 2009.

Respondents were screened and invited to participate by email and telephone, then completed the survey on a secure web site. They were only included in the final tally if they were

involved in their organisation's use or exploration of cloud computing, and had at least a basic knowledge of cloud computing.

Within China, the survey was conducted as a collaboration between the Accenture Institute for High Performance and the Chinese Institute of Electronics' Cloud Computing Expert Committee (CIE), an academic and nonprofit organisation affiliated with the Chinese Ministry of Industry and Information Technology. The results in China were published in May 2010 in a report entitled "China's Pragmatic Path to Cloud Computing."
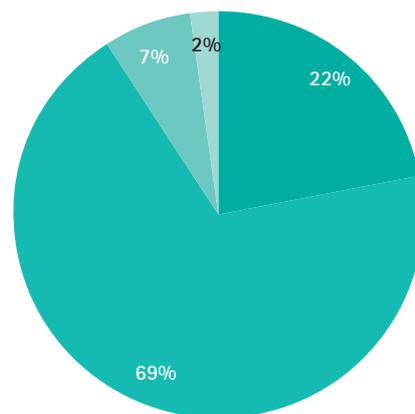
Figure 19: Global survey respondents

By job title

By revenues
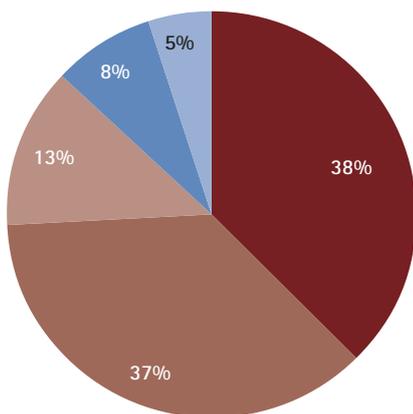
By job title
- Head of IT (including CIO)
- IT executive
- Chief IT architect or strategist
- CFO, COO or CSO
- Chairman, president or CEO

By revenues
- $10 billion or more
- $1.5 billion – $9.9 billion
- $500 million – $1.49 billion
- below $500 million

- IT
- Non-IT

Percentages do not add up to 100% due to rounding

About the authors

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Accenture is a global management consulting, technology services and outsourcing company, with approximately 204,000 people serving clients in more than 120 countries. Combining unparalleled experience, comprehensive capabilities across all industries and business functions, and extensive research on the world's most successful companies, Accenture collaborates with clients to help them become high-performance businesses and governments. The company generated net revenues of US$21.6 billion for the fiscal year ended August 31, 2010. Its home page is www.accenture.com.

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The Accenture Institute of High Performance creates strategic insights into key management issues and macroeconomic and political trends through original research and analysis. Its management researchers combine world-class reputations with Accenture's extensive consulting, technology and outsourcing experience to conduct innovative research and analysis into how organisations become and remain high-performance businesses.

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