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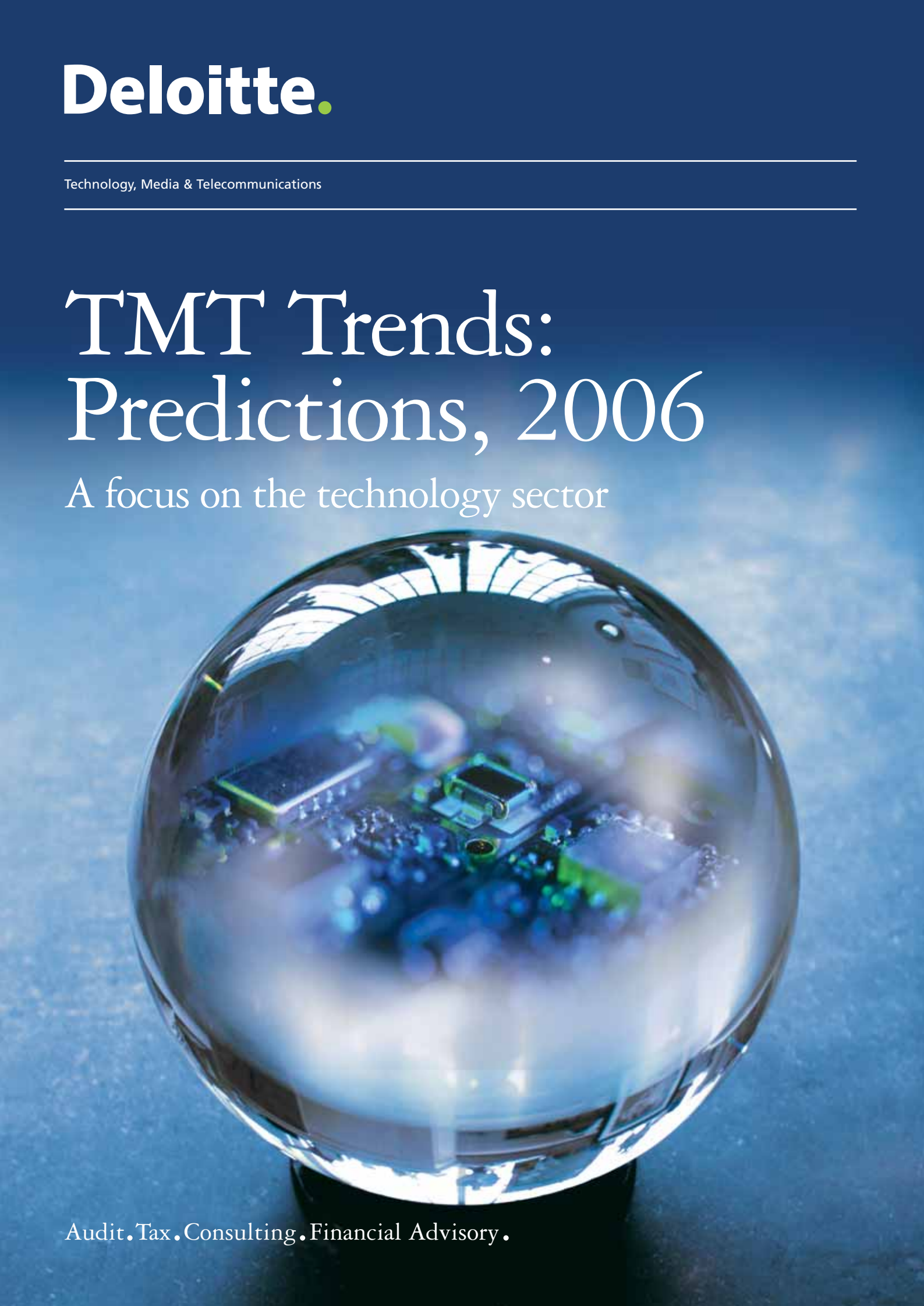
Technology, Media & Telecommunications

TMT Trends: Predictions, 2006

A focus on the technology sector



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Contents

Foreword

Welcome to the 2006 edition of Deloitte Touche Tohmatsu's (DTT) Technology, Media and Telecommunications (TMT) predictions for the global technology sector.

These predictions are the result of comprehensive research throughout 2005, the principal elements of which include:

- input from DTT's member firms' 5,000 TMT partners, directors and senior managers around the world;
- conversations with DTT's member firms' clients;
- dialog with leading industry and financial analysts.

Accompanying each of these ten predictions is the DTT TMT group's bottom line: the suggestions to the sector for exploiting each key development that the coming year holds. DTT's TMT group trusts that this guidance makes this report a valuable reference for your company. On behalf of DTT and the TMT practices of its member firms, may I take this opportunity to wish you all the best for 2006.

Igal Brightman

Igal Brightman
Global Managing Partner
Technology, Media & Telecommunications

Executive summary

2006 should see rapid change across all aspects of the technology sector. Most prominent amongst these will likely be the Internet.

Consumers may well change their use of the Internet, with search potentially displacing email as the most used digital application[1]. The inexorably expanding mass of digital information will likely raise most users' reliance on search. In 2006, it is likely that the vast majority of personal and corporate information will be created in digital format, and it is forecast that approximately 20 exabytes (billion gigabytes) of new digital data will be created in 2006[2]. Digital photography alone may generate over 100 petabytes (million gigabytes)[3]. And consumers will be increasingly likely to turn to search as a means of bringing order to this overwhelming mass of data. Search engines, however, will likely remain relatively unchanged – with most searches being text-based and requiring users to understand Boolean logic. As a result, the need for new search tools will become increasingly apparent.

In parallel, governments around the world will likely try to lessen some of the disparities between what happens on the Internet and what is allowed elsewhere. This will reflect the fact that the Internet has evolved from being an essentially amateur body into a largely self-interested, commercial infrastructure generating billions of dollars of revenue every year. Some governments may move to tax Voice over Internet Protocol (VoIP) services in the same manner as traditional Public Switched telephone Network (PSTN); others may attempt to enforce restrictions on advertising content and targets for online commercials; many more may move to crack down on counterfeiting and IP theft – as the virtual world finds itself having to deal with the realities and regulations of the real world.

Technology companies should see change on two main levels, both linked to efficiency – there will likely be increasing collaboration in research and development (R&D); and in parallel, a growing reliance on offshoring.

Businesses, research institutes, government laboratories and academic institutions will likely work ever more closely on R&D in order to minimize overheads. With global R&D spending expected to top $1 trillion in 2006[4], companies will be increasingly likely to seek to share their R&D burden with others. Companies will likely also turn to government research organizations and academic institutions to access leading edge thinking at a non-commercial level. And the trend toward offshore R&D is also likely to continue[5]. Low wage rates will still be a major driver, but access to qualified talent is expected to become increasingly important.

Offshoring may well become an important strategic issue for technology companies. Those who make active and dynamic use of offshoring for more than just the basics are likely to see numerous benefits – including the assimilation of market knowledge in key emerging markets, as well as the accumulation of a new body of intellectual property, and indeed, intellectual horsepower. In some sectors, offshoring may well evolve from being an exceptional practice into a prerequisite for survival.

The software world will likely see its dynamics continue to change, as open source becomes a growing threat to the established software business model, impacting both established software providers as well as end-users. Open source may well challenge long-established products and services in Customer Relationship Management (CRM), Enterprise Resource Planning (ERP) and other enterprise software infrastructure functions, in addition to its growing strength in server management, operating systems and office productivity software[6]. Open source's key differentiation will likely remain the global community development model, which may continue to usurp the legacy approach of closed source software development, driven by a single company's developers. As well as lowering R&D costs, the global collaborative effort of thousands of developers will be likely to be seen increasingly as a way of sharply reducing product development time frames.

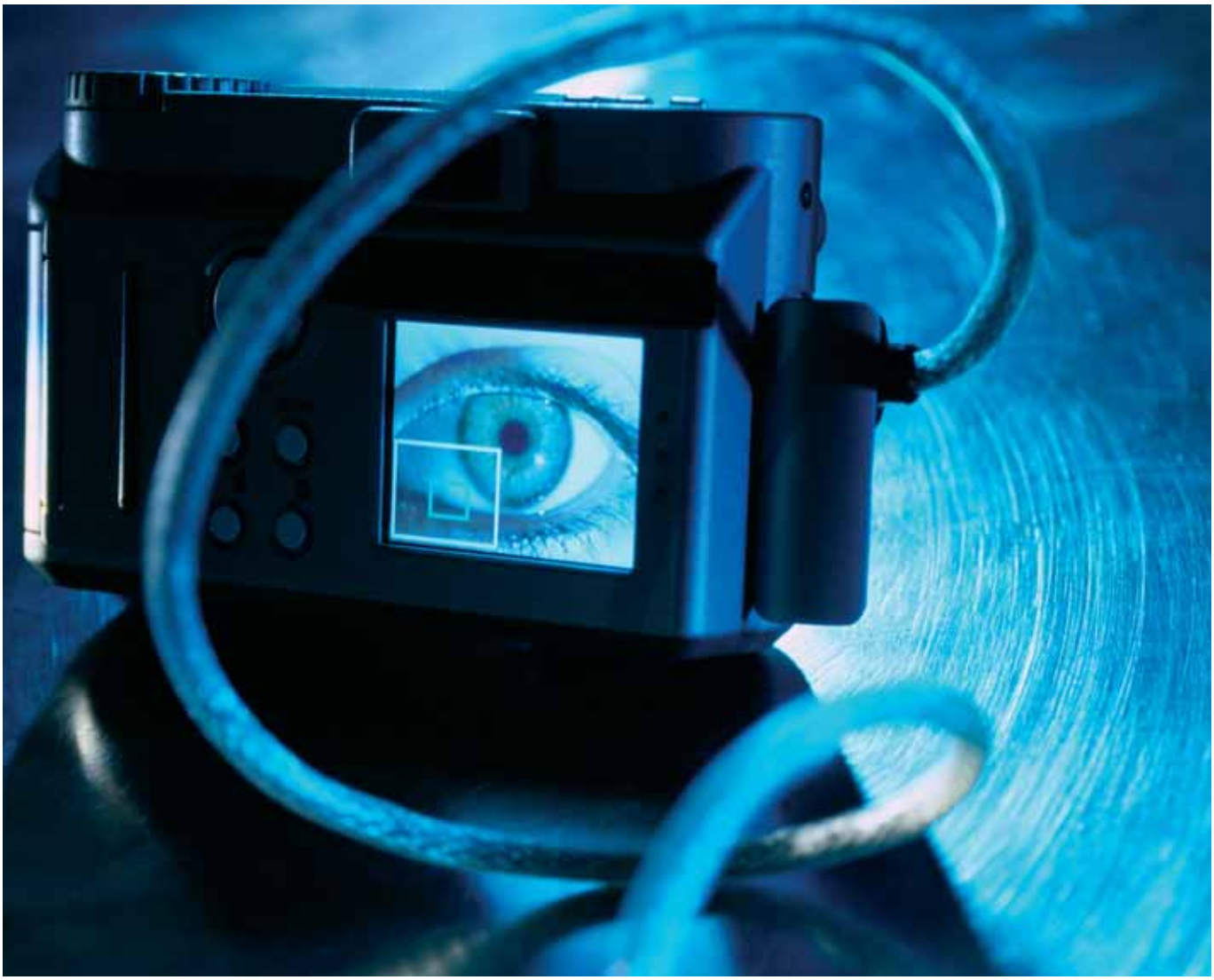
Technology's general impact on the world will most likely become more pervasive and comprehensive than ever in 2006. However the technology-based products and services with the greatest impact on the bottom line will likely be those that permanently change common human behaviors. Among them will likely be products and services whose trade name ultimately becomes part of the dictionary.

Technology's impact will likely extend into the classroom. During the year, a growing number of schools in developed countries are likely to install digital whiteboards, such that by 2010 every classroom in developed countries should have one[7]. Schools will also focus on improving the ratio of PCs to pupils, with leading countries likely to achieve a rate of one computer for every two students[8]. The benefits of these developments are likely to become more obvious as an increasing quantity of teaching material is made available, and as teachers from around the world share lessons with each other, enabling rapid assimilation of high-quality interactive educational materials.

Advances in processing and storage will likely enable key improvements to the interface between people and machines. As intelligent devices become increasingly ubiquitous, other forms of interaction – such as speech recognition – will probably be needed. In parallel, the year will likely see the launch of a widening range of devices, from cameras to cars, that have the ability and necessary connectivity to be remotely upgraded, updated, maintained and even generate additional revenue.

But through all of this change, the digital divide – that is the gap between those who have digital technology and those who do not – is likely to deepen on several axes. Historically, the digital divide has been most noticeable between developed and developing countries. This will most likely continue in 2006. In addition, however, the digital divide in developed countries is also expected to deepen along two key dimensions.

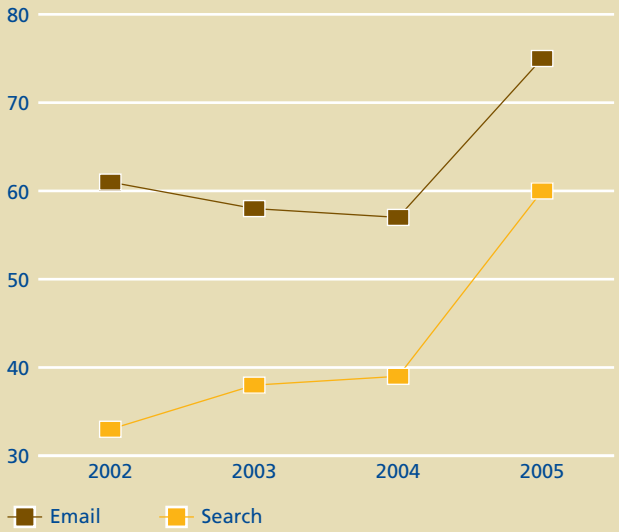
The first dimension is **access to lower cost products and services**. Many poorer households will likely still be unable to afford the cost of a computer and connectivity, while wealthier households with Internet access will pay less to connect to a growing range of products and services. The second dimension is **job skills**. People who grow up without ready access to PCs at home or at school will likely lack the technology skills needed to qualify for the best jobs. It is likely that both of these trends will only widen the gap between the **haves** and **have nots**.



Search challenges email as the leading digital application

Search may well displace email as the most used digital application in 2006[9], owing to rising functionality, an ever expanding volume of searchable data and higher speed connectivity (see Figure 1). However the search tool will likely remain immature in many respects – implying even more potential for value to be captured in the future.

Figure 1: Average daily number of US Internet users by task
Millions of users



Source: Pew Internet and American Life Project, surveys in September 2005, June 2004, June 2003 and January 2002. For a summary, see http://www.pewinternet.org/pdfs/pipsearchdata1105.pdf

The inexorably expanding mass of digital information will likely raise most users' reliance on search. It is likely that the vast majority of personal and corporate information will mostly be created in digital format. Indeed it is forecast that approximately 20 exabytes (billion gigabytes) of new digital data will be created in 2006[10]; digital photography alone may generate over 100 petabytes[11]. Growing volumes of existing content (from centuries-old books to early television archives) will also be digitized and made available online[12].

Search is increasingly necessary as a means of bringing order to this overwhelming mass of digital data. It is becoming increasingly time-consuming and expensive for individuals to index their own private and business data manually. Without effective search, therefore, digital data's value will likely decay through the difficulty in finding relevant information.

Thus the scope of search will likely expand to include digital data held on devices, principally the PC, but increasingly other electronic devices such as mobile phones, digital cameras, and personal video recorders (PVRs).

The search industry may also become more global in 2006. Currently the sector is dominated by English-speaking companies; but search engines specialized by language will likely gain traction, leading to a surge in non-Romance language searches[13].

Yet search will probably remain confusing and complex for the majority of potential users. 2006 is unlikely to see major advances in search engine user interfaces. Consequently, finding useful information may well still daunt the majority of people who are not proficient with Boolean logic. Search will also remain mostly text-based, with video, image and audio search still based on keywords, rather than symbols, sketches and sounds.

Bottom Line
A key recommendation for the search sector in 2006 would be to focus on the development of more intuitive search-engine user interfaces. Search, in its current mainstream format, is now ten years old. Yet it remains exclusively text-based, and requires an understanding of Boolean logic to conduct searches with more than one parameter. However single-word searches often provide an overwhelming number of irrelevant hits.

Search companies should also consider seeking new routes to market. The search function has typically been linked to consumer-owned devices such as personal computers and to a lesser extent, mobile phones. However, there are a number of other access points, such as bank ATMs and public phones, where search services could be extremely useful to consumers. These devices could be used specifically for certain types of search, such as local information, creating an additional value layer for search businesses.

Additionally, the role of search should be expanded to cover portable devices and multimedia devices, such as digital televisions and in-car information/entertainment systems. Exploiting these opportunities will likely require a different approach for each application – both for inputting search terms and delivering results.

Finally, search companies should consider offering different pricing models. Although advertising-sponsored search is sufficient for many users, a growing proportion of professional, academic and high-use consumers may be prepared to pay a fee for higher quality, more accurate searches that draw on a wider range of information sources and are not skewed by advertising sponsorships.

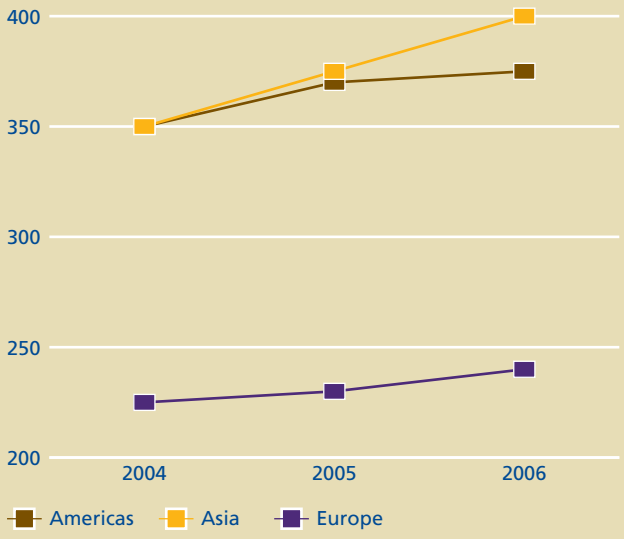
Innovation becomes collaborative

R&D is likely to become increasingly collaborative in 2006. Traditionally R&D has been company-specific, internally driven and sometimes even secretive. But in 2006 and beyond, businesses, research institutes, government laboratories and academic institutions will likely work ever more closely on R&D.

The move towards collaborative R&D will often be driven by economics. R&D costs are expected to continue rising through 2006, and collaboration may be the only affordable approach particularly since total global R&D spend is projected to top $1trillion in 2006, as illustrated in Figure 2 below[14].

For example, the cost of a semiconductor plant is forecast to rise to $6 billion by 2007[15]. Next generation video game consoles are pushing up the cost of developing a game to tens of millions of dollars, from an average of $10 million today[16]. The investment required to implement a next generation telecommunications network is in the range of tens of billions of dollars[17]. It is likely, therefore, that companies will increasingly want to share the burden of development in order to minimize costs.

Figure 2: Global R&D expenditure forecast



Source: R&D Magazine, September 2005[18].

The increasing complexity of products is driving the cost of R&D upwards. New generations of products and services may require a combination of nanotechnology, grid computing, advanced processors and high-capacity memory. These technologies often span multiple disciplines, from pure physics to biotechnology, obliging an expensive multi-disciplinary approach that ever fewer companies can accommodate on their own.

Businesses will likely increasingly co-operate with government research organizations and academic institutions to access leading-edge thinking at a non-commercial level. During 2006, a growing number of organizations are expected to establish small research facilities within universities, as a means of gaining a foothold in the academic world.

The trend toward offshore R&D is also likely to continue[19]. Low wage rates will still be a major driver, but access to qualified talent is expected to become increasingly important. In some cases, companies may also enjoy faster product and service development. Offshore R&D will be highly selective, and will likely center around India, China, Russia and Eastern Europe.

Bottom Line

The shift towards a shared approach to R&D – innovation through collaboration – must be carefully managed. All collaborators should be aware of each others' schedules: some academic institutions and businesses may have different notions of deadlines. Each party within collaboration should receive benefits proportionate to their contribution.

Collaborative R&D will also require flexibility. In many cases, it may be best for companies to partner on a project-by-project basis – since the right partner for one innovation may not be right for the next. Changing partners now and then can also help foster fresh thinking, renewed energy and improved creativity.

As always, the customer should be the focal point for all R&D. R&D partners should deliberately and repeatedly remind themselves of the characteristics and needs of their own and their partners' customers. The worst case scenario for any technology company would be an R&D team that ultimately just turned out engineers' follies.

Offshoring evolves from option to obligation

Offshoring as a means of minimizing corporate costs and optimizing efficiency will continue to gain in popularity throughout 2006. In some sectors, offshoring may well evolve from an exceptional practice into a prerequisite for survival.

India will likely remain the country of choice for offshore activities, owing to its unique blend of skills, tax breaks, manageable legal and fiscal environment and low labor costs. As a result, revenues from offshored activities are forecast to generate more than $17 billion for Indian companies[20]. China will likely also gain, earning upwards of $2 billion[21], and other developing nations may welll see their revenues from such activities continue to grow.

The commercial importance of the processes moved offshore will likely intensify through 2010, with more and more technology companies moving business critical activities to offshore locations. These may include wholesale transfer of manufacturing facilities, and even R&D. However, most companies will choose to keep their headquarters, along with sales, marketing and personnel functions in their country of origin.

2006 may see offshoring become an important strategic issue – defining at least some of the difference between success and failure. Technology companies who make active and dynamic use of offshoring for more than just the basics are likely to see numerous benefits – including the assimilation of market knowledge in important emerging markets such as India and China, as well as the accumulation of a new body of intellectual property, and indeed, intellectual horsepower. Companies who shun offshoring may, in the medium-term, struggle to find effective means to reduce costs permanently, and to identify new paths to growth.

China will likely also gain, earning upwards of $2 billion, and other developing nations may well see their revenues from such activities continue to grow.

Bottom Line
Technology companies should consider taking offshoring seriously, if they are not already doing so. The cost advantage derived from exploiting low labor costs and overheads in emerging markets will likely evolve from being a bonus to a necessity.

Companies must also increasingly regard offshoring as more than just a means of reducing cost. Developing countries are generating increasing quantities of well educated, bright and hard-working people[22]. As a result, the industry's offshoring focus should increasingly shift from cost reduction to finding and employing the best talent, wherever it may be. This means that offshored staff should be offered a career path, and become integrated into global operations, rather than just be treated as cheap, back office resource[23].

Technology firms should also try to ensure that the migration of certain jobs offshore occurs in tandem with the reskilling of the local workforce, which will likely need to specialize in value-added roles from product design to project management[24].

The rise and risk of electronic education

The classroom of 2006 will likely ramp up its assimilation of digital teaching aids. During the year, a growing number of schools in developed countries are likely to install digital whiteboards, such that by 2010 every classroom in developed countries is expected to have one[25]. Schools will also focus on improving the ratio of PCs to pupils, with leading countries likely to achieve a rate of one computer for every two students[26].

The benefits from this new technology will become more obvious as an increasing quantity of teaching material is made available, and as teachers develop their ability to use these new tools. One possible benefit is that teachers from around the world will be able to share lessons with each other, enabling rapid assimilation of high-quality interactive educational materials.

Digitization of lesson content and coursework will allow parents to take a more active role in their children's education. Course objectives, lesson content, test results and teachers' comments will be available online, enabling parents to monitor and support the formal teaching process.

The benefits from this new technology will become more obvious as an increasing quantity of teaching material is made available, and as teachers develop their ability to use these new tools.

Bottom line
Technology does seem to be playing an increasingly large part in education. It can certainly improve the overall efficacy of education, although all those responsible for delivering education should ensure technology-based education is delivered as a package, not just as components.

Technology in schools should be considered as a key objective for education ministries around the world. It both provides a foundation for delivering digital teaching materials and also nurtures pupils' general ability with technology – a skill which will likely become a prerequisite when reaching working age. However, setting targets for PCs per pupil ratios may be insufficient. This approach may even lead to PCs languishing in classrooms in their original packaging for months, as there may be insufficient trained staff to use them, or no space in which to accommodate them.

Furthermore, encouraging pupils simply to use more technology may be inappropriate if this does not stimulate their ability to think but rather encourages laziness. Technology can empower, but it can also weaken, encouraging the use of spreadsheets to count, instead of mental arithmetic, and enabling the growing trade in downloaded essays, rather than developing writing skills[27]. Technology should be advocated as a set of tools to assist the development of analytical skills, not to replace them.

Thus technology should be integrated into schools, based on a package of changes. Accompanying the raw technology, there should always be:

- training for teachers, showing them how technology supports, rather than threatens teaching;
- digital classroom material that supports national curricula, rather than distracting from them;
- guidance to parents on the pros and cons of technology-assisted education, and on the extent of the role that parents should play in their child's education.

Finally, all those involved in developing, deploying and evaluating classroom technology should recognize that technology is not a magic bullet. It does not reduce the need for professional teachers; indeed if anything, it expands their role – requiring more attention to the preparation of materials that make full use of the capabilities of computers and other devices. Technology can greatly enhance the education process – but it should always remain subordinate to the guidance, leadership and knowledge of teachers.

Open source moves towards center stage

2006 will likely see open source ramp up its challenge to the established software business model, impacting both established software providers as well as end-users. 2006 may well see open source challenge long-established and credible products and services in CRM, ERP and other enterprise software infrastructure functions, in addition to its growing strength in server management, operating systems and office productivity software[28].

Open source's key differentiation will likely remain as its development model, which in turn changes the cost structure for software. Open source's global community development model will likely continue to usurp the legacy approach of closed source software development, driven by a single company's developers. As well as lowering R&D costs, the global collaborative effort of thousands of developers can sharply reduce product development time frames.

In 2006, open source's growing adoption will likely cause many in the industry to take a different view towards the value of intellectual property, and how to best leverage it. Many established software players may well choose to provide previously proprietary intellectual property to open source communities, recognizing the power of the open source model as a distribution mechanism; and one which need not threaten the value of intellectual assets[29]. As a result, it will likely become increasingly difficult to identify pure open source development projects.

The hype caused by open source will likely catalyze market entry, particularly encouraging start-ups building enterprise grade open source products. Some new entrants will likely focus on developing service and maintenance businesses based on open source software provided; others may develop integrated closed and open source software solution; others may rely on charged-for ancillary toolkits to generate revenues.

Bottom Line
The maturing and growing acceptance of open source will likely require considered responses from both established software suppliers and end-users alike in 2006.

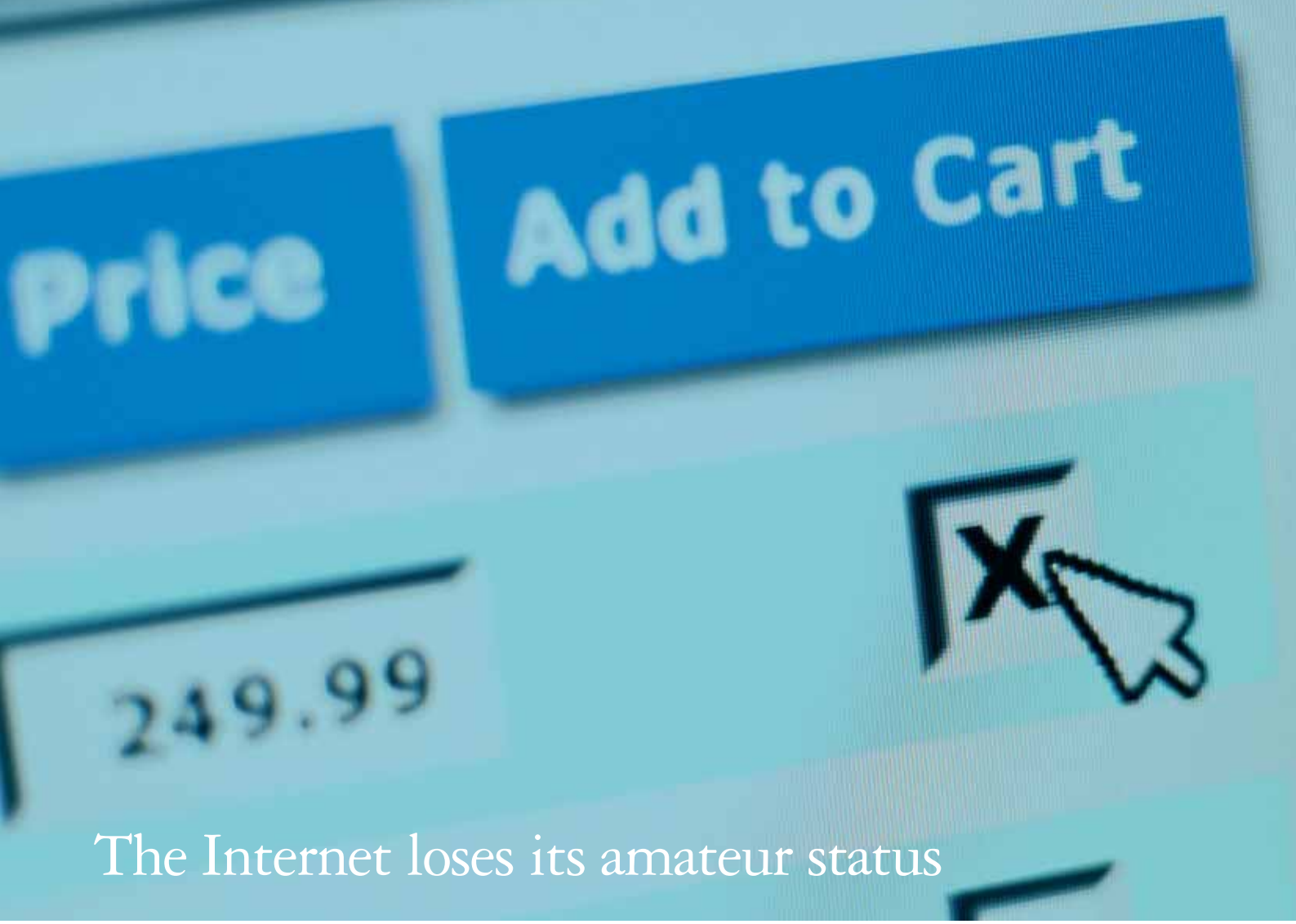
Established software industry players should, if they have not already done so, develop an open source strategy that is agreed by the Board. Elements of this strategy may include identifying new areas to accrue revenues, if the belief is that the traditional charging model no longer applies. Alternatively some companies may seek out specialist niches in which the open source community would most likely have no interest, such as developing specialist software to reduce the overhead associated with regulatory compliance. All, however, should seriously consider the power of the open source model as a means of distribution in an increasingly crowded, competitive and complex market.

Businesses considering acquiring open source software should bear in mind its dynamics. While open source is sometimes mistakenly perceived as free, businesses should bear in mind that its ultimate impact may be to redistribute, rather than sharply reduce, the flow of revenues to the software sector. Ancillary products and services, from maintenance to developer tool kits, may well consume technology budgets, rather than the core product itself.

Furthermore, while the cost of software R&D – and hence the cost of products themselves – may decline in the short-run, as pride, rather than profit, becomes a major motivator for developers. In the long-run profit may resume its pole position as the principal lure for the best developers. This may well have a knock on impact on the cost of software.

Additionally, while key potential benefits of open source products include flexibility and lower total cost of ownership (TCO), the downsides include a potentially poorer quality product. Businesses should ensure that operations are not disrupted because of breakdowns in lower cost, but lesser quality, software. Moreover, businesses should think carefully about whom they contract to provide their software solutions. Just because a small open source company has access to world-class code, does not mean it will be able to support its clients properly.

Finally, the open source community should start to broaden its reach. There remains a considerable opportunity to take open source code into new areas, including mobile smart phones, PDAs and even set-top boxes[30]. As more and more devices become intelligent, the opportunity for the open source model will likely grow accordingly.



The Internet loses its amateur status

Ever since its conversion into a global, common good, the Internet has been relatively unregulated. When the Internet was niche, with only a few million enthusiasts, rather than its current billion users[31], the relative freedom afforded to Internet users, both suppliers and customers, was of little concern.

In 2006, governments will probably increasingly be encouraged to lessen some of the disparities between what happens on the Internet and what is allowed elsewhere. This will reflect the fundamental transition that has occurred to the Internet: it has evolved from being an essentially amateur body, with a fair degree of self-regulation, into a largely self-interested, commercial infrastructure generating billions of dollars of revenue every year.

Through 2006, some of the anomalies between business conducted over the Internet and its real-world equivalent will likely heighten. For example: in some countries the tax on VoIP services is far less than for services based on the traditional PSTN[32]; in some nations, restrictions on advertising content and targets for online commercials are much more lax than for television or radio advertisements[33]; some online stores may provide a marketplace for both pirated goods and also digital products that enable illegal activities, such as IP theft, but may not be controlled as rigorously as a bricks and mortar store. Some Internet-based references may be subject to less control than a published equivalent.

Bottom Line

The growth of product and service sales over the Internet has taken place at breakneck speed over the last few years. In such an environment, defining the most relevant tax structure and legal framework has been problematic. However, in 2006, governments should work together with Internet-based businesses to ensure the Internet's transition to professional status happens as smoothly as possible.

The Internet is a dynamic generator of new processes and new businesses and this ability should not be extinguished. Illegal downloading of music over the Internet identified the latent demand for legal online music services. However at the same time, a level playing field is essential, especially for sectors where Internet-based companies are now the giants and no longer the minnows.

Technology humanizes technology

In 2006, advances in key technology areas – processing and storage – will likely enable significant improvements to the interface between people and machines[34]. Keystrokes have historically been the most efficient means of interacting with machines, but as intelligent devices become increasingly ubiquitous, other forms of interaction will most probably be needed. Technological advances may well reinvigorate adoption of the thus far niche interfaces such as speech recognition and voice synthesis. Furthermore well designed artificial intelligence applications may remove the need for some interactions altogether.

In 2006 a growing number of services, from directory inquiries to tourist information, will likely start to incorporate increasing degrees of natural language speech recognition – often without the public even realizing it. Previously, public natural language speech recognition applications were hampered by the cost of the processing power and memory required to look up instantly millions of voice samples.

Similarly, speech recognition and voice synthesis will likely be combined with basic artificial intelligence to create a wide range of services, for example, within vehicles. Possible applications include: distance monitoring, collision avoidance and voice controlled appliances (such as air conditioning, windshield wipers and stereos). These applications and others will likely lead to vehicles that take full advantage of ongoing developments in digital storage and processing power.

Bottom Line
Processing and storage advances have the potential to diversify and improve the man-machine interface.

Companies should think carefully about where such technologies can genuinely add value. Although replacing a call center with a computer may represent considerable cost savings, it may not be worth doing unless the resulting service is equal or, preferably, superior to the current offering on other key dimensions such as speed, convenience and utility.

Similarly, allowing more fluent man-machine interactions is only useful if it is practical and safe. For example, some countries have completely banned the use of mobile phones in cars. Even though speech recognition now allows calls to be made without even looking at the phone, or indeed touching it, the law in these countries still considers it a reckless act. Other technological aids that make driving safer are obviously appealing, but the technology must be completely reliable[35].

A great deal of progress is likely to be made in the way people interact with machines. And although these developments are still in their infancy, now is the time for the technology industry to start thinking about standards. If individual companies create multiple, conflicting and proprietary standards, customers are likely to get confused and development may stall.

Connectivity transforms the device into a service

Less than a decade ago, products were largely static. Once a product rolled off the assembly line, its features and functions were effectively set. But this is changing: 2006 will see the launch of a widening range of devices, from cameras to cars, that have the ability and necessary connectivity to be remotely upgraded, updated, maintained and even generate additional revenue.

Manufacturers and customers have become accustomed to remote software updates on personal computers, and increasingly, mobile phones. This has paved the way for a growing number of consumer products that have the required processing power, memory capacity and connectivity to be updated via digital download – helping to extend their value well beyond the initial purchase.

The update mechanism will likely most often be used for software and firmware upgrades, bug fixes, and the purchase and delivery of additional features and services, both frivolous and functional. Indeed the value of frivolity has been shown by the $5 billion mobile phone personalization market, based on ring tones and screen savers – digital products small enough to distribute over a cellular network[36]. These files, costing up to several dollars, allow users to customize their devices without changing the underlying capabilities or functionality.

In other sectors, of course, data will likely be downloaded for more serious purposes. The ability to update maps in GPS receivers, add new features to in-car computers, or patch software bugs in a set top box will all have value for customers. Their value to manufacturers will also be significant – but not just in financial terms. Each upgrade, patch or enhancement creates an opportunity to interact with the customer, allowing manufacturers to improve their understanding of customer needs, provide higher quality service and identify new revenue opportunities. Upgrade capabilities also allow companies to address product problems and deficiencies on the fly, reducing the overall time to market.

Bottom Line
The ability to upgrade and enhance products after the initial purchase represents a considerable market opportunity, but it should be used with caution and common sense. The first recommendation relates to customers: the process should be kept simple. As a reference point, the aim should be to make any download as easy, as quick and as foolproof as acquiring a ring tone.

Remote upgrades increase the risks from hackers: this exposure needs to be contained. Any device that is updated or enhanced over a network has the potential to become susceptible to viruses, worms and other malicious code. Companies delivering remote access services should spare no effort in ensuring that devices are resistant to infection, and that patches and other fixes can be installed safely and easily.

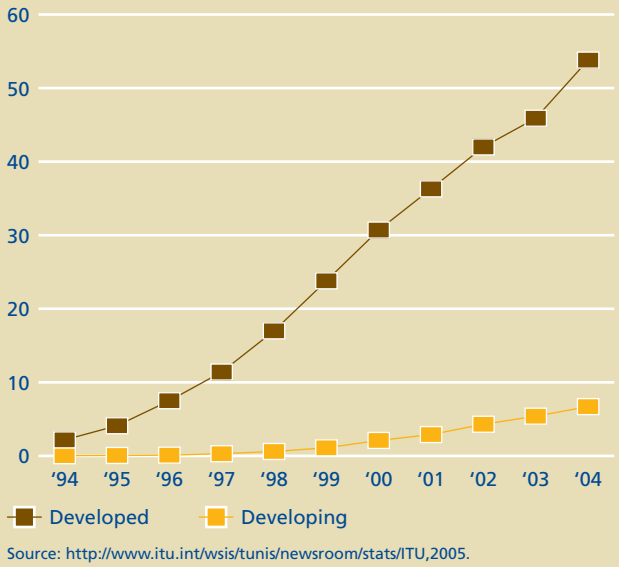
Manufacturers and customers have become accustomed to remote software updates on personal computers and increasingly mobile phones.

The digital divide deepens

The digital divide – that is the gap between those who have digital technology and those who do not – is likely to deepen in a number of directions during 2006.

Historically, the digital divide has been most noticeable between developed and developing countries. This will most likely continue in 2006. Citizens of poorer nations will be increasingly disadvantaged by their lack of access – to the media, to the Internet, to electronic communications, and to information in general. Many organizations will probably focus on the problem, but little change is expected during 2006. One obstacle is the sheer scale of the challenge: more than half of the world's population live more than three miles from a telephone line[37], never mind an Internet connection. Another obstacle in some countries is taxation policy, which may exacerbate the digital divide by classifying certain communications products as luxuries, not necessities[38]. The net effect is that the developing world is being left behind (see Figure 3).

Figure 3: Internet users in the developed and developing world
Users per 100 inhabitants



Source: http://www.itu.int/wsis/tunis/newsroom/stats/ITU,2005.

The digital divide in developed countries is also expected to deepen along two key dimensions. The first dimension **is access to lower cost products and services**. Many poorer households will likely still be unable to afford the cost of a computer and connectivity, while wealthier households with Internet access will pay less to connect to a growing range of products and services, from airline tickets to voice communication. The second dimension is **job skills**. People who grow up without ready access to PCs at home or at school will generally lack the technology skills needed to qualify for the best jobs. Both of these trends will likely only widen the gap between the **haves** and **have nots**.

Schemes to address this situation will likely abound, including: free municipal WiFi access; sub-$100 notebook computers[39]; low-cost broadband networks in developing countries; and $30 mobile phones[40]. But some may argue that technology components alone will not be enough to reduce the digital divide.

Bottom Line
Near-term efforts to bridge the digital divide in the developing world will probably fail to address the underlying problems, which derive from far-reaching economic, political and social issues. There will doubtless be isolated success stories where technology helps to reduce the problem within a particular village or a community. But in most cases, effective solutions are likely to require a more profound and integrated approach. The overall impact of modern technology in the developing world depends on a number of social and economic variables that differ greatly from one country to the next, and therefore requires careful analysis and preparation on a country-by-country basis. For example, in countries with low literacy levels, the introduction of the Internet – however cheap – is unlikely to have a major impact.

In the developing world, the digital divide should be viewed as a consequence of larger and more complex socio-economic issues, all of which should be addressed. It should also be remembered that simpler solutions, such as the provision of basic telephony services over mobile or fixed networks, are likely to deliver the most immediate and practical benefits. In other words, technologies that foster basic communication, such as SMS, email and VoIP, will generally be more effective than PC-based technologies such as word processors, databases and spreadsheets.

In the developed world, similar principles apply. The fundamental problem is the economic gap between rich and poor; between working class and middle class. The digital divide is just one of many symptoms that must be addressed. For example, providing free WiFi coverage to everyone is laudable, but it is unlikely to have much impact unless combined with subsidized equipment and training.

Life changing technology will likely be the most profitable

Technology's general impact on the world will most likely become more pervasive and comprehensive than ever in 2006. However the technology-based products and services with the greatest impact on the bottom line will likely be those that permanently change common human behaviors. Among them will likely be products and services whose trade name ultimately becomes part of the dictionary.

In recent years, technology has changed people's behavior in a variety of ways. Thanks to the digital address book in mobile phones and personal digital assistants (PDAs), people dial names, rather than memorize telephone numbers[41]. The proliferation of computers and mobile phones has rewritten, literally and metaphorically, the way people communicate, converting handwriting almost into an art form in the process[42]. MP3 music players encourage owners to carry their entire music collections with them, rather than just a selection. The increasingly ubiquitous games console has created a new leisure category as well as a new concern for parents and spouses[43]. Portable PCs and broadband connections have enabled home working; mobile email has made the employee more accessible than ever.

Bottom Line
Every year a myriad new technology-based products and services are launched, but only a few go on to be blockbusters. Technology companies have often struggled to determine which of their upcoming products or services will go on to achieve global success. An additional criterion for assessment could be the impact on human behavior: the greater the human reliance and even dependence on a technology, the greater the potential demand.

Behavior-altering technology will tend to be that which takes commonplace functions and makes them a combination of: more efficient, more user-friendly, quicker, more secure or even more entertaining. In essence, it empowers and liberates the owner.

Technology companies should bear in mind, however, that the greater the empowerment, the deeper the potential vulnerability if that technology breaks down. Flawed but vital technology damages both the supplier and the consumer. And as technology pervades deeper and deeper, for example becoming the basis of vehicle collision warning systems or health monitoring devices, its responsibility will increase accordingly. Thus, if a product or service stops working, not only will it cost to rectify the problem, it can also damage the brand, and in some cases even the bottom line.

However the technology-based products and services with the greatest impact on the bottom line will likely be those that permanently change common human behaviors.

Notes

1 Search Engine use November 2005, Pew Internet and American Life Project (Data Memo). Http://www.pewInternet.org/pdfs/PIP_SearchData_1105.pdf. According to Pew Internet Project data, search engine usage among US Internet users has jumped from 30 percent (38 million) in June 2004 to 41 percent (59 million users) in September 2005, an increase of over 50 percent. This compares to email, used by 52 percent of US Internet users in September 2005 up from 45 percent in June 2004.

2 http://www.sims.berkeley.edu/research/projects/how-much-info-2003/execsum.htm#summary. According to a study by the University California, five exabytes of data were created in 2002, of which 92 percent was stored digitally. Information flows through electronic channels contained 18 exabytes of new information in 1992, 98 percent of which was from phone calls. Of the remaining two percent, email generated 400,000 terabytes of new information; instant messaging generated 274 terabytes a year; television produced about 70,000 terabytes of original programming. New stored information grew about 30 percent a year between 1999 and 2002. Moore's Law, better connectivity and more powerful computers would suggest that the rate of growth of new stored information has grown at least this rate since 2002. If this is the case, 20 exabytes of data will be created in 2006.

3 Based on IDC data on the average number of digital photographs taken every month, quoted in **Red Herring**, 26 August 2005; IDC data on sales of digital cameras, quoted in news.com, 28 April 2005; data on average resolution of digital cameras, sourced from: Lyra Research Projects Worldwide Digital Camera Shipments Will Exceed 100 Million Units in 2008, Lyra Research, 22 February 2005.

4 http://www.rdmag.com/pdf/R&D%209_05%20Global2.pdf. According to a study conducted by Batelle Consulting of Ohio, commissioned by **R&D Magazine**, global R&D expenditure will grow to over $1 trillion in 2006, with Asia overtaking the United States in terms of expenditure for the first time.

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Designed and produced by The Creative Studio at Deloitte & Touche LLP, London.

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