

IT Doesn't Matter

by Nicholas G. Carr



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IT Doesn't Matter

by Nicholas G. Carr

As information technology's power and ubiquity have grown, its strategic importance has diminished. The way you approach IT investment and management will need to change dramatically.

IN 1968, a young Intel engineer named Ted Hoff found a way to put the circuits necessary for computer processing onto a tiny piece of silicon. His invention of the microprocessor spurred a series of technological breakthroughs—desktop computers, local and wide area networks, enterprise software, and the Internet—that have transformed the business world. Today, no one would dispute that information technology has become the backbone of commerce. It underpins the operations of individual companies, ties together far-flung supply chains, and, increasingly, links businesses to the customers they serve. Hardly a dollar or a euro changes hands anymore without the aid of computer systems.

As IT's power and presence have expanded, companies have come to view it as a resource ever more critical to their

success, a fact clearly reflected in their spending habits. In 1965, according to a study by the U.S. Department of Commerce's Bureau of Economic Analysis, less than 5% of the capital expenditures of American companies went to information technology. After the introduction of the personal computer in the early 1980s, that percentage rose to 15%. By the early 1990s, it had reached more than 30%, and by the end of the decade it had hit nearly 50%. Even with the recent sluggishness in technology spending, businesses around the world continue to spend well over \$2 trillion a year on IT.

But the veneration of IT goes much deeper than dollars. It is evident as well in the shifting attitudes of top managers. Twenty years ago, most executives looked down on computers as proletarian tools—glorified typewriters and

calculators—best relegated to low level employees like secretaries, analysts, and technicians. It was the rare executive who would let his fingers touch a keyboard, much less incorporate information technology into his strategic thinking. Today, that has changed completely. Chief executives now routinely talk about the strategic value of information technology, about how they can use IT to gain a competitive edge, about the “digitization” of their business models. Most have appointed chief information officers to their senior management teams, and many have hired strategy consulting firms to provide fresh ideas on how to leverage their IT investments for differentiation and advantage.

Behind the change in thinking lies a simple assumption: that as IT's potency and ubiquity have increased, so too has its strategic value. It's a reasonable assumption, even an intuitive one. But it's mistaken. What makes a resource truly strategic—what gives it the capacity to be the basis for a sustained competitive advantage—is not ubiquity but scarcity. You only gain an edge over rivals by having or doing something that they can't have or do. By now, the core functions of IT—data storage, data processing, and data transport—have become available and affordable to all.¹ Their very power and presence have begun to transform them from potentially strategic resources into commodity factors of production. They are becoming costs of doing business that must be paid by all but provide distinction to none.

IT is best seen as the latest in a series of broadly adopted technologies that have reshaped industry over the past two centuries—from the steam engine and the railroad to the telegraph and the telephone to the electric generator and the internal combustion engine. For a brief period, as they were being built into the infrastructure of commerce, all these technologies opened opportunities for forward-looking com-

panies to gain real advantages. But as their availability increased and their cost decreased—as they became ubiquitous—they became commodity inputs. From a strategic standpoint, they became invisible; they no longer mattered. That is exactly what is happening to information technology today, and the implications for corporate IT management are profound.

Vanishing Advantage

Many commentators have drawn parallels between the expansion of IT, particularly the Internet, and the rollouts of earlier technologies. Most of the comparisons, though, have focused on either the investment pattern associated with the technologies—the boom-to-bust cycle—or the technologies' roles in reshaping the operations of entire industries or even economies. Little has

rights to a new packaging material that gives its product a longer shelf life than competing brands. As long as they remain protected, proprietary technologies can be the foundations for long-term strategic advantages, enabling companies to reap higher profits than their rivals.

Infrastructural technologies, in contrast, offer far more value when shared than when used in isolation. Imagine yourself in the early nineteenth century, and suppose that one manufacturing company held the rights to all the technology required to create a railroad. If it wanted to, that company could just build proprietary lines between its suppliers, its factories, and its distributors and run its own locomotives and railcars on the tracks. And it might well operate more efficiently as a result. But, for the broader economy, the value produced

When a resource becomes essential to competition but inconsequential to strategy, the risks it creates become more important than the advantages it provides.

been said about the way the technologies influence, or fail to influence, competition at the firm level. Yet it is here that history offers some of its most important lessons to managers.

A distinction needs to be made between proprietary technologies and what might be called infrastructural technologies. Proprietary technologies can be owned, actually or effectively, by a single company. A pharmaceutical firm, for example, may hold a patent on a particular compound that serves as the basis for a family of drugs. An industrial manufacturer may discover an innovative way to employ a process technology that competitors find hard to replicate. A company that produces consumer goods may acquire exclusive

by such an arrangement would be trivial compared with the value that would be produced by building an open rail network connecting many companies and many buyers. The characteristics and economics of infrastructural technologies, whether railroads or telegraph lines or power generators, make it inevitable that they will be broadly shared—that they will become part of the general business infrastructure.

In the earliest phases of its buildout, however, an infrastructural technology can take the form of a proprietary technology. As long as access to the technology is restricted—through physical limitations, intellectual property rights, high costs, or a lack of standards—a company can use it to gain advantages over rivals. Consider the period between the construction of the first electric power stations, around 1880, and the wiring of the electric grid early in the twentieth century. Electricity remained a scarce

Nicholas G. Carr is HBR's editor-at-large. He edited The Digital Enterprise, a collection of HBR articles published by Harvard Business School Press in 2001, and has written for the Financial Times, Business 2.0, and the Industry Standard in addition to HBR. He can be reached at ncarr@hbsp.harvard.edu.

resource during this time, and those manufacturers able to tap into it – by, for example, building their plants near generating stations – often gained an important edge. It was no coincidence that the largest U.S. manufacturer of nuts and bolts at the turn of the century, Plumb, Burdick, and Barnard, located its factory near Niagara Falls in New York, the site of one of the earliest large-scale hydroelectric power plants.

Companies can also steal a march on their competitors by having superior insight into the use of a new technology. The introduction of electric power again provides a good example. Until the end of the nineteenth century, most manufacturers relied on water pressure or steam to operate their machinery. Power in those days came from a single, fixed source – a waterwheel at the side of a mill, for instance – and required an elaborate system of pulleys and gears to distribute it to individual workstations throughout the plant. When electric generators first became available, many manufacturers simply adopted them as a replacement single-point source, using them to power the existing system of pulleys and gears. Smart manufacturers, however, saw that one of the great advantages of electric power is that it is easily distributable – that it can be brought directly to workstations. By wiring their plants and installing electric motors in their machines, they were able to dispense with the cumbersome, inflexible, and costly gearing systems, gaining an important efficiency advantage over their slower-moving competitors.

In addition to enabling new, more efficient operating methods, infrastructural technologies often lead to broader market changes. Here, too, a company that sees what's coming can gain a step on myopic rivals. In the mid-1800s, when America started to lay down rail lines in earnest, it was already possible to transport goods over long distances – hundreds of steamships plied the country's rivers. Businessmen probably assumed that rail transport would essentially follow the steamship model, with some incremental enhancements. In fact, the greater speed, capacity, and reach of

the railroads fundamentally changed the structure of American industry. It suddenly became economical to ship finished products, rather than just raw materials and industrial components, over great distances, and the mass consumer market came into being. Companies that were quick to recognize the broader opportunity rushed to build large-scale, mass-production factories. The resulting economies of scale allowed them to crush the small, local plants that until then had dominated manufacturing.

The trap that executives often fall into, however, is assuming that opportunities for advantage will be available indefinitely. In actuality, the window for gaining advantage from an infrastructural technology is open only briefly. When the technology's commercial potential begins to be broadly appreciated, huge amounts of cash are inevitably invested in it, and its buildout proceeds with extreme speed. Railroad tracks, telegraph wires, power lines – all were laid or strung in a frenzy of activity (a frenzy so intense in the case of rail lines that it cost hundreds of laborers their lives). In the 30 years between 1846 and 1876, reports Eric Hobsbawm in *The Age of Capital*, the world's total rail trackage increased from 17,424 kilometers to 309,641 kilometers. During this same period, total steamship tonnage also exploded, from 139,973 to 3,293,072 tons. The telegraph system spread even more swiftly. In Continental Europe, there were just 2,000 miles of telegraph wires in 1849; 20 years later, there were 110,000. The pattern continued with electrical power. The number of central stations operated by utilities grew from 468 in 1889 to 4,364 in 1917, and the average capacity of each increased more than tenfold. (For a discussion of the dangers of overinvestment, see the sidebar "Too Much of a Good Thing.")

By the end of the buildout phase, the opportunities for individual advantage are largely gone. The rush to invest leads to more competition, greater capacity, and falling prices, making the technology broadly accessible and affordable. At the same time, the buildout forces

users to adopt universal technical standards, rendering proprietary systems obsolete. Even the way the technology is used begins to become standardized, as best practices come to be widely understood and emulated. Often, in fact, the best practices end up being built into the infrastructure itself; after electrification, for example, all new factories were constructed with many well-distributed power outlets. Both the technology and its modes of use become, in effect, commoditized. The only meaningful advantage most companies can hope to gain from an infrastructural technology after its buildout is a cost advantage – and even that tends to be very hard to sustain.

That's not to say that infrastructural technologies don't continue to influence competition. They do, but their influence is felt at the macroeconomic level, not at the level of the individual company. If a particular country, for instance, lags in installing the technology – whether it's a national rail network, a power grid, or a communication infrastructure – its domestic industries will suffer heavily. Similarly, if an industry lags in harnessing the power of the technology, it will be vulnerable to displacement. As always, a company's fate is tied to broader forces affecting its region and its industry. The point is, however, that the technology's potential for differentiating one company from the pack – its strategic potential – inexorably declines as it becomes accessible and affordable to all.

The Commoditization of IT

Although more complex and malleable than its predecessors, IT has all the hallmarks of an infrastructural technology. In fact, its mix of characteristics guarantees particularly rapid commoditization. IT is, first of all, a transport mechanism – it carries digital information just as railroads carry goods and power grids carry electricity. And like any transport mechanism, it is far more valuable when shared than when used in isolation. The history of IT in business has been a history of increased interconnectivity and interoperability, from mainframe time-

sharing to minicomputer-based local area networks to broader Ethernet networks and on to the Internet. Each stage in that progression has involved greater standardization of the technology and, at least recently, greater homogenization of its functionality. For most business applications today, the benefits of customization would be overwhelmed by the costs of isolation.

IT is also highly replicable. Indeed, it is hard to imagine a more perfect commodity than a byte of data – endlessly and perfectly reproducible at virtually no cost. The near-infinite scalability of many IT functions, when combined with technical standardization, dooms most proprietary applications to economic obsolescence. Why write your own application for word processing or e-mail or, for that matter, supply-chain management when you can buy a ready-made, state-of-the-art application for a fraction of the cost? But it's not just the software that is replicable. Because most business activities and processes have come to be embedded in software, they become replicable, too. When companies buy a generic application, they buy a generic process as well. Both the cost savings and the interoperability benefits make the sacrifice of distinctiveness unavoidable.

The arrival of the Internet has accelerated the commoditization of IT by providing a perfect delivery channel for generic applications. More and more, companies will fulfill their IT requirements simply by purchasing fee-based "Web services" from third parties – similar to the way they currently buy electric power or telecommunications services. Most of the major business-technology vendors, from Microsoft to IBM, are trying to position themselves as IT utilities, companies that will control the provision of a diverse range of business applications over what is now called, tellingly, "the grid." Again, the upshot is ever greater homogenization of IT capabilities, as more companies replace customized applications with generic ones. (For more on the challenges facing IT companies, see the sidebar "What About the Vendors?")

Too Much of a Good Thing

As many experts have pointed out, the overinvestment in information technology in the 1990s echoes the overinvestment in railroads in the 1860s. In both cases, companies and individuals, dazzled by the seemingly unlimited commercial possibilities of the technologies, threw large quantities of money away on half-baked businesses and products. Even worse, the flood of capital led to enormous overcapacity, devastating entire industries.

We can only hope that the analogy ends there. The mid-nineteenth-century boom in railroads (and the closely related technologies of the steam engine and the telegraph) helped produce not only widespread industrial overcapacity but a surge in productivity. The combination set the stage for two solid decades of deflation. Although worldwide economic production continued to grow strongly between the mid-1870s and the mid-1890s, prices collapsed – in England, the dominant economic power of the time, price levels dropped 40%. In turn, business profits evaporated. Companies watched the value of their products erode while they were in the very process of making them. As the first worldwide depression took hold, economic malaise covered much of the globe. "Optimism about a future of indefinite progress gave way to uncertainty and a sense of agony," wrote historian D.S. Landes.

It's a very different world today, of course, and it would be dangerous to assume that history will repeat itself. But with companies struggling to boost profits and the entire world economy flirting with deflation, it would also be dangerous to assume it can't.

Finally, and for all the reasons already discussed, IT is subject to rapid price deflation. When Gordon Moore made his famously prescient assertion that the density of circuits on a computer chip would double every two years, he was making a prediction about the coming explosion in processing power. But he was also making a prediction about the coming free fall in the price of computer functionality. The cost of processing power has dropped relentlessly, from \$480 per million instructions per second (MIPS) in 1978 to \$50 per MIPS in 1985 to \$4 per MIPS in 1995, a trend that continues unabated. Similar declines have occurred in the cost of data storage and transmission. The rapidly increasing affordability of IT functionality has not only democratized the computer revolution, it has destroyed one of the most important potential barriers to com-

petitors. Even the most cutting-edge IT capabilities quickly become available to all.

It's no surprise, given these characteristics, that IT's evolution has closely mirrored that of earlier infrastructural technologies. Its buildout has been every bit as breathtaking as that of the railroads (albeit with considerably fewer fatalities). Consider some statistics. During the last quarter of the twentieth century, the computational power of a microprocessor increased by a factor of 66,000. In the dozen years from 1989 to 2001, the number of host computers connected to the Internet grew from 80,000 to more than 125 million. Over the last ten years, the number of sites on the World Wide Web has grown from zero to nearly 40 million. And since the 1980s, more than 280 million miles of fiber-optic cable have been installed – enough, as *BusinessWeek* re-

cently noted, to “circle the earth 11,320 times.” (See the exhibit “The Sprint to Commoditization.”)

As with earlier infrastructural technologies, IT provided forward-looking companies many opportunities for competitive advantage early in its buildout, when it could still be “owned” like a proprietary technology. A classic example is American Hospital Supply. A leading distributor of medical supplies, AHS introduced in 1976 an innovative system called Analytic Systems Automated Purchasing, or ASAP, that enabled hospitals to order goods electronically. Developed in-house, the innovative system used proprietary software running on a mainframe computer, and hospital purchasing agents accessed it through terminals at their sites. Because more efficient ordering enabled hospitals to reduce their inventories—and thus their costs—customers were quick to embrace the system. And because it was proprietary to AHS, it effectively locked out competitors. For several years, in fact, AHS was the only distributor offering electronic ordering, a competitive advantage that led to years of superior financial results. From 1978 to 1983, AHS’s sales and profits rose at annual rates of 13% and 18%, respectively—well above industry averages.

AHS gained a true competitive advantage by capitalizing on characteristics of infrastructural technologies that are common in the early stages of their buildouts, in particular their high cost and lack of standardization. Within a decade, however, those barriers to competition were crumbling. The arrival of personal computers and packaged software, together with the emergence of networking standards, was rendering proprietary communication systems unattractive to their users and uneconomical to their owners. Indeed, in an ironic, if predictable, twist, the closed nature and outdated technology of AHS’s system turned it from an asset to a liability. By the dawn of the 1990s, after AHS had merged with Baxter Travenol to form Baxter International, the company’s senior executives had come to view ASAP as “a millstone around their necks,” ac-

cording to a Harvard Business School case study.

Myriad other companies have gained important advantages through the innovative deployment of IT. Some, like American Airlines with its Sabre reservation system, Federal Express with its package-tracking system, and Mobil Oil with its automated Speedpass payment system, used IT to gain particular op-

erating or marketing advantages – to leapfrog the competition in one process or activity. Others, like Reuters with its 1970s financial information network or, more recently, eBay with its Internet auctions, had superior insight into the way IT would fundamentally change an industry and were able to stake out commanding positions. In a few cases, the dominance companies gained through

What About the Vendors?

Just a few months ago, at the 2003 World Economic Forum in Davos, Switzerland, Bill Joy, the chief scientist and cofounder of Sun Microsystems, posed what for him must have been a painful question: “What if the reality is that people have already bought most of the stuff they want to own?” The people he was talking about are, of course, businesspeople, and the stuff is information technology. With the end of the great buildout of the commercial IT infrastructure apparently at hand, Joy’s question is one that all IT vendors should be asking themselves. There is good reason to believe that companies’ existing IT capabilities are largely sufficient for their needs and, hence, that the recent and widespread sluggishness in IT demand is as much a structural as a cyclical phenomenon.

Even if that’s true, the picture may not be as bleak as it seems for vendors, at least those with the foresight and skill to adapt to the new environment. The importance of infrastructural technologies to the day-to-day operations of business means that they continue to absorb large amounts of corporate cash long after they have become commodities – indefinitely, in many cases. Virtually all companies today continue to spend heavily on electricity and phone service, for example, and many manufacturers continue to spend a lot on rail transport. Moreover, the standardized nature of infrastructural technologies often leads to the establishment of lucrative monopolies and oligopolies.

Many technology vendors are already repositioning themselves and their products in response to the changes in the market. Microsoft’s push to turn its Office software suite from a packaged good into an annual subscription service is a tacit acknowledgment that companies are losing their need – and their appetite – for constant upgrades. Dell has succeeded by exploiting the commoditization of the PC market and is now extending that strategy to servers, storage, and even services. (Michael Dell’s essential genius has always been his unsentimental trust in the commoditization of information technology.) And many of the major suppliers of corporate IT, including Microsoft, IBM, Sun, and Oracle, are battling to position themselves as dominant suppliers of “Web services” – to turn themselves, in effect, into utilities. This war for scale, combined with the continuing transformation of IT into a commodity, will lead to the further consolidation of many sectors of the IT industry. The winners will do very well; the losers will be gone.

IT innovation conferred additional advantages, such as scale economies and brand recognition, that have proved more durable than the original technological edge. Wal-Mart and Dell Computer are renowned examples of firms that have been able to turn temporary technological advantages into enduring positioning advantages.

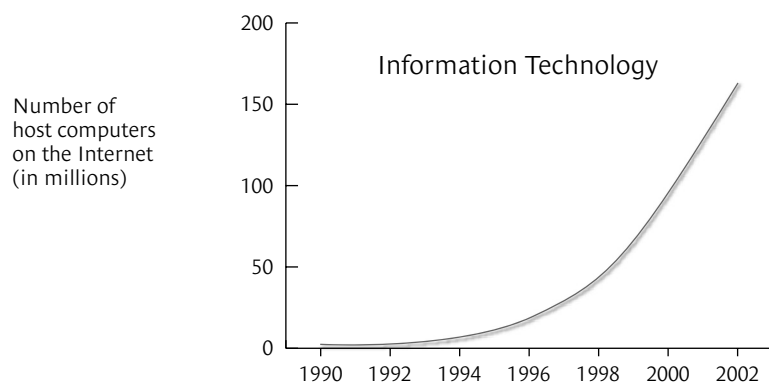
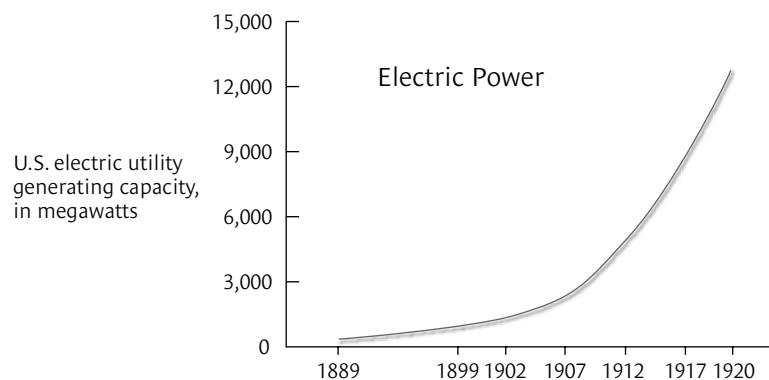
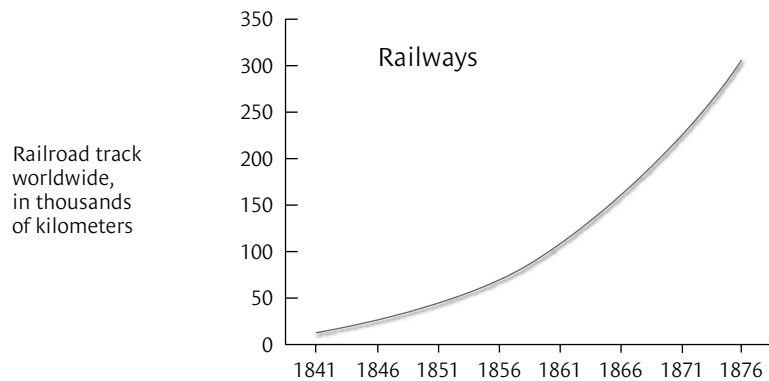
But the opportunities for gaining IT-based advantages are already dwindling. Best practices are now quickly built into software or otherwise replicated. And as for IT-spurred industry transformations, most of the ones that are going to happen have likely already happened or are in the process of happening. Industries and markets will continue to evolve, of course, and some will undergo fundamental changes—the future of the music business, for example, continues to be in doubt. But history shows that the power of an infrastructural technology to transform industries always diminishes as its buildout nears completion.

While no one can say precisely when the buildout of an infrastructural technology has concluded, there are many signs that the IT buildout is much closer to its end than its beginning. First, IT's power is outstripping most of the business needs it fulfills. Second, the price of essential IT functionality has dropped to the point where it is more or less affordable to all. Third, the capacity of the universal distribution network (the Internet) has caught up with demand—indeed, we already have considerably more fiber-optic capacity than we need. Fourth, IT vendors are rushing to position themselves as commodity suppliers or even as utilities. Finally, and most definitively, the investment bubble has burst, which historically has been a clear indication that an infrastructural technology is reaching the end of its buildout. A few companies may still be able to wrest advantages from highly specialized applications that don't offer strong economic incentives for replication, but those firms will be the exceptions that prove the rule.

At the close of the 1990s, when Internet hype was at full boil, technologists

The Sprint to Commoditization

One of the most salient characteristics of infrastructural technologies is the rapidity of their installation. Spurred by massive investment, capacity soon skyrockets, leading to falling prices and, quickly, commoditization.



Sources: railways: Eric Hobsbawm, *The Age of Capital* (Vintage, 1996); electric power: Richard B. Duboff, *Electric Power in Manufacturing, 1889–1958* (Arno, 1979); Internet hosts: Robert H. Zakon, *Hobbes' Internet Timeline* (www.zakon.org/robert/internet/timeline/).

offered grand visions of an emerging “digital future.” It may well be that, in terms of business strategy at least, the future has already arrived.

From Offense to Defense

So what should companies do? From a practical standpoint, the most important lesson to be learned from earlier infrastructural technologies may be this: When a resource becomes essential to competition but inconsequential to strategy, the risks it creates become more important than the advantages it provides. Think of electricity. Today, no company builds its business strategy around its electricity usage, but even a brief lapse in supply can be devastating (as some California businesses discovered during the energy crisis of 2000). The operational risks associated with IT are many – technical glitches, obsolescence, service outages, unreliable vendors or partners, security breaches, even terrorism – and some have become magnified as companies have moved from tightly controlled, proprietary systems to open, shared ones. Today, an IT disruption can paralyze a company's ability to make its products, deliver its services, and connect with its customers, not to mention foul its reputation. Yet few companies have done a thorough job of identifying and tempering their vulnerabilities. Worrying about what might go wrong may not be as glamorous a job as speculating about the future, but it is a more essential job right now. (See the sidebar “New Rules for IT Management.”)

In the long run, though, the greatest IT risk facing most companies is more prosaic than a catastrophe. It is, simply, overspending. IT may be a commodity, and its costs may fall rapidly enough to ensure that any new capabilities are quickly shared, but the very fact that it is entwined with so many business functions means that it will continue to consume a large portion of corporate spending. For most companies, just staying in business will require big outlays for IT. What's important – and this holds true for any commodity input – is to be able to separate essential investments

from ones that are discretionary, unnecessary, or even counterproductive.

At a high level, stronger cost management requires more rigor in evaluating expected returns from systems investments, more creativity in exploring simpler and cheaper alternatives, and a greater openness to outsourcing and other partnerships. But most companies can also reap significant savings by simply cutting out waste. Personal computers are a good example. Every year, businesses purchase more than 100 million PCs, most of which replace older models. Yet the vast majority of workers who use PCs rely on only a few simple applications – word processing, spreadsheets, e-mail, and Web browsing. These applications have been technologically mature for years; they require only a fraction of the computing power provided

by today's microprocessors. Nevertheless, companies continue to roll out across-the-board hardware and software upgrades.

Much of that spending, if truth be told, is driven by vendors' strategies. Big hardware and software suppliers have become very good at parceling out new features and capabilities in ways that force companies into buying new computers, applications, and networking equipment much more frequently than they need to. The time has come for IT buyers to throw their weight around, to negotiate contracts that ensure the long-term usefulness of their PC investments and impose hard limits on upgrade costs. And if vendors balk, companies should be willing to explore cheaper solutions, including open-source applications and bare-bones network PCs, even

New Rules for IT Management

With the opportunities for gaining strategic advantage from information technology rapidly disappearing, many companies will want to take a hard look at how they invest in IT and manage their systems. As a starting point, here are three guidelines for the future:

Spend less. Studies show that the companies with the biggest IT investments rarely post the best financial results. As the commoditization of IT continues, the penalties for wasteful spending will only grow larger. It is getting much harder to achieve a competitive advantage through an IT investment, but it is getting much easier to put your business at a cost disadvantage.

Follow, don't lead. Moore's Law guarantees that the longer you wait to make an IT purchase, the more you'll get for your money. And waiting will decrease your risk of buying something technologically flawed or doomed to rapid obsolescence. In some cases, being on the cutting edge makes sense. But those cases are becoming rarer and rarer as IT capabilities become more homogenized.

Focus on vulnerabilities, not opportunities. It's unusual for a company to gain a competitive advantage through the distinctive use of a mature infrastructural technology, but even a brief disruption in the availability of the technology can be devastating. As corporations continue to cede control over their IT applications and networks to vendors and other third parties, the threats they face will proliferate. They need to prepare themselves for technical glitches, outages, and security breaches, shifting their attention from opportunities to vulnerabilities.

if it means sacrificing features. If a company needs evidence of the kind of money that might be saved, it need only look at Microsoft's profit margin.

In addition to being passive in their purchasing, companies have been sloppy in their use of IT. That's particularly true with data storage, which has come to account for more than half of many companies' IT expenditures. The bulk of what's being stored on corporate networks has little to do with making products or serving customers – it consists

another powerful way to cut costs – while also reducing a firm's chance of being saddled with buggy or soon-to-be-obsolete technology. Many companies, particularly during the 1990s, rushed their IT investments either because they hoped to capture a first-mover advantage or because they feared being left behind. Except in very rare cases, both the hope and the fear were unwarranted. The smartest users of technology – here again, Dell and Wal-Mart stand out – stay well back from the

panies and discovered that the top performers tended to be among the most tightfisted. The 25 companies that delivered the highest economic returns, for example, spent on average just 0.8% of their revenues on IT, while the typical company spent 3.7%. A recent study by Forrester Research showed, similarly, that the most lavish spenders on IT rarely post the best results. Even Oracle's Larry Ellison, one of the great technology salesmen, admitted in a recent interview that “most companies spend too much [on IT] and get very little in return.” As the opportunities for IT-based advantage continue to narrow, the penalties for overspending will only grow.

IT management should, frankly, become boring. The key to success, for the vast majority of companies, is no longer to seek advantage aggressively but to manage costs and risks meticulously. If, like many executives, you've begun to take a more defensive posture toward IT in the last two years, spending more frugally and thinking more pragmatically, you're already on the right course. The challenge will be to maintain that discipline when the business cycle strengthens and the chorus of hype about IT's strategic value rises anew. 

of employees' saved e-mails and files, including terabytes of spam, MP3s, and video clips. *Computerworld* estimates that as much as 70% of the storage capacity of a typical Windows network is wasted – an enormous unnecessary expense. Restricting employees' ability to save files indiscriminately and indefinitely may seem distasteful to many managers, but it can have a real impact on the bottom line. Now that IT has become the dominant capital expense for most businesses, there's no excuse for waste and sloppiness.

Given the rapid pace of technology's advance, delaying IT investments can be

cutting edge, waiting to make purchases until standards and best practices solidify. They let their impatient competitors shoulder the high costs of experimentation, and then they sweep past them, spending less and getting more.

Some managers may worry that being stingy with IT dollars will damage their competitive positions. But studies of corporate IT spending consistently show that greater expenditures rarely translate into superior financial results. In fact, the opposite is usually true. In 2002, the consulting firm Alinean compared the IT expenditures and the financial results of 7,500 large U.S. com-

1. “Information technology” is a fuzzy term. In this article, it is used in its common current sense, as denoting the technologies used for processing, storing, and transporting information in digital form.

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