CHAPTER ONE

INTRODUCTION: THE AGE OF NETWORKED INTELLIGENCE

Are you looking to drive my dreams
You here to run my screens?

R.E.M.

A TIME OF TRANSFORMATION

When the Atlanta-based rock band R.E.M. went on tour in 1995, the first time the supergroup had played so extensively in five years, much of the promotional effort was focused on the Internet. The dates for the North American portion of the band's tour were posted on the World Wide Web (WWW) in January, just days before the first concert in Perth, Australia. Fans could look in the R.E.M. folder created by MTV News not only for the schedule but also for audio and video interviews with band members, as well as concert footage. Want more? Well, just tap into the WWW for the entire list of R.E.M. bootleg records, band photographs, all the song lyrics, and even the sounds from some of their famous guitar riffs.

And coming soon? Click on your favorite hit from any singer, sit back, and enjoy the video. The marketplace for R.E.M. is an electronic one—the Net! Can it be long before R.E.M.'s distribution system is the Net as well?

What will happen to their current publisher, Warner Brothers Records? What is the role of a record store in this new world? Or what will happen to the radio station when R.E.M.'s music can be accessed from the Net with the push of a button from the digital radio in your car? What will happen to MTV itself when you can say to your television, "Play me the first cut from R.E.M.'s new album?"

In music, and in everything, the times they are a-changing. A new age is upon us and no one can halt its progress. Unlike revolutions of the past, however, the opportunity to share more fully in the largesse of this revolution is huge. Aspects of this new age already exist; the rest is being born daily. Amid the apparent chaos of change, there are rhythms at work, and patterns are beginning to appear.

We are at the dawn of an Age of Networked Intelligence—an age that is giving birth to a new economy, a new politics, and a new society. Businesses will be transformed, governments will be renewed, and individuals will be able to reinvent themselves—all with the help of the new information technology.

There is a vast new promise but also new perils. A looming dark side holds the potential for severe social stratification, unprecedented invasion of privacy and other rights, structural unemployment, and massive social dislocation and conflict. The future will depend on what we as businesses and as a society do—on our decisions and our actions.

Look at what happened in April 1995 immediately following the blast at the federal government building in Oklahoma City. The Net became a focal point for all sides of the debate. Some messages went so far as to allege that the FBI was to blame. Others, posted by extremist gun cults, exhorted fellow members to more rebellious acts. But the Net was also the focal point for helpful information. The FBI, using its Home Page, quickly posted descriptions of the suspects. And the Net was used to spread pleas for heavy equipment that could be used in the rescue operation. The promise and the peril.

Even Newt Gingrich, the Georgia Republican who became speaker of the House of Representatives in 1995, made the disruptions of the new age a major theme upon taking office. "The most accurate analogy to what is happening to us now is to look at the period between 1770 and 1800, when America was changing from a rural to a manufacturing society," said Gingrich in a speech. "What is happening to us now—the transition from the industrial era … is forcing us to ask very similar and profound questions about ourselves."

But how can companies transform themselves for the new economy? In the 1980s, the main management tool for change was quality. The total quality and continuous improvement movement helped many companies respond to the newly emerging global situation.

In the 1990s the attention shifted to business process reengineering (BPR), a management technique that swept through corporations and governments around the world. It is true that the old business processes, management practices, organizational structures, and ways of working have become inappropriate for the new volatile, global, competitive business environment. Clearly, many large companies needed to reengineer to reduce their cost base.

However, by all accounts, BPR is in trouble. A survey by *Systems Reengineering Economics,* a newsletter published by Computer Economics Inc., of Carlsbad, California, found that companies will spend $52 billion on business reengineering by 1997. Of that, $40 billion will go to information technology. Will corporations be satisfied? According to *InformationWeek,* two-thirds of such projects fail. According to management consulting firm Arthur D. Little Inc., only 16% of companies are "satisfied." Of the rest, 45% are partially satisfied and 39% are dissatisfied. Other companies have simply wasted money; Citibank has frankly admitted that the $50 million it spent on reengineering produced no results.

The idea behind BPR seems to be a good one. So, what's the problem? The number one culprit on everyone's list is resistance to change. A study by Deloitte & Touche listed 60% of respondents as indicating resistance to change as the main factor behind the failure of BPR. Among the top five reasons, three were variants on resistance—lack of executive consensus; lack of a senior management champion; and unrealistic expectations.

Old business processes die hard. They have built-in resistance to their own transformation. But scratch the surface and you'll find that much of this so-called resistance is rational—at least from the perspective of the human subjects who are reengineered. Notwithstanding the lofty statements of BPR theorists about improving customer service, the real goal of most reengineering projects is to streamline processes and reduce costs—specifically head count. People, having heads, reflect that theirs might be one of those to be counted, and decide to resist. They openly resist. They passively resist. Or they superficially comply rather than buy in. But resist they do. And such resistance is basically rational.

Don't get me wrong. All companies need to control or reduce costs. Old processes, from the old economy and old enterprise, are an obstacle to

competitiveness. They need to be reengineered for efficiency and high performance. This becomes especially clear when your customer calls on Friday and says that you must reduce prices by 10% by Monday or they will no longer do business with you. The 10% isn't going to come from reducing margins, which are already razor thin.

But increasingly BPR will not be adequate for success. Although downsizing may be laudable in some situations, it is not a strategy for the future. A vision for transformation beyond "neutron bombing" your enterprise is required. Success in the new economy will require inventing new business processes, new businesses, new industries, and new customers—not rearranging old ones.

For the 1990s and the next millennium, corporations need to get beyond reengineering to the transformation of the corporation enabled by information technology (IT). The goal should not just be cost control but the dramatic and profound transformation of customer service, responsiveness, and innovation.

Business process reengineering does not a strategy for the new economy make. Like quality, reengineering is a *necessary* but *insufficient* condition for competitiveness. The reason is that the world, the economy, and all the rules of business are changing.

THE NEW WORLD (DIS)ORDER

The superlatives to describe the changes underway are never-ending—tectonic shifts, revolutionary changes, a new paradigm, a tsunami of transformation (all adding up to a tsunami of superlatives). Such extreme characterizations don't arise because the world has acquired a new taste for hyperbole. Rather, the language flows from the attempts of baffled business leaders, boggled academics, and amazed journalists to somehow characterize the world we are entering and how the changes underway are unlike anything before.

Retired General Colin Powell tells the story of how the first thirty years of his thirty-five year military career were quite straightforward. For those years, the entire strategy of the United States in the world was summed up in one word: containment. The goal was to contain the military, political, and ideological advance of communism. The United States had a unifying systems theory of the world that everyone could understand. There was a single enemy—according to Powell, a "good enemy"—complete with villains like Stalin, who ordered horrible atrocities, and Khrushchev, who pounded his shoe on his desk at the United Nations. The United States built 30,000 nuclear weapons matched by the Soviets' 30,000 nuclear weapons. Both sides lined up their troops across Europe. And then suddenly it all changed.

General Powell describes a historic meeting with Gorbachev, who was getting frustrated trying to explain how the old model of the world was unworkable. Gorbachev finally leaned across the table to Secretary of State Schultz and said, "You need to understand, Secretary Schultz; today I am ending the cold war." And then Gorbachev said to Powell, "General, you will have to find yourself another enemy."

Powell thought to himself at the time, "I don't want to find another enemy. I've got a few years to retirement. You are a good enemy. You can't just sit there and kick out all of the assumptions, rules, trading systems, political structures that have held the world together for the last 40 years." And then, in December 1991, the Soviet Union ceased to exist as a country. The Soviets lost their economic system, their values, their system of beliefs. That ended the bipolar world, the policy of containment, and the unifying systems theory of how the world works.

The result today is the new world disorder, unfolding at warp velocity. Previously unimagined changes taking place in the world and their implications for our professional and personal lives are relentless. There are an openness and a volatility that seem rich with opportunity and fraught with danger for your country, for your organization, for you, and for humanity.

With the collapse of the bipolar world, East and West Germany were reunited, but there was more change globally. Nelson Mandela, once unacceptable as an alleged Soviet-supported "communist," was freed after twenty-seven years in jail, and a multiracial state was created in South Africa headed by him. There was a war in the Mideast involving twenty countries in a coalition including the USSR and the United States—on the same side. Horrible civil wars broke out in Yugoslavia, Georgia, Bosnia, Chechnya, Croatia, and elsewhere. Hundreds of thousands of people in Somalia and half a million people in Rwanda fell victim to the unconstrained new world disorder. Two of the most bitter enemies in modern times, Israel and the PLO, signed a peace agreement; their respective leaders shook hands at the White House. The United States invaded Haiti. The United States invaded Somalia. The United States invaded … Peace and war broke out all over the planet.

This new global situation is turning the world economy upside down. The CEO of Alcoa wakes up one morning to find that Russia is now dumping aluminum on world markets at half the current price. The first major survey of Chinese people shows that the top priority for two-thirds of the country is to get rich through hard work, whereas only 4% want to continue the revolution. Economist Lester Thurow asks his audience in a recent speech to U.S. business leaders, "Who do you think has more high school graduates—the United States or China?" He replies: "If you guessed China, you're right—by a couple of hundred million. Now why would I hire a graduate in the U.S. for $30,000 per year when I can get an equivalently educated person in China for $100 per month?" Many U.S. businesses have already answered that question with a resounding, "We don't." Millions of so-called virtual aliens are clicking away on keyboards in Shanghai, New Delhi, and Hong Kong—fully networked and employed as members of the U.S. economy. Except that they don't pay U.S. taxes or live in the United States.

The bipolar world has become a multipolar economy. In the 1960s, East Asia accounted for only 4% of the world's economic output. Today, that region accounts for 25%. At the same time, the GNP in the United States has been growing at a not-bad 3% annual rate, but the Pacific Rim has seen rates that have been more than twice that high. Taiwan and South Korea, not so long ago low-cost countries themselves, now find that they have to ship some work to lower-cost places like China.

The economy for the Age of Networked Intelligence is a *digital economy.* In the old economy, information flow was physical: cash, checks, invoices, bills of lading, reports, face-to-face meetings, analog telephone calls or radio and television transmissions, blueprints, maps, photographs, musical scores, and direct mail advertisements.

In the new economy, information in all its forms becomes digital—reduced to bits stored in computers and racing at the speed of light across networks. Using this binary code of computers, information and communications become digital ones and zeros. The new world of possibilities thereby created is as significant as the invention of language itself, the old paradigm on which all the physically based interactions occurred.

The technological whirlwind sweeping us into the digital economy is relentless. Patrick Stewart, the great Shakespearean actor who played Captain Jean Luc Picard in the *Star Trek* TV series, points out that the original *Star Trek* communicator—the device used to transmit the famous phrase, "Beam me up, Scotty"—now has a parallel in the cellular flip-phone. In the follow-on series, *The Next Generation,* the character Wesley Crusher, teenage son of the ship's doctor, received his education via individualized on-line sessions through the ship's computer—not so much different from how engineers learn today through the networks of the National Technological University (NTU). John Seely Brown, head of the Xerox Palo Alto Research Center (PARC), talks about the shift from tools that support the mind to tools that support relationships. All these future shocks have come in less than a generation. David Ticoll, Alliance for Converging Technologies (Alliance) president says: "The pace of innovation and onslaught of new technologies is accelerating so fast we have to have regular discussions in our research teams to define and maintain consistency of neologisms." As Nicholas Negroponte says in his lucid book *being digital:* "Early in the next millenium your right and left cufflinks or earrings may communicate with each other by low-orbiting satellites and have more computer power than your present PC. Your telephone won't ring indiscriminately; it will receive, sort, and perhaps respond to your incoming calls like a well trained English butler. Schools will change to become more like museums and playgrounds for children to assemble ideas and socialize with children all over the world. The digital planet will look and feel like the head of a pin."[1]

The new economy is also a *knowledge economy* based on the application of human know-how to everything we produce and how we produce it. In the new economy, more and more of the economy's added value will be created by brain rather than brawn. Many agricultural and industrial jobs are becoming knowledge work. Already almost 60% of all American workers are knowledge workers and eight of ten new jobs are in information-intensive sectors of the economy. The factory of today is as different from the industrial factory of the old economy as the old factory from the craft production that preceded it. Farms are operated with agricultural equipment brimming with chips. Cargo is shipped in containers loaded by giant computer-controlled cranes or in jumbo jets loaded with software. Products themselves have knowledge content. There are smart clothes with chips in the collar; smart vehicles brimming with microprocessors that do a hundred new things every year; smart maps that tell a trucker's location and automatically change tire pressure according to the weather

and road conditions; smart radios that store the traffic report for when you want it; smart houses that manage energy, protect you from intrusion, and run a bath for you before you arrive; smart elevators that phone in when they're getting sick; and smart greeting cards that sing to you. These are only a few examples.

More than that, the knowledge content of dumb products is increasing in new ways. In the new economy, adding ideas to products and turning new ideas into new products is what the future is all about. Whether people act as consumers or producers, adding ideas will be central to wealth creation in the new economy. Take something as low-tech as bread. There are now boutique bakeries where you can specify the ingredients for your own custom bread, order it over a computer network, and have it delivered that afternoon. Your ideas, culture, knowledge, and tastes about bread become part of the loaf. The bread increases in knowledge content and is mass-customized rather than mass-produced to meet your individual needs. And the gap between you as consumer and as producer narrows.

The existence of "virtual aliens" points to the role of networks in this new age. In the agricultural age, what mattered was the plow and the mule. In the industrial age, steel, engines, fuel, and roads were king. In the Age of Networked Intelligence, silicon, microprocessors, and roads of glass fiber as thin as a human hair are enabling humans across the hall and across the planet to apply their know-how to every aspect of production and economic life. This is an age of networking not only of technology but of humans, organizations, and societies.

Nathaniel Hawthorne, who inspired the development of the telegraph, wrote in 1851: "By means of electricity, the world of matter has become a great nerve, vibrating thousands of miles in a breathless point of time. ... The round globe is a vast ... brain, instinct with intelligence." For over a century humanity has been taking steps to realize Hawthorne's vision of a world where human intelligence could be networked. That age has arrived. Organizations can become conscious on a global scale. Perhaps societies and even humanity can as well. As Vice President Al Gore puts it: "These highways, or more accurately networks, of distributed intelligence ... will allow us to share information, to connect and to communicate as a global community. From these connections we will derive robust and sustainable economic progress, strong democracies, better solutions to global and local environmental challenges, improved

health care, and—ultimately—a greater sense of shared stewardship of our small planet."[2]

The overall structure of the economy is changing as well. A new industrial sector is emerging from the convergence among computing (computers, software, services), communications (telephony, cable, satellite, wireless), and content (entertainment, publishing, information providers). This structure is depicted in Figure 1.1. This interactive multimedia industry is narrowly defined as 10% of the U.S. GDP. By the end of 1996, this industry will be an almost $1 trillion industry—44% computing, 28% communications, and 28% content. By 2005, the industry will have grown to $1.47 trillion. (See Appendix 1.)

Just as the automobile changed the landscape of the world, both physically and socially, interactive multimedia will revolutionize the world again. Already, more Americans make computers than cars, make more semiconductors than construction machinery, and work in data processing than in petroleum refining.[3]

The impact of the new sector can be seen when examining data on job growth (Appendixes 2, 3, and 4). Although output in this sector is growing faster than are jobs, there is significant employment growth. It is noteworthy that whereas output growth is fastest in the computing sector, jobs are growing fastest in the content sector.

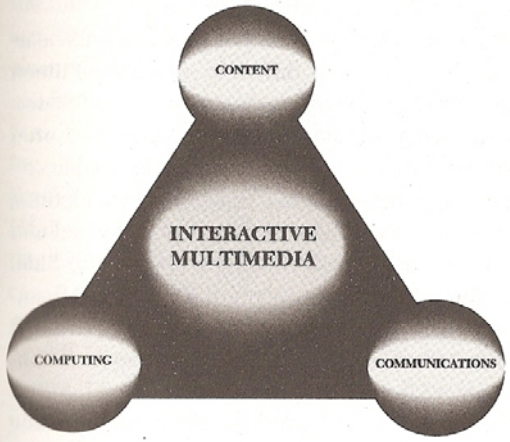


Figure 1.1 *Converging Technologies.* SOURCE: © New Paradigm Learning Corporation, 1995.

A NEW ENTERPRISE REQUIRED

The new economy is creating a tyranny of conflicting drivers causing every company to rethink its mission. Virtual aliens and a hundred other factors are pressuring the cost structure of large companies. Time to reach market is critical when products have a competitive life span of one year, one month, one week, or one afternoon, as in the case of some products in financial services. Innovation, rather than access to resources, plant, and capital, is what counts most. (Remember when eyeglasses took two weeks?) Customers have changed, expecting that companies must provide best quality, green products, fast, at lowest price, with best service, and ensuring social responsibility—to name a few.

Five years ago, competitors to Xerox were Kodak, Canon, and Ricoh. Today, the rivals are Hewlett-Packard, Microsoft, and IBM. Five years from now, it may be Sega-Genesis, Andersen Consulting, AT&T, and the banks. The most famous last words that could possibly be uttered inside any firm these days are: "We don't have any real competition." No one is secure, not even the Fortune 500 companies. Of the companies on that prestigious list in 1955, 70% are now out of business. Of the companies on the 1979 list, fully 40% no longer exist as corporate entities. By 1993, the combined market value of Intel and Microsoft was larger than that of IBM; the suppliers had become more valuable than the customer.[4]

The Queen of England's bank—Barings—was put under by a 28-year-old employee. American banks have faced different pressures. Fifteen years ago all the top money-center banks were based in the United States. Now, none are. In fact, of the world's twenty-five biggest banks, measured by assets, fifteen are Japanese—and now many of them are in trouble.

In the digital economy, competition doesn't come from competitors only—it comes from everywhere. When information becomes digital and networked, walls fall and no business is safe. There is nowhere to hide. Take the case of Microsoft's ill-fated attempt to acquire the personal financial software company Intuit. The proposed deal was dropped by Microsoft in light of potential Justice Department opposition, which was in turn stimulated by the banks. The financial industry was worried that Microsoft would become a bank! Consumers would pay bills electronically using Microsoft software, generating almost instant annual revenues of hundreds of millions of dollars. Microsoft could then demand a share of the clearinghouse revenue of the banks. Over time, brand identities of the banks would

fade as consumers would appear to use Microsoft products for banking. Microsoft could also enable investors to surf the stock market and execute trades themselves, "disintermediating" the investment banks. As *Fortune*'s Terence P. Paré put it: "Microsoft would become, in effect, a nationwide consumer bank."[5] Banks would become commodity suppliers competing only on price. And although Microsoft backed off from the Intuit deal, it is clearly not backing off from being a player in the world of electronic banking.

In the 1980s, American business believed the answers would come from MBA graduates. Management also grabbed any passing guru with a catchy phrase covering customer satisfaction, high-octane productivity, and competitive culture. "Adopting 'new' ideas became a way for companies to signal to the world that they were progressive, that they had come to grips with their misguided pasts, and that they were committed to change. After all, the worst thing one could do was stick with the status quo," say Nitin Nohria and James D. Berkeley of Harvard Business School.[6] In the 1990s, there is no status quo. The velocity of change in information technology has seen to that. Products are becoming digital. Markets are becoming electronic. Industries are in upheaval. Organizations are having to go far beyond reengineering to fundamentally rethink everything about themselves and their future. As Tony Comper, president of the Bank of Montreal, says: "It's kind of like the early days of the universe after the Big Bang, when gasses are congealing and galaxies are forming. No one is really sure how it will all sort out and it's not yet clear where Earth is."

Even the tried-and-true familiar clichés of business are no longer accurate. Take the old adage that executives used in the past to halt fresh thinking, "If it ain't broke, don't fix it." At Philadelphia-based Bell Atlantic, they've not only updated that phrase, they've stood it on its head, saying: "If it ain't broke, keep looking." Home Depot, with more than 300 stores the largest home-improvement center in the United States, puts the same case differently: "Unless you keep fixing it, someday it will be broke." For many companies with products having short life cycles, the message should be, "If it ain't broke, break it before your competitors do." What that means for the future of business is this: Only those organizations that understand the pace of change and can develop successful strategies—and are willing to ride that wild surf—can succeed. As Bette Davis said in *All About Eve*, "Fasten your seatbelts. It's going to be a bumpy night."

What's a business person to do?

For starters, create a company. Many of the brightest and most energetic people of the new economy would rather create a business than change an old big one. "Big" was what made companies successful in the old economy. Today, being big is often a liability, whereas innovation, agility, and organizational learning are the key variables for success. Besides, by growing your own, you get to share in the value you create.

Or maybe you've chosen to "reinvent" your current company. Just about everyone agrees that a shift from the traditional bureaucratic hierarchy is needed. The new organization has many names. Peter Drucker calls it the "networked organization."[7] Peter Senge has coined the "learning organization."[8] Davidow and Malone call it the "virtual corporation."[9] For Peter Keene, it's the "relational organization."[10] For Tom Peters, it's the "crazy organization."[11] For D. Quinn Mills, it's the "cluster organization."[12] Charles Savage calls it "human networking."[13] Russell Ackoff describes the "democratic corporation."[14] For James Brian Quinn, it's the "intelligent enterprise."[15] For Michael Hammer and James Champy, it is the "reengineered corporation."[16] For Gary Hamel and C.K. Prahalad, the challenge is not just a new organizational paradigm but a new strategy paradigm.[17] Call it what you like, fundamental change is necessary.

The new enterprise is a network of distributed teams that act as clients and servers for each other. Teams received a big push back in the 1980s when John Welch, GE's CEO, launched the workout program, which was centered on the creation of cross-functional teams. Now teams reach out to customers, suppliers, and others, thereby changing the relationships between organizations.

Easy? No, but it surely can't be as hard as Charles De Gaulle found running France to be. "How can you govern a country," the soldier-statesman once lamented, "with 246 varieties of cheese?"

Moreover, the answer lies not in new organizational structures. As Petronius Arbiter, an officer in the Roman Imperial Army, said in 60 A.D., "I was to learn later in life that we tend to meet any new situation by reorganizing, and a wonderful method it can be for creating the illusion of progress, while producing confusion, inefficiency and demoralization."

Companies need fundamentally new strategies for the new economy. Networking is enabling new structures and new strategies. But even more, it is enabling strong personal trusting relationships among people—relationships that are very different from those of the old hierarchy. Having trouble building a learning organization? Individual learning requires intelligence and consciousness. Such learning has been going on for millennia. But both can now be networked to create conscious organizations. Organizational consciousness is a prerequisite for organizational learning. The new networks are opening the bandwidth of human communication. But how?

THE I-WAY: HYPE, REALITY, AND PROMISE

At the heart of all this change is the much-hyped, much-maligned, but absolutely critical information highway (I-Way). Networks are the foundation of the digital economy and the Age of Networked Intelligence.

Now is a good time to hit the slo-mo button and sift through some of the I-Way's claims and criticisms. Even though the term *information highway* has been in common use for only a few years, some people are tired of hearing about it. Others object to the term on aesthetic grounds. But as Bob Allen, chairman of AT&T, points out: "There's good reason why the highway metaphor has become so widely used. It's a form of shorthand for the collective expectations people all over the world have for what information technology can deliver."[18]

There is also a justified sense of enthusiasm about the emerging opportunities for business and society, not to mention a widespread concern about how those benefits may or may not be achieved. If anything, the hyperbole is low key compared to not only the potential but what has already occurred.

Based on the model of the Internet—the vast, expanding network of networks—the I-Way is becoming a high-bandwidth web of communication systems that will pump huge quantities of text, sound, images, and video into and out of homes, businesses, factories, hospitals, schools, and government offices. Although there are other important technologies, such as satellites and terrestrial wireless technologies, the Internet is emerging as the exemplar of the I-Way. Broadly defined, the publicly available network (referred to in this book as "the Net") is the means by which all computers in the world will be able to communicate.

And what will be the "killer application"—the software tool or use that will catapult the new technology into mass use? This debate is basically silly, making about as much sense as a hypothetical discussion of the killer application for the telephone from decades earlier. The telephone was and is used for financial applications (placing orders for stocks), man-

agement applications (supervising a remote employee), health care (collaboration between hospitals), personal applications (courting), and thousands more applications. But the telephone pales in comparison to the richness and capacity of interactive multimedia. The I-Way will be used for every kind of communication, information, business, learning, entertainment, and social development application we can imagine—and millions more.

The "Killer Application"?

Some I-Way applications will change the world. Others won't. For example, staff at the University of Cambridge Physics Department were wasting time walking down the hall to see if the coffee was ready. The solution? They put the coffee pot on the Net with a video camera. Their collaborators at Butler University in Indianapolis occasionally take a break to check on the status of Cambridge's coffee.

And will we be couch potatoes watching more TV? Chances are we'll be doing less watching and more interacting. The TV is converging with the home computer and telephone to create the information appliance that is intelligent, interactive, and multimedia. This appliance will look a lot more like a computer than a TV. The number of houses with PCs is growing phenomenally every year. In 1993, 21 million households had PCs; in 1994 the number reached 30 million, a 43 per cent increase; by the end of 1995 the number will be 45 million. Networking has grown even faster. In 1994 the number of home PCs with a modem was about 5 per cent. By the end of 1995 this had doubled to 10 per cent. We can expect that the number will continue to double until 1998 when most will be connected.

Rather than enabling more MTV cartoon characters like Beavis and Butthead, there is a growing consensus in business, government, community, and social interest groups that the I-Way can be the key to economic and social success. Evidence is mounting that it will provide a new basis for everything from wealth creation, national competitiveness, the reinvention of the corporation, the renewal of the business of government, and the sustaining of social development, all the way to the saving of lives, protection of the environment, improvement of democratic processes, and nation building. This may sound like hyperbole. It is not. It is a conclusion based on the extension of the current experience with the new technology in changing the way we do business, work, learn, and live.

To begin, it is a misnomer to call the new economy a service economy. Industrial production and agriculture will continue to be central as long as humans need to eat, be housed, be clothed, and be mobile. However, just as agriculture was transformed by the industrial age (by tractors, milking machines, etc.), so both agriculture and industry are being transformed in the Age of Networked Intelligence. Industrial production now has robotics, computer-aided manufacturing, and mass customization. Farmers have PCs on their tractors. When the cow is sick, you log on to a network, do an interactive diagnosis ... and while you're there you might check prices on the commodity market.

Just as the highway system and electrical power grid were the infrastructure for the industrial economy, so our information networks will be the highways for the new economy. Without a state-of-the-art electronic infrastructure throughout organizations, no country can succeed. Organizations and societies that understand this shift have a chance of succeeding in this crazy, new, volatile, competitive business and geopolitical environment. Those that don't will be bypassed and fail.

The I-Way will enable the networking of intelligence as the pipelines for knowledge transfer and human collaboration become digital, vast, and of very high capacity. Some brief examples illustrate the concept. A rural doctor consults an urban specialist by sharing high-resolution images of a lab test or EKG over the I-Way. An auto mechanic checks with factory technicians on new models through interactive television, pointing to a 3D simulation of the part in a window on the screen. Aerospace researchers thousands of miles from one another instantaneously view and discuss sophisticated wind-tunnel computer models. A consumer shops at home for a new sweater through an interactive video catalogue, perhaps trying on the sweater to see how it looks on a computerized model of her body. A cluster of companies comes together on the Net to create and market a new set of products—previously not possible due to constraints of the physical world. A nuclear physicist studies a 1979 KGB document showing, prior to the disaster at Chernobyl, how the main reactor pillars are 100 mm out of alignment. A family plans its holidays by taking an interactive multimedia walk poolside at the Hyatt Caribe resort in Cancun—without leaving home.

The crowning achievement of networking human intelligence could be the creation of a true democracy. Technology itself is shifting from mainframe, host, centralized computers to *network computing*, where each computer has autonomy and functions as a peer of the others. Similarly, rather than an all-powerful centralized government, arrogating decisions to

itself, governments can be based on the networked intelligence of people. Individuals can collaborate on networks to create processes and decisions that correspond to their real needs. People can become directly and indirectly involved in making important decisions. Government as centralized mainframe can be replaced by government as network. And perhaps by combining their intelligence, people can create new levels of consciousness at the local, regional, national, and even international levels.

The I-Way is not some future dream. The garden paths, roads, on-ramps, and bridges (see sidebar on analogy madness, pg. 23) are being built today and many are already working. Between now and the end of this decade, I-Way construction and use will grow like crazy.

Take the Internet. One fairly reliable method of measuring growth is to look at the number of host computers on the Net. Hosts are the computers that deliver information and services to users; hosts range in number from one to thousands. According to the Internet Society, which measures traffic, there were around 100,000 hosts in 1989; 1 million by 1992; and close to 10 million by the end of 1995. This number is projected to grow to more than 100 million before the end of the decade!

Although no one knows for sure, conservative estimates put the number of users of the Internet at around 10 million in 1993, approaching 50 million by the end of 1995 (Figure 1.2). There should be well over 1 billion

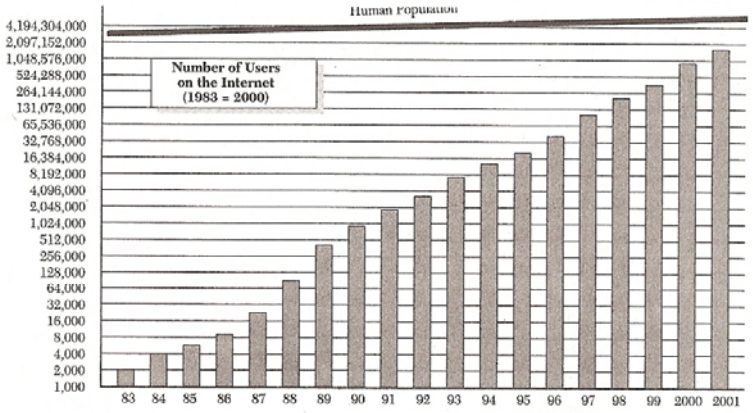


Figure 1.2 *Estimated Number of Users on the Internet—1983–2001.* SOURCE: © New Paradigm Learning Corporation, 1996.

before the end of the decade. By the end of the decade there will be more than 1 million networks connected. Traffic in the network will exceed telephone traffic. There has never been any technology or innovation in human history that comes close in speed of adoption, significance, and impact.

Back when he was still a senator from Tennessee, Al Gore was well ahead of the curve. In 1991, after fifteen years of promoting federal policy that invested in information superhighways, Gore wrote: "Gutenberg's invention, which so empowered Jefferson and his colleagues in their fight for democracy, seems to pale before the rise of electronic communications and innovations, from the telegraph, to the television, to the microprocessor and the emergence of a new computerized world—an information age."

When Gore became Vice President, he began using that position as a bully pulpit to promote an electronic highway that would parallel the post-war construction of interstate freeways and what those concrete links did for economic development. Gore is right, because in a global market there is an urgent need to eliminate—or at least reduce—time and space dependencies and to move to new forms of economic activity, learning, and social development.

WHAT IS TECHNOLOGY TO A KID?

> Apple fellow Alan Kay once said that technology is "technology" only for people who are born after it was invented. Twelve-year-old Niki Tapscott would agree. When asked if she would participate in a "consumer of the future" panel at a technology conference, she lectured her father; "Okay, Dad, I'll do it if you want me to. But I don't understand why you adults make such a big deal about technology. Kids just use computers to do stuff. We don't think of them as technology. Like a fridge does stuff. It's not technology. When I go to the fridge, I want food that is cold. I don't think about the technology that makes food cold."

Ironically, the Internet was created not by social visionaries but by cold warriors at the Department of Defense. The Internet was launched as a packet-switching system in 1969 for the Advanced Research Projects Agency (ARPA), part of the Department of Defense, so that ARPA research sites could share information and give access to computers elsewhere. The model of the network was highly distributed rather than the current vogue—hierarchical—to enable easy re-routing of communications in the case of an attack.

Electronic mail (e-mail) was a kind of add-on feature that allowed researchers to send messages to one another, and it quickly became among the most popular aspects of the system. Other outgrowths included electronic conferences and bulletin boards where messages, questions, comments, and other types of information are posted for anyone to read and react to what's going on in what has become known as cyberspace.

What ARPA was trying to do was connect users without worrying about how many networks were involved or how the connections were made. It has become a network of networks that allows global access to computers and databases as diverse as the Library of Congress all the way to little-known publishers. Because the Internet consists of local telephone systems, all of them interconnecting, it's particularly helpful when long distance lines are out. In the hours following the January 1994 earthquake in Los Angeles, the Internet and other on-line systems all reported high usage because they were working when other connections weren't. Prodigy (a joint venture between IBM and Sears Roebuck and Co.) had its second busiest day when users, hungry for up-to-date information, plugged in and worried relatives posted notes on electronic bulletin boards looking for loved ones. There were 813,000 log-ons compared with 890,000 on Bill Clinton's election day, about one third more than a typical day. Another service, GEnie, saw use double in the twenty-four hours following the first shocks. During the early days of the coup attempt against Mikhail Gorbachev in 1991, the Internet offered the only accurate information.

An offshoot are "freenets," another way of thinking globally, acting locally. In their simplest form, freenets are just electronic bulletin boards, usually organized to serve one city or small region, that let individuals send electronic mail to one another without going, in the jargon of the users, F2F (face-to-face). E-mail is already doing for the modern world what the British Post Office did in the eighteenth century when the rates were made standard. Could there be a modern parallel to the strength of industrial Britain as a result of regularizing the cost of communicating the written word?

Originally, the most popular use for the Net was e-mail and what might be called "chat," that is, practical pursuits. Corporate e-mail systems are now changing the way that many companies communicate and work. Scott McNealy, CEO of Sun Microsystems, says that Sun's 13,000 employees send or receive, on average, about 1.8 million electronic mail messages per day. That's an average of over 135 per person per day. People wasting time, you say? Well, somehow working this way works. Pound per pound, Sun is

one of the most profitable companies on Earth. Now e-mail systems are being hooked up to the Internet, expanding the addressable population from a company's employees to the tens of millions of Net users. These days, a business card without a Net address is seen as a sign that you're some kind of Jurassic manager.

Beyond e-mail, a new world of applications is opening up. If a city agency has decided to put a contract out for tender, the specifications can be posted on the Net. That means a contractor doesn't need to dispatch an employee to pick up a thick document from city hall. The contractor can simply call up the contract, capture it in the company's own system, and read it whenever the need strikes. When the time comes for the contractor to put in a bid, the return trip is just as easy. Author Stephen King marketed a short story, *Utney's Last Case,* by putting it on the Internet, thus giving electronic nomads a free read. For the rest of the stories in the collection, *Nightmares and Dreamscapes,* the nomads phoned or sent a fax (with credit card number) to a designated bookstore.

Before the Gulf War, linguist George Lakoff placed some interesting new analogies on the Internet for discussion. He was concerned about the analogies being drawn between Saddam Hussein and Hitler, so he asked a series of questions about the Hussein-as-Hitler metaphor. His thinking quickly spread and became part of the fabric of the discussion, a way of elevating the tone of debate and placing modern times in a historic context. Yet, there is another point here—access to the thinking was widespread. Lakoff's thesis wasn't published in some learned magazine with small circulation or delivered at a think-tank gathering of like-minded souls. The Internet set the tone for the debate.

Alex Finds Wayne Gretzky on the Net

When 9-year-old hockey player Alex Tapscott and his teammate Stephen Senders needed to solve a debate about their hero Wayne Gretzky, they interrupted Alex's dad to get access to the Net. Dad took a break from his Mac, and two minutes later the boys had found an NHL server in Hawaii containing a spec sheet on Gretzky. They printed it with a color photo of their hero and the debate was settled. They were both right. When Dad asked Alex why he went to a server in Hawaii, Alex replied: "We just thought it was so amazing that they would have information about hockey in Hawaii that we wanted to check it out." Alex and Stephen—Net surfers.

The new technology is penetrating our lives; much of this is happening through our children. Over one-quarter of American homes have a computer, but for many adults the machine is a mystery, or it is used for word processing, accounting, or home business applications. Children, on the other hand, are using machines for games, homework, communications, art, music, reference, and a host of emerging applications on the Internet. The average age of an Internet user is twenty-one and declining.

Such communications capacity doesn't mean an end to infojunk. When telegraph wires were first strung between Texas and Maine in the nineteenth century, writer Henry Thoreau wondered if the two states really had anything constructive to communicate. Maybe, Thoreau said, the telegraph system was nothing more than an "improved means to an unimproved end." Thoreau isn't the only writer to twit new ideas. Columnist Dave Barry has had similar fun with the information highway, wondering whether or not the whole thing isn't just "CB radio with more typing."

But already software "agents" or "knowbots" are on the marketplace. They go out onto the Net to find the information you want. Rather than drowning in data, agents will provide the structure to form data into information and the context into which to translate information into knowledge. When you apply your own human judgment and transhistorical insights, knowledge can become wisdom. Chances are the Net will enable us to move up this chain rather than down.

The World Wide Web

And how do you get on the Net? Various on-line services are available today including America Online, CompuServe, Prodigy, GEnie, and MicrosoftNet. Strangely, however, it was a freenet called the World Wide Web (WWW or "the Web"), as discussed earlier, that really got things going.

The WWW was developed at the European Particle Physics Lab as a vehicle by which to share information about high-energy physics among physicists working in a dispersed international environment. Led by Tim Berners-Lee, the developers rightfully reasoned that coming up with standards for hardware or software was a waste of effort. Instead, they developed a standard for representing the data. The standard was called the Hypertext Markup Language, or HTML. Using HTML, you simply attach a proper tag to a word or phrase causing it to become a link to another page. This link can be to a document on the same machine or on one across the world, exploiting the other major innovation on the Web, a universal addressing system. With this addressing system, nearly any Web document, optionally including sound, image, and even video, can be accessed and viewed effortlessly, without redialing another number, knowing any computer addresses, or entering log-in IDs.

A Net browser called Mosaic was the catalyst that got the WWW going. In February 1993, Mosaic was released by University of Illinois student Marc Andreessen. This event catalyzed the explosion of information exchange now occurring. With Mosaic, a Mac, Windows, OS/2, or UNIX user with any level of Internet access could literally view the world of on-line information as a vast, seamless, interconnected universe. You entered at any point and began exploring, effortlessly visiting something called Home Pages and information-rich documents from around the world. Most with-it companies now have Home Pages—places where customers and others can go to learn about their products, services, and the companies themselves. Through the hypertext links called "hotlinks" you simply click on any highlighted word in a document and link to other computers, Home Pages, and documents anywhere. According to John Landry, "Mosaic 'energized' the World Wide Web."

Mosaic was the first wildly successful graphical browser for the Web. According to Landry, "Andreessen must have watched *Field of Dreams*. He believed that if he built it they would come—and come they did."

To get Mosaic, all you had to do was download it, for free, from the University of Illinois or numerous other "mirror" sites around the world. In 1994, every day nearly 4000 people did. In the first two years since release, over 1 million copies were downloaded from Illinois, thousands more from the mirror sites, thousands more from sharing disks, yielding estimates of more than 3 million users before the end of 1994. In January 1993, when Mosaic was introduced, there were only fifty known Web servers. By October 1993 there were more than 500. By June 1994 there were 1500 growing to 5000 by the end of the year. By the end of 1995 there were more than 100,000 Web servers.

Now the market has shifted to a commercial product based on the Mosaic model called Netscape, which is provided by a commercial venture cofounded by Andreessen. The new company is able to offer the kind of support and quality expected of commercial software. And in a widely oversubscribed public offering in August 1995, Andreesen became an instant multimillionaire.

Adam Landry—New Information Publisher!

Adam Landry, 15-year-old son of Lotus chief technology officer John Landry, has built his own Home Page, complete with pictures (from a photo CD) and curriculum vitae (sports, music, travel, etc.). His CV highlights, in particular, those interests he feels would be attractive for consumption by browsers of the opposite sex. He's debating whether to put in "No Girlfriend, Yet!" And, of course, Adam can track interest in his Home Page. Of special interest to him is the number of hits from young ladies. (This gives a whole new meaning to "being hit on.")

According to Dad, "Adam is no geek, but he does know how to compose HTML pages because he downloaded the instructions off a server on the Net. Compose the page with any text editor, tag it with HTML, and link it to another page and voilà, you're a Webster!"

So Adam Landry, sophomore at Wayland High, is now an information publisher, and his interests, opinions, image, and voice, as well as links to things that he thinks are "cool" on the Web, are available effortlessly to millions of people worldwide. And the value of that experience for him is incalculable, and for Dad, unforgettable. And although Adam hasn't realized it, he is an early example of an incredible worldwide phenomenon that will revolutionize learning, work, and living. As Dad puts it: "This is the new information publisher—Adam Landry."

One turning point for the commercial use of the Net was the formation in 1991 of the Commercial Internet Exchange (CIX), a group of commercial Internet providers that established cooperative agreements to let users communicate with others, regardless of which network provided their Internet connection.

But nobody owns the Net. Every participant owns it. The Net is about giving something back as much as it is taking advantage. Intrusive ads, gratuitous junk mail, and nothing-for-nothing attitudes will do a disservice to any organization that contemplates using these tactics on the Net (in fact, such users risk being heavily criticized and ostracized faster than they can say "I'm sorry").

Internet-related standards are truly global and are advancing at a rapid rate to meet the demands of the participants. The users of the Net are deciding the viability of Net services (voting by their use). We are entering a new era of truly open systems in which all technology platforms can participate and all users can have a say.

This is not to say that there are no problems. There are huge issues regarding security and authentication on the Net. The expression used to

be, "Doing that is like putting it in the *New York Times*." Now it is, "Doing that is like putting it on the Internet." But the genius of tens of thousands of companies and hundreds of thousands of people from the converging industries of computing, communications, and content (entertainment and publishing) is being applied to transforming our nascent networks into a robust information highway. And every day the situation changes and improves.

Other concerns center on control of the Net. The introduction of Microsoft Network in late 1995 was seen by many as an effort to take over the Net, although arguably the company is now just another player (albeit a significant one).

Highway Analogy Madness

Bumper-to-bumper: Sex chat group.

Construction delays: When mergers fail and alliances peter out.

Drive-by shootings: Your competitor steals a client.

Easy rider: Ace on the Net.

Fastlane: Broadband communication networks, as in "Life in the Fastlane."

Firefighters: Those who attempt to douse flamers.

Gridlock: Network's down.

Guardrails: A way of imposing responsibilities on I-Way users.

Holiday Inn file: No surprises.

HOV lane: Bulletin board.

In the ditch: Where organizations go that aren't getting ready for the Net.

Mad drivers: Flamers (those who bury neophytes or traffic violators with abusive messages).

Minimum speed: A 286.

On-ramps: The computers, televisions, and other information appliances and their associated software providing access to the Net.

Out of gas: Information underload.

Pedal to the metal: Putting the boots to mainframes.

Photo radar: Videoconferencing gone awry.

Pothole: Pentium chip.

Rest stations: MUDS—Multi User Dungeons to pause for a respite. As in virtual water cooler.

Road hogs: I-Way riders who load up e-mail addresses.

Roadkill: The companies that either through poorly conceived strategies or failed alliances end up as someone else's dinner.

Rush hour: A bad time to be on the Net.

Tollbooths: Devices that may be used to collect taxes to pay for services and enable the highway to be extended to underserved areas.

Tow trucks: Systems administrators who can rescue crashed systems.

Traffic jams: What happens at rush hour. See Gridlock.

Out of control: I-Way analogies.

Such advances mean that time and space have become far different concepts than they once were for the 40% of Americans who do some part of their job each day away from the office. Some 8.8 million people were telecommuters in 1994, a 16% increase from 7.6 million in 1993.[19] The most eye-popping example of telecommuting must surely be Steve Roberts, who publishes *High-Tech Nomadness* while he rides the roads on a bike with built-in keyboard, computer, and Earth station. His motto: "Home is everywhere."

The future has arrived in Palo Alto, California, where citizens have been provided with full, two-way Internet capability. Access nodes in City Hall mean that the Palo Alto World Wide Web server accommodates 1500 inquiries a day for information such as the city government directory, local maps and train schedules, local news, and access to the Stanford University server. "It truly opens up possibilities and potential we haven't even imagined yet," says Palo Alto mayor Liz Kniss.

The project is just part of what's known as Smart Valley, Inc., a nonprofit organization that acts as a focal point for information infrastructure and applications projects on a regional basis—an electronic community that will include Silicon Valley, San Francisco, and Santa Cruz. Such high-speed networks can help business use distributed work teams, do two-way videoconferencing, deliver parts designs to fabricators, and reduce publishing and delivery costs. Telecommuting in particular may change the very makeup of the region; the project has a goal to make up to 10% of all area employees telecommuters by the end of the decade. "The public access phenomenon is sweeping the Bay Area and the nation," says Dr. Harry Saal, president and CEO of Smart Valley. "It is a wave we are all catching."

The future is information technology, and it isn't just for propeller heads. It's not just about bits and bytes and other jargon. Instead, the new technology is a real business tool that shakes up the basics of the game. Look at gains made possible by IT in the retail sector. After ten years of going nowhere, productivity began to skyrocket at the beginning of this decade. "Information technology is suddenly making a difference," says Jerre Stead, former head of AT&T Global Information Solutions. "The collection, dissemination, and analysis of customer information has become an essential prerequisite of a modern retailing operation. Technology is no longer just an aid to retail strategy—it's at the heart of the strategy."

At its simplest level, IT can tell a retailer when and if expansion is required. Talbot's, the women's wear chain, collects the zip codes of all shoppers at the point of sale and uses that information to plan future stores. At a more complex level, Wal-Mart is organized so that inventory is minimized, suppliers decide when to ship, and Wal-Mart can pay for its goods with cash collected from consumers. Chase Manhattan Bank is using interactive video kiosks to supply product information to clients. Nordstrom, of Seattle, Washington, offers a direct mail catalog through on-line services like Prodigy, CompuServe, and America Online. The next step in the evolution will be an interactive multimedia application that will be the equivalent to an in-store personal shopper. The secret of Nordstrom's future success, according to Pat Adkisson, operations and business development manager, is "being where the customers want to be, whether that is in stores, in a catalog, hi-glossy brochures, talking to an 800 number personal shopper, on the road ordering through a dial-up on their laptop, or in the home."[20]

Now retailers are set for the really big changes as markets become electronic. Want a pair of custom-designed Levi's jeans? Click onto Levi's Home Page on the Net; watch the program about how to measure yourself; enter the data and your credit card number and within a couple of weeks the jeans arrive at your house, guaranteed to be a 100% perfect fit. The work of creating the jeans is done by many companies working on the Net that are coordinated not by Levi's but by a new company called Custom Clothing Technology. Many stores as we know them will be replaced by virtual stores and FedEx trucks. The bricks-and-mortar buildings that remain will have to become interesting places to actually visit.

For many organizations, however, their structure and the people within them are long out of date because the world has changed. The gap is widening between what is actually occurring and what we believe is going on. New leaders must be created with strategic visions that fit tomorrow.

"When you come to a fork in the road," says everyone's favorite baseball pop philosopher Yogi Berra, "take it." The world is at just such a crossroads and must embrace change. The industrial age is over; the Age of Networked Intelligence is beginning.

And Who Will Build the I-Way?

Because public coffers are empty and leading-edge innovation is desirable, the private sector needs to take the front-line role in financing, building, and operating the information highway, but there are many differing views on where the business opportunities lie. In the nineteenth century, when railways were built across the North American continent, investors found that the most profitable aspects turned out not to be passengers (the population was too thin) but the millions of acres of real estate that went with the right-of-way. The information superhighway may be just like that. As Joel Birnbaum of Hewlett-Packard puts it: "In a gold rush there are two ways to get rich—digging for gold and supplying the infrastructure for the gold diggers."

There are also vigorous debates regarding the nature of the highway. For example, will it be based on the telephone networks, cable systems, satellites, digital radio, or other transmission media? What will be the most important applications—business, education, entertainment, shopping, health care, interpersonal communications? What will be the economic model—that is, how will users pay for using the Net? And how can companies make money? Right now there appear to be more prophets than profits on the Net. What will be the structure of the I-Way—an open network of networks like the Internet, or some other model?

An emerging consensus is that more competition and less regulation are necessary to stimulate private-sector investment and innovation. In such a world, governments act as referees to safeguard the public interest rather than controllers of how technology will evolve. Perhaps the first inkling of this change came in 1984 with the government-ordered breakup of AT&T and the creation of the so-called Baby Bells. The resulting competition in the residential long-distance telephone market is widely credited with driving down costs, improving quality, and stimulating innovation.

For example, in 1987 AT&T said it would take more than two decades to convert its network to superior digital technology. But the competitive pressure from companies such as MCI and Sprint forced AT&T to achieve the conversion in just four years. In the past decade American residential long-distance costs have dropped 50%.

Reengineering: Inadequate for the New Economy?

If the main management tool of the past half dozen years has been business process reengineering (BPR), a far more comprehensive approach is urgently needed to handle the challenges of the new situation. What matters in every case is that the new technologies can transform not only business processes but also the way products and services are created and marketed, the structure and goals of the enterprise, the dynamics of competition, and the actual nature of the enterprise. "Virtually every business will find it possible to use these new tools to become more competitive," Vice President Al Gore said in his 1994 speech to the Academy of Television Arts and Sciences. "And by taking the lead in quickly employing these new information technologies, America's businesses will gain enormous advantages in the worldwide marketplace."[21]

Why isn't BPR making the grade?

The Four Problems with Reengineering as Practiced

1. *The cost reduction thrust.* BPR arose in the early 1990s, fueled by a recession and the beginnings of the restructuring of western economies. Cost cutting was the focus of most businesses, and BPR fit in well with that goal. Downsizing, rightsizing, smartsizing, streamlining, working out, and reengineering became euphemisms for cutting costs—typically headcount.

As one CEO asked of the BPR manager in a bank, "How many heads are we gonna get?" Another was heard describing a project: "When we found redundancies everywhere, I had to bite the bullet and lay off a bunch of people." (The reference to biting the bullet is interesting. During the American Civil War, soldiers facing amputation were given a bullet to bite to help distract them from the excruciating pain. But here we have the amputator, rather than amputee biting the bullet.) One company was so obsessed by reengineering that to save money they turned off the light at the end of the tunnel ...

As the new economy gathers steam, companies in most sectors need to focus on growth and value-added objectives, rather than just cost cutting.

Cost control will be important forever and in some sectors key to competitive success. But even in the most cost-sensitive businesses such as retailing, companies need to shift their paradigms—marketing electronically, for example, delivering goods rather than building actual structures. BPR is inadequate and in some cases diversionary from such out-of-the-box thinking. Whether reengineering is well intentioned or not, there is a danger of companies entering into some new corporate *anorexia*, to use the phrase made popular by management consultant Gary Hamel, where in pursuit of cost control they permanently downsize their market share, revenues, profits, long-term competitiveness, and viability.

2. *BPR focuses on business processes.* A business is more than a set of processes, so process improvement is an inadequate response to the challenges of the new economy. BPR projects typically miss opportunities to go beyond the streamlining of work to the transformation of business objectives and effectiveness. The starting point for transformation should not be the business process but the business model—the high-level abstraction of how the business can respond to and create markets, of what the business is and could be. The new economy demands that companies change their business model, and the new technology enables it.

The best impact of BPR itself occurs if it is done within the context of a higher-level model of the business. Says Dave Cox, CIO at Northern Telecom: "We found that we needed to get beyond the lower-level process modeling being done by many companies today. We found that when we did BPR we lacked the larger context of the business model. Having spent some time developing that model, our horizons have been widened and reengineering projects have far greater scope and creativity. Companies need to bring business modeling into prime time."

Furthermore, reengineering typically focuses on and results in creating relatively *structured* business processes. However, in the new economy much of the effort of the new enterprise is knowledge work based on teams, changing human networks, new types of jobs, serendipitous communications, ad hoc collaboration, and brainstorming for innovation.

Ron Ponder, CIO of AT&T, is responsible for the work of more than 25,000 information systems professionals. His message to all of them is to focus on the customer. "Reengineering doesn't cut it. Every company needs to make processes better, faster, and more economical—but this is really just continually fine-tuning your operating structure," says Ponder. "But you can't use reengineering to transform a business. You reengineer inside of a

business, addressing operational needs of the business. But our transformation is coming from the outside in. It is market-driven, not process-driven."

3. *The human imperative.* In many situations, BPR projects have misunderstood the human imperative. Projects with a goal of massive cost cutting have often been resisted by workers; newly reengineered business processes are conducted by demotivated workers. Couple this with what Paul Strassman calls "the violence of reengineering" and you have a formula for fear. Finding the dark side of reengineering is simple. Here are just a few of the pronouncements by reengineering leaders. "On this journey ... we shoot the dissenters."[22] "What you do with the existing structure is nuke it!"[23] "[Re]engineering must be initiated ... by someone who has enough status to break legs."[24]

Furthermore, many reengineering efforts falsely assume that some senior czar or steering committee can, in a top-down way, comprehend business processes as well as opportunities for change and sell this vision down to the organization. Such approaches are contrary to modern thinking and practice about creating learning organizations, shared vision, and team leadership.

Reengineering theorists to date have also missed the broader implications of the IT-enabled transformation of business on virtually every other aspect of human work and social life. Huge issues need to be tackled—from quality of work life, retraining, and lifelong learning for the new economy, the changing nature of work and the end of the career as we know it, the danger of a haves and have-nots society, all the way to fundamental changes in the nature of the workings of government, the democratic process, and democracy itself.

4. *Old paradigm views of technology.* Many reengineering proponents assume information technology is critical to new processes. However, other than *Paradigm Shift*, none have really explained how the old paradigm in technology is ill-equipped for the new enterprise. As a result, many companies have thrown old paradigm technology at new paradigm reengineering problems. To bring about organizations that are high performance, integrated, networked, open, and client-service, companies need the new technology that is high performance, integrated, networked, open, and client-server. The old model of computing—low performance (traditional mainframe or minicomputer), unintegrated (based on islands of computing), host-based (rather than networked), proprietary (nonembracing standards), command and control (unlike client-server) computing—is the antithesis of the new enterprise.

The Power of Internetworking

As John Landry, chief technology officer for Lotus, told me: "I'm not talking about incremental change here. I'm talking about a set of technologies that will be as significant in impact as assembly-line technology was to mass production, and as mass-media technology was to mass marketing. But this internetworking technology will replace many advantages of mass production and mass marketing by allowing for mass customization … creating, in some industries, custom goods better, faster, and cheaper than mass-produced goods and providing the framework for addressing individuals with custom marketing and messages and individualized customer service."

Rather than only quality or reengineering, companies need a new approach for business transformation. The differences among the three are outlined in Table 1.1.

QUALITY, BPR, AND BUSINESS TRANSFORMATION: WHAT ARE THE DIFFERENCES?

Table 1.1 Differences Among Quality, Reengineering, and Business Transformation

	Quality	Reengineering	Business Transformation
Full-scale Deployment	1980s	1990s	Latter 1990s
Life Cycle	Mature	Midlife	Embryonic
Goals (in practice)	Reduce defects	Streamlining, cost displacement, and cost avoidance	Value creation, new products/services delivered through new distribution channels to new markets
Business Context	Globalization, new international competition, changing customer expectations	Recession of the early 1990s and pressures from the emerging economy for disaggregation, responsiveness, and strategic efficiencies	Rise of the digital economy, the national information infrastructure, new drivers for innovation
Targets	Incremental	Breakthrough	Breakthrough
Approach	Continuous improvement	Greenfield—start from scratch	Envisioning the future, modeling today, gap analysis, and migration plan
Investment Required	Relatively low	High (management attention, work redesign effort, information systems)	High (management and all other personnel involved, migration to enabling infostructure)
Impact	Long-term	Short- and middle-term	Short-, middle-, and long-term
Success Rate of Those Undertaking	High (for those that stick it out)	Low	Moderate
Domain	Product	Process	Enterprise, extended enterprise
Competitive Differentiation	No. Quality is a necessary but insufficient condition for competitiveness.	No. Strategic efficiencies are required for competitive parity.	Yes, if done correctly.

THE DARK SIDE OF THE AGE OF NETWORKED INTELLIGENCE

There are significant perils for business in the new economy. Some companies that have delayed embracing the new media are already showing signs of falling behind. As Alliance collaborator Araldo Menegon says, "When we look back at the end of the century, companies will have fallen into two categories: those that did and those who did not." But the dark side extends beyond the business imperatives for change.

When Alexander Graham Bell invented the telephone, he thought he was creating a tool to help deaf people and that's how he wanted to be remembered. Thomas Edison thought the main use for the phonograph would be as a dictation machine. Johannes Gutenberg had no idea what the impact of his invention would be on society, but movable-type printing in the fifteenth century meant that books became more widely available.

Knowledge was no longer the privilege of a very few. Gutenberg changed culture, science, power, economic structures, and the very fabric of society.

The early pioneers in the automotive business were equally unaware of the revolution they were unleashing. The car was a liberator that provided mobility to the masses and helped to create wealth and jobs, but there was a terrible downside, too: cities cloaked in smog, the alienation of suburbia, carnage on the highways, sprawling metropolitan areas, and streets choked by traffic. In the words of Joni Mitchell's lament, "They paved Paradise and put up a parking lot." At the same time, the automotive sector became the dominant force in the U.S. economy for the most part of the twentieth century, employing one worker in six.

At this point, it is unclear how the new media will affect the way society does business, works, learns, and lives. Yes, the I-Way is already evolving to provide the infrastructure for a digital economy. In the digital frontier of this new economy, however, old social norms, laws, regulations, institutions, education, and customs are proving to be inadequate and inappropriate. There appear to be more questions than answers regarding what is to come and how business and societies can successfully manage the transition.

There is widespread concern that life in the settlements of the new digital frontier and in the vast society to follow may not be entirely pleasant.[25] Fear lurks everywhere that technology will bring unemployment, numbing of the mind, and invasion of privacy.

Are we to become captive of the new technologies? Will a new technology imperative or market-driven determinism confound our ability to guide these new tools in responsible directions? Can we devise useful investment criteria, organizational structures, marketplace rules, and government policies to ensure that technology serves people?[26]

Revolution is usually the midwife of a new age. Violence, war, and social upheaval are all part of the transition from an old economy to a new one. How will the transition to the Age of Networked Intelligence be achieved? So far in the 1990s, the world has seen far too much violence. Nor has suffering remained outside the realm of the developed world. The 1995 bombing in Oklahoma serves as a fearsome reminder that not all is right.

There are far-reaching management and social issues as we make the shift:

- Change will cause dislocations. Employment in agriculture went from 90% of the population at the turn of the century to 3% of the population today. Today, the worker displaced when the foundry in Nashville closes

can't get a job in the Northern Telecom plant where the average plant worker has the equivalent of a community college degree. The fact that we're entering a new economy is of little consolation to that displaced worker and his or her family. How will we manage the transition to new types of work and a new knowledge base for the economy?

- The I-Way has the chilling potential to destroy privacy in an unprecedented and irrevocable manner. Most of us believe we have the right to decide what personal information we divulge, to whom, and for what purpose. We accept that we must give government and corporations some details about our lives to qualify for services, loans, and so on. But such information should be used only for the purpose for which it was obtained and not sold to someone else. And if the demand for information seems unreasonable, we can always say "no." Left unchecked, the I-Way could render such thinking irrelevant. As human communications, business transactions, working, learning, and playing increasingly come onto the Net, unimaginable quantities and types of information become digitized and networked. How can we safeguard privacy in an economy that is digital?

- Recent trends show a severe bipolarization of wealth in which the top 20% of households—those worth $180,000 or more—have 80% of the country's wealth. This skewing of income and wealth is happening faster in the United States—the leading new economy country—than anywhere else and faster than ever before. Surely this is undesirable, but is this trend reversible? An ill-conceived information highway and transition to the digital economy could foster a two-tiered society, creating a major gulf between information haves and have-nots—those who can communicate with the world and those who can't. As information technology becomes more important for economic success and social well-being, the possibility of "information apartheid" becomes increasingly real. Is there an emerging "revolt of the elites"[27] who will use the new infrastructure to further cocoon themselves—children in private schools, paying for their own social services, surrounded by high perimeter fences, identifying closer with friends and business associates in cyberspace, losing any sense of responsibility to others in their physical communities or country? (In 1995, the hottest real estate category was "secure communities" surrounded by walls and security systems and accessible only through guarded gates. However, the Oklahoma bombing indicates that the perimeters will have to be expanded.)

- What about other gaps caused by differential access to the new technology and the economy—between knowers and know-nots, men and women, old and young, cities and rural communities or inner cities, whites and minorities, skilled professionals and unskilled hourly workers, developed world and undeveloped world? A study on home ownership of computers in Canada points to the problem. By education: high school—27%; college—47%; university—63%. By income: less than $30,000—21%; $40,000 to $49,000—39%; over $70,000—66%. By gender: men—45%; women—35%. By profession: professional—62%; unskilled 27%. How will the new technology change the social fabric?
- What impact will the digital economy have on quality of life? Will telework create new, flexible, enjoyable working environments, or will it enslave people to piecework done in isolation? Will we, as some pundits argue, drown in data or amuse ourselves to death? As Alan Kay says, "Another way to think of roadkill on the information highway will be the billions who will forget that there are offramps to destinations other than Hollywood, Las Vegas, the local bingo parlor, or shiny beads from a shopping network!"[28] As technology invades our offices, homes, cars, hotel rooms, airplane seats, kitchens, and washrooms, is there a danger of the separation of work and leisure vanishing? Psychologists have already argued that multitasking is leading to new stress-related disorders. Or can the technology do the opposite—freeing us, stimulating us, relaxing us?
- What will be the impact of the new media on the family? The new media hold the promise of strengthening the family by moving many family activities dispersed by industrial society back into the home. These include some working, learning, shopping, entertainment, health care, caring for the elderly, and even participation in democracy. But are there other dangers? Despite its unhealthy impact on people, television at least brought families together around an electronic hearth. But in my family today, it's not unusual for the four of us to be clicking away on our keyboards in separate rooms. Further, some families will have better access to the new media than others.
- How will we deal with the sleaze and porn running down the gutters of the I-way? How will parents protect their children from the exaggerated yet very real, unwholesome, violent, racist, sexist, and (for lack of a better word) disgusting experiences available on the Net? Rather than pulp fiction, how to protect them from violent offensive "bit" fiction, or worse from pedophiles prowling the Net for victims? Censorship and the purification of cyberspace as envisaged by the 1995 Communications Decency Act is neither feasible nor desirable. It won't work because, as Internet pioneer John Gilmore says, "The Net interprets censorship as damage and routes around it." Further, the Act doesn't differentiate between naughty behavior among consenting adults and obscenity. It makes the federal government a censor for communication between adults. As such it is an unprecedented attack on free speech. How should this problem be addressed?

Marilyn Ferguson was one of the first to popularize the notion of a paradigm shift in the *Aquarian Conspiracy—Personal and Social Transformation In Our Time.* In 1976 she wrote that a paradigm shift involves dislocation, conflict, confusion, and uncertainty. New paradigms are nearly always received with coolness, even mockery or hostility. Those with vested interests fight the change. The shift demands such a different view of things that established leaders are often the last to be won over, if at all.[29]

This is leading to a crisis of leadership in many organizations, in business, and in the developed world as a whole. Many businesses are falling behind because of old economy thinking. Corporate executives, blinded by cynicism about the poor payback from the old technologies, are unable to see the opportunities for the new.

Still, important changes are happening in the world of work. The contract between a company and those who perform work is being altered radically, for employee loyalty and job security are no longer acceptable bases for employment. Some people have mistakenly argued that the concept of the job is obsolete, but these new directions do not mean that all knowledge workers will become independent contractors. Rather, they will thrive from intense collaboration that is provided by an organization. Organizations can also provide an environment for trust and learning.

At the same time, the concept of supervision and management is changing to team-based structures. Anyone responsible for managing knowledge workers knows they cannot be "managed" in the traditional sense. Often they have specialized knowledge and skills that cannot be matched or even understood by management. A new challenge to management is first to attract and retain these assets by marketing the organization to them, and second to provide the creative and open communications environment where such workers can effectively apply and enhance their knowledge.

One of the most important emerging themes is trust. It is only when workers identify with the goals of the organization and trust its managers to act in mutual self-interest that effective knowledge work can be performed. As Riel Miller, OECD economist working with the Alliance says, "Netiquette is not, as some have implied, about being nice. It is about creating the norms and rules on a new frontier where trust between people is essential for functioning." Yet how can trust be created and maintained in molecular, virtual, ever-changing businesses where there are no guarantees of permanence?

Many governments seem slow to comprehend the shift; bureaucracies by definition resist change, thinking that heads-down is the route to survival. Can government become electronic, transforming the way government services are delivered? The so-called reinvention of government is not possible without reinventing the delivery system for government, and in doing so, dramatically reducing costs and improving the services government provides to its customers. And beyond changing the business of government, how can the new technology and the new economy change the nature of the democratic process itself? Will the electronic town hall become an electronic mob? Will cyberdemocracy become hyperdemocracy? Or can we craft a new age in which networked intelligence can be applied for the good of the people?

And what will be the role of the unions in the new economy? It is in the interests of working people to partner with business and government to help achieve transformation. Every nation needs competitive businesses or it will face structural unemployment; but national competitiveness cannot be achieved through a low-wage strategy. Such approaches are generally infeasible (reducing wages from $15 per hour to $1); undesirable (reducing purchasing power, motivation, and quality of life); and unnecessary. A low-wage strategy will not bring national competitiveness and success in the new economy. Rather, countries can attract investment and generate new wealth and high-paying jobs only through a value-adding workforce—one that is highly educated, motivated, disciplined, empowered, and equipped with state-of-the art knowledge tools and infrastructures. But will organized labor step up to a fuller role and help to change institutional structures or, in restricting ambitions to combating employers for the short term, will they become marginalized?

As for the mass media, they have an uneven appreciation of the challenge as well; the misunderstanding of many in the media is reflected in simplistic stories of computers killing jobs. Can the media shift to become

full participants in achieving a national awareness of the transformation we are going through?

What about education? There's an old saying that war is too important to be left to the generals. In the new economy, learning is too important to be left to the schools. Besides, as knowledge becomes part of products, production, services, and entertainment, the factory, the office, and the home all become colleges. As educational activity shifts from schools to firms, will businesses continue to emphasize social responsibility, humanism, liberal arts, and political and moral values, or will they shift values to competitiveness, profit, and materialistic goals?

Can the formal education system transform itself? Can we create a virtual college or university system for all the other faculties that eliminates the lineups of tens of thousands of prospective students across the country? Will teachers and administrators be able to reinvent education? Talk to the students; they're willing. As Geoffrey Bannister, president of Butler University, says: "Just wait till the generation of teenage Internet users hit the universities where the average age of a tenured professor is fifty. Sparks are going to fly!"

The regulatory environment will have to change, too. In this intense, competitive environment we need an open, competitive domestic environment for telecommunications. We can't continue the current practices; they hobble progress.

Every company, hospital, school, publication, police force, local government, retailer, union, native band, and nation needs to find within itself the leadership for transformation. And with will, every person, regardless of position in an organization, can become a leader for change.

The easy route for businesspeople is to turn their backs on such complex challenges. Every corporation needs to grapple with these questions because they will deeply affect their customers, employees, and the environment for business transformation. Rather than passively observing or merely predicting these broader societal changes, businesspeople need to become actively involved in solving the problems and shaping the future.

The challenge is one of leadership for the digital frontier. Executives from all industry sectors are uniquely positioned to provide socially responsible leadership in resolving the myriad of emerging challenges the new technology is posing to the way society works, learns, and lives. We must forge common directions and strategies for a new economy and a new age. Businesspeople need to make a turn and do the right thing. Let the discussion begin.

NOTES

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PART ONE

THRIVING IN A NEW ECONOMY