

HIGH TECH, FREE TRADE
AND
A CENTURY OF PROGRESS*

Human Enterprise in the Wired Global Village

by

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As with almost any type of human enterprise, timing can be crucial in the forecasting business. Twenty years ago, we compiled a decade's research on historic patterns of technologic innovation and concluded that, while computers would eventually revolutionize all enterprise and produce a surge of productivity and prosperity, these happy outcomes would first require substantial investments in workforce up-skilling and organizational restructuring. Guided by historic examples of successful technologic adaptation and organizational transformation, we counseled enterprises to make specific near-term commitments and investments, in order to be prepared to exploit information technology when it matured, and to capture the "high ground" before their competitors.

Unfortunately, our blueprint for post-industrial success, *Future Forces*, was released in 1984, at the end of the "Great Recession" of 1981-83. Having just come through 36 months of massive layoffs, rising inflation and plunging profits, the American marketplace was not interested in reading that genuine prosperity was still a decade or more of hard work in the future, especially when the prevailing economic wisdom of the moment – "supply side economics" – promised that corporate America was going to be able to "buy" prosperity off the high-tech shelf, paid for by investment tax credits and accelerated depreciation rates. While big picture conceptualizations of the future, like *Powershift* and *Megatrends*, sold briskly, our "intellectual rearmament/ organizational transformation" game plan disappeared from the booksellers' shelves.

Undaunted, almost ten years later, we published our most recent book, *America in the 1990s*. The central message of this book was that, after twenty-five years of desultory economic performance, the U.S. was about to enter a quarter-century of soaring national productivity and prosperity. And, just as we were putting the finishing touches on our manuscript, the cheerful conclusions of our own long-term research were reinforced by newly-released work from economic historians at Stanford University's Center for Economic Policy Research, in Palo Alto, California.

Policy makers in Washington had asked the scholars in Silicon Valley to explain why the \$1 trillion that corporate America had spent on IT during the 1980s had not improved business productivity and profitability. After sifting through the records on the last techno-economic transformation through which the U.S. had passed – the shift from steam to electric power – the economic historians concluded that it simply takes a half-century or so for a breakthrough invention to mature into an affordable, universally productive tool. They also found that, once a new general-purpose technology reaches marketplace maturity, it sustains a surge of rising productivity and prosperity that lasts for decades.

In the early 1990s, the U.S. was ready for an explosion of prosperity. For over twenty years, average real wages had been falling and the gap between the wealthiest and the poorest Americans had been growing, as the U.S. passed through the “counter-productive” phase of maturing computer technology. But, with the Stanford chronology to back up our own models of techno-economic assimilation, we reasoned that, by the second half of the 1990s, IT should have matured enough to generate substantial new marketplace value. Within five years, we confidently asserted, a rising tide of increasing productivity would be “lifting all our boats.”

The Boom Arrived on Time. . .

Our book was released in January 1992, in the face of the biggest monthly layoffs in America since 1931. Our forecasts were dismissed as mindlessly optimistic. *America in the 1990s* was quickly remaindered, while dystopian books like *The End of Work* and *The Jobless Future* were best sellers. The bright side of all this, of course, was that we were right. U.S. productivity improvement rates began to rise significantly in 1993, and average wages stopped their 21-year-long decline in August 1994. Today, average household income in the U.S. is at an all-time high, as are per capita wages. Perhaps most importantly, the income gap between the “haves” and the “have-nots” in America has been shrinking since 1993; and with the recent declines in stock market values, the wealth gap has also significantly narrowed.

... but Went Home Early

Of course, recent declines in equity values – and in corporate profits – have also called into question the entire idea of an “information revolution” and a “new economy.” Indeed, U.S. and global economic growth surged simultaneously since 1994, and have slowed simultaneously in the past twelve months. One can easily assemble an explanatory model of the 1990’s world economy in which plunging PC prices and the introduction of color and graphics on the Internet – i.e. “the Web” – rapidly transformed a useful piece of office equipment into a compelling mass-market consumer product. Under this scenario, once the consumer market became saturated, the computer industry would be just another low-profit-margin appliance-maker, adding no leveraged value to the larger economy.

Some economists are certain that this is precisely what has happened. The global PC industry now has a 200 million unit annual production capacity. This is enough to handle projected First world growth and replacement, plus gradual expansion into the Second and Third worlds, much of which will initially be equipped with rebuilt First world hand-me-downs. If the prosperity of the past five years – in the U.S. and elsewhere – was simply the natural consequence of scaling up the global IT industry, now that this expansion has been largely completed, traditional economists expect to see an end to double-digit growth in the IT industry, followed by a period of consolidation, during which the economies of the world will begin to behave much more like they did from 1950 to 1995.

Macro-economists at the Federal Reserve, the O.E.C.D. and the big international investment houses, on the other hand, are convinced that the entire U.S. economy has begun to shift to a higher long-term rate of productivity improvement, and that the rest of the industrialized nations will ultimately follow suit. Their confidence rests largely upon the not unreasonable assumption that, with a robust info-structure now in place, competitive marketplace realities will force all enterprises to copy the proven best practices of the successful early-adopters in their respective industries, inexorably driving up productivity and prosperity worldwide.

Why We’re Not Going “Back to the Future”

While it is possible that the traditional economists are correct, and that the industrial business cycle has now returned, history suggests that such a “back to the future” scenario is highly unlikely. At the same time, while the progression of historic techno-economic revolutions has been inexorable, they have not been single, sweeping events, like a forest fire or a tidal wave. Rather, technologic revolutions have typically been episodic, roller coaster processes, propelled by the ongoing interaction between maturing technology and changing socio-economic circumstances. In this context, the current hiatus in our technology-driven economic expansion is much more likely the entirely expectable side-effect of our transition

from one stage of the Information Revolution to the next; specifically, from the PC to the PDA.

Now Entering the Post-PC Era . . .

When we emerge from the PC→PDA transition, the PC will no longer be the principal device by which we do digital things. Essentially every post-industrial person will be carrying a personal digital assistant, or PDA (which by that time will surely have acquired a less cumbersome popular name). For most of the world's population who have electronic access to one another, the PDA – not the telephone – will provide that access. PDA's will eventually afford billions of people with their only access to personal computing, using code and memory that they will buy or rent from on-line providers.

In the global electronic marketplace, the PDA will be the “automobile” for the information highway, or “I-Way.” Meanwhile, the PC will principally be the tool of programmers, content creators, trouble shooters and power users; an “S.U.V.” for the I-Way. Whatever the means, a crucial dimension of the transition from PC's to PDA's will be that, from now on, a growing share of the world's population will have ready access to enormous computing power and to the informing/communicating capabilities that such power can make casually available.

Computing will not only become ubiquitous in the decade ahead, it will also become garrulous. In less than ten years, many routine marketplace inter-actions – e.g. restaurant and travel reservations, stock purchases, weather information, customer service and assistance, etc. – will involve conversational computers with simulated personalities. And, as voice recognition/speech replication improve (2010-15), PDA's will morph into personal “verbots” – chatty, hand held cyber-assistants, programmed to be helpful, resourceful, trustworthy and cheerful – who will make our appointments, keep our Rolodex's up-to-date, and serve as our personal search engines, fetching data and compiling files in response to our verbal instructions.

. . . Next Stop, the “Wireless Global Village”

From the standpoint of the *production end of enterprise*, conversational computing has huge potential for reducing training costs while improving productivity at all levels of operation by affording all employees easy access to expert systems, diagnostic feedback and peer collaboration and review. From the standpoint of the *marketing end of enterprise*, the arrival of conversational computing means that anyone with a telephone will eventually have access to the Internet. Within five years, Voice Application Service Providers (VASPs) expect to have linked up to two billion people to the World Wide Web, up from 300 million today. Once one-third of the world's population has access to a single info-sphere, we truly will have become a “global village.”

The problem with this impending avalanche of miraculous IT capabilities is that they all require low-cost, high-speed wireless Internet access. And, while there are at least a half-dozen different communications technologies capable of providing such access, all have been delayed by problems in “development,” most are underfunded, and all are competing with the current dominant providers of high-speed Internet access, the Baby Bells and the cable television companies – who are not particularly eager to see cheap wireless competitors enter a marketplace that they have previously had largely to themselves, charging monopolistic rates. We are about to live through a classic phase of techno-economic revolutions, in which powerful, established institutions of the pre-revolutionary era seek to maintain dominance in their industries by preempting new-era competitors. This will involve large-scale, hard-ball, winner-take-all campaigns, fought not just in the marketplace, but in the courts and the legislatures. The struggle will almost certainly last for several years, and the outcome is by no means certain.

A “Hydromatic” Shift (or Slipping Transition)

This temporary but indefinite disruption in the continuum of IT innovation has given rise to our current economic slowdown. The decline in IT expansion has already produced fallout in the stock market and is now expected by industry experts to lead to a shakeout in the PC business as early as this fall, especially if, as is widely forecast, year-to-year PC sales volumes in 2001 drop for the first time in 20 years. In fact, since all mature mass markets eventually coalesce to a limited number of competitors, economists have long assumed that the rising costs of R&D, combined with occasional business cycles, would eventually reduce the PC industry to two to four dominant manufacturers. If Dell buys Gateway next November, it will provoke comment, but it will be an entirely expectable event that will have little impact on America’s long-term economic performance.

The impact of our “slipping transition,” on the other hand, will loom more substantial with every passing year. A recent analysis by the Brookings Institution in Washington, D.C., has concluded that, for the IT industries to return to robust growth, residential high-speed Internet will have to achieve mass-market adoption rates. While the most sanguine industry experts expect to achieve such sales volumes within 12 to 24 months – peaking in 2007 – recent reassessments suggest that the residential broadband market won’t “take off” until 2005 or 2006, and won’t peak until 2010-2011. Such a delay, the Brookings report concluded, would cost the U.S. economy over \$500 billion in lost economic growth during the second half of this decade.

Over a five-year period, a half trillion dollars represents roughly a one percent annual increase in the U.S. gross domestic product; not something that society should contemplate foregoing lightly. But the macro-economists are not nearly so excited by the theoretical possibilities of new technologies yet to come as they are about the proven potential of new technologies that we have already installed and mastered. In

every major U.S. industry, trade and profession, there are critical-mass communities of enterprises engaged in “best-tech” practice. In any given economic sector, the best-practice firms amount to no more than five percent of the sector’s employers, but they have set formulaic examples of IT usage for other enterprises in their field to follow. Using existing technologies and proven organizational practices, any enterprise should be able to achieve the productivity and profitability of the most successful enterprises in its industry. And the necessities of free-market competition, the meta-economists reason, will eventually force **all** enterprises to adopt best practice.

Frictionless Commerce: The Power to Transform

The world’s macro-economists remain sanguine about the long-term outlook because they believe that the capital investment required to sustain and extend the productivity improvements of the recent past is already largely in place. Together, the world’s installed computing capacity combined with the installed digital communications capacity of the Internet now constitute a global information infrastructure – or “info-structure” – that will enable all enterprise to engage in “frictionless commerce.”

Frictionless commerce will manifest itself in a multitude of ways, from the mundane to the metamorphic. In the mundane world of daily work over the next 10 years, the info-structure will finally permit us to eliminate paper from 99 percent of all business-to-business (B2B), business-to-government (B2G), and Citizen-Government-Citizen (CGC) transactions. This is not a trivial matter. Paperwork places an enormous “drag” on the efficiency of individual organizations and entire economies. In the U.S., the average lifetime overhead cost of a typical paper-based purchase order has been variously estimated at between US\$50 and \$100, when all accounting, records management, internal audit, retrieval and error correction costs are factored in. The same procurement, executed electronically, has an average overhead cost of between US\$0.50 and US\$5.00.

The Yankee Group estimates that the average overhead cost for a government or private sector institution to handle a telephone inquiry from the public is between \$25 and \$33; while the same inquiry handled over the Internet has a typical overhead cost of \$1.50. Similarly, Booz Allen Hamilton estimates that the overhead cost for the average paper banking transaction is US\$1.07, while an electronic transaction costs only US\$0.01.

In a report released in February 2000, the U.S. investment bank Goldman Sachs projected that the cost savings simply from shifting existing paper-based transactions to the Internet would boost the long-term annual output of the U.S., German, Japanese, British and French economies by 5 percent for the foreseeable future. Meanwhile, to foster global commerce, the U.N. Center for the Facilitation of Administration, Commerce and Transport (UN/Cefact) is currently working with OASIS (Organization for the Advancement of Structured Information Standards) to

develop an easy-to-use on-line international trading system that will allow companies to do business with customers and suppliers anywhere in the world, and which will also supply documentation to customs and tax authorities, banks, and insurance companies. UN/Cefact expects the new online software – called ebXML, and slated for release later this year – to substantially reduce the US\$420 billion annual cost of paperwork associated with the world’s US\$6 trillion in international trade.

In addition to eliminating costly paper from most transactions, the infrastructure will also eliminate costly cash from most transactions, as well. Those retail transactions that are not handled by credit, debit or “smart” cards will increasingly be paid for via “smart” cell phone. From now on, a growing percentage of all vending machines, parking meters, and toll booths, etc., will be given telephone numbers so that people with Net-smart cell phones will be able to charge the little transactions of daily life to their phone bills.

With its enormous capacity to reduce the overhead costs of paperwork and cash accounting throughout the marketplace, the *transactional efficiencies* arising from frictionless commerce will clearly be substantial. But it is the *organizational efficiency* made possible by frictionless commerce that will most enhance the performance of free-market capitalism in the years ahead and, in the process, dramatically transform the organization of private and public enterprise. This structural metamorphosis is happening because, as frictionless commerce reduces the overhead costs of all transactions, it changes the answer to a fundamental question of all enterprise: “What are the boundaries of this organization?”

Transaction Costs Determine Organizational Boundaries

The issue of organizational boundary underlies the recurring management question of whether to do something in-house, to out-source it, or to partner with others. The parameters of this question first entered the economics literature in 1932, in a paper defining “The Nature of the Firm,” by British professor, Ronald Coase, who was 81 years old when the Royal Swedish Academy of Sciences finally awarded him the Nobel Prize in economics for his ideas in 1991.

To be fair to the Academy, until the Internet came along, Coase’s insights, while true, made little difference to the marketplace. In his original lecture, Professor Coase demonstrated that marketplace price is **not** the sole determining factor when management decides whether to outsource a good or service, or to produce it in-house. There are also significant overhead – or “transaction” – costs, to use Coase’s word, involved in finding the right vendor at the right price and the right time, and by negotiating the right terms and then executing and administering the contract. Such costs, Coase argued, are often the dominant factors when management decides whether or not to outsource. Indeed, for most of the 20th Century, the transaction costs of outsourcing remained so high that it was essentially ignored as an organizational option except in special circumstances.

Basically, until the 1990s, essentially all *formal* commercial communications were on paper, and moved by mail. Official interaction between individuals in different organizations routinely took days. This was too slow and unpredictable for the complex logistic requirements of industrial mass production, so most large-scale manufacturers initially chose to produce their own components and services in-house. Henry Ford, for example, didn't just produce his own tires; he had his own rubber plantation in Brazil. *The Saturday Evening Post* didn't only run its own paper mill in Maine, it owned thousands of acres of trees to supply the mill, and a fleet of steamships to transport the paper to its Philadelphia printing plant. The practice of "vertical integration" worked so well for industrial enterprise that internal self-sufficiency was widely adopted by most large private enterprises and public institutions, from insurance companies and public schools to retail chains and tax collection agencies.

Today, however, the Internet has changed the context of enterprise. Almost overnight, the transactional efficiencies of on-line commerce have dramatically reduced the overhead costs of outsourcing. Net service providers can locate and vet qualified suppliers, and conduct competitive selections in a matter of hours. What's more, as most in-house communication – including telephony – migrates to the Internet, dealing with subcontractors will be no different from dealing with co-workers; it will all be via e-mail and video-conferencing. Indeed, the capacity of cyberspace to make institutional barriers and boundaries transparent – and porous – will prove extremely useful, because from now on, **everybody** in modern enterprise will either be dealing with subcontractors, or be a subcontractor, or both. This is because outsourcing has proven to be the most effective way for dealing with the universal management challenge of the computer age: INFORMATION OVERLOAD!

Outsourcing Information Overload

In every industry, trade and profession today, and for every kind of production process, fabrication material or technical practice, as well as for every administrative function and managerial activity, there is an ever-rising FLOOD of information dealing with every crucial parameter of every enterprise and its operating environment, including regulatory changes, competitive innovations, product quality/liability, consumer values, intellectual capital, etc. As a result, the leadership of a typical vertically-integrated enterprise today requires the mastery of a semi-infinite array and volume of data. This problem first acquired crucial dimensions in the U.S. electronics/IT industry in the late 1980s, when information overload was exacerbated by accelerating rates of technical innovation and corporate realignments.

To cope with their increasingly unmanageable planning and decision-making environments, U.S. IT firms were among the first to seriously commit themselves to a "virtual enterprise" strategy, by disaggregating from their vertically-integrated enterprises those functions whose equivalents could be purchased in the marketplace

at lower cost than they could be produced in-house. These initiatives have the twin benefits of **both** reducing costs **and** concentrating management's focus on a reduced number of variables. In 1991, the Iacocca Institute at Lehigh University – a U.S. auto industry truly critical think tank – produced a 10-year scenario, *21st Century Manufacturing Enterprise Strategy*, in which it urged the automotive industry as a whole to abandon its traditional vertical integration in favor of collaborative networks of independent competitive suppliers. This plan, which has largely been carried out by America's "Big 3" auto makers, has been instrumental in improving the quality of U.S. cars and the profitability and market share of U.S. auto companies.

Abandoning Vertical Integration . . .

The Outsourcing Institute at Dun & Bradstreet, the U.S. investments analyst, has estimated that the annual amount spent by U.S. corporations, non-profits and government at all levels on outsourced components and services will reach over US\$300 billion this year, up from U.S.\$100 billion in 1996. To date, most commonly outsourced functions in the U.S. are administrative services, such as facilities management, payroll and data processing. Unisys now earns two-thirds of its revenues from operating the computers it sells, and Hewlett-Packard earns over an eighth of revenues from such turnkey operations. BP has contracted out most of its accounting to PricewaterhouseCoopers, and **all** of its human resource management to Exult, a California human resource consultancy. The Canadian Customs and Revenue Agency has outsourced its payroll operations and the Australian Defence Ministry has even outsourced its military recruitment to Manpower, Inc.

While the outsourcing of administrative services is a departure from traditional management practices, it does not constitute a radical restructuring of enterprise, especially to the degree that it permits the outsourcing organization to focus more on its central purpose and core operations. Presumably, the executives at BP can focus their undivided attention on the enormous complexities of the international oil and gas business without having to worry whether their books are in compliance with the tax laws of the 60 countries in which they have operations. And the Australian Defence Ministry will be able to devote more time to matters of military importance, secure in the knowledge that Manpower, Inc. will deliver the contracted 5,000 to 6,500 qualified recruits per year.

Other recent adopters of outsourcing, however, have used the opportunities posed by frictionless transactions to seriously examine the value added by **each** of their individual organizational components. Much to their surprise, many have found that the unique, competitively superior elements of their operations number *a relatively few select activities or components*. For example, only 20% of the employees at Volkswagen's Sao Paulo plant have a VW logo on their uniforms; the other 80% have logos from Rockwell, Cummins or Maxion, etc. In most cases, components at the Brazilian plant are being installed by employees of the companies that made the components, while VW personnel handle market research, design and

engineering, contracting, coordination, final assembly, testing, quality control and marketing.

IBM made an even more audacious commitment to disaggregation in the spring of 1997, when they announced that they would *outsource the assembly of their PCs*. IBM based their decision on the fact that, by the mid-1990s, nearly all IBM PCs sold were uniquely configured to suit each individual customer's specific requirements: i.e., differing combinations of motherboards, graphic and communication boards, etc. As a result, more than 90% of all business PCs shipped by IBM were substantially disassembled and reconfigured by the dealers, requiring several hours of essentially duplicated effort per unit sold. IBM's pragmatic solution to the problem was to outsource the original assembly of their PCs directly to the dealers.

An in-house strategic assessment had concluded that IBM was not able to mass-produce built-to-order (BtO) machines competitively. (In fact, IBM offered factory-produced BtO PCs in Europe for several years, and found that they could not do it as well – or as profitably – as the retailers.) So now, IBM invents and develops new technologies, designs and engineers new PCs, manufactures and/or contracts for the multiple components of the PC, and then has everything shipped to the dealers/resellers for assembly to individual customer specifications. This “distribution channel assembly” strategy permitted IBM to cut the price of its BtO PCs to the price range of off-the-rack, discount computers, and 9% below comparable machines sold by its principal competitors.

As “Anonymous” observed many years ago, “There is nothing so powerful as an idea whose time has come.” Within six months of IBM's announcement, not only had most PC makers in the U.S. market adopted some form of “distribution channel assembly” arrangement, but most computer retail chains had begun to order components directly from suppliers to permit them to assemble house-brand BtO PCs for 10% to 20% less than non-customized, national brand PCs. Today, across a growing array of industries, marketplace experience suggests that most enterprises are able to achieve startling improvements in performance simply by retaining and improving those value-adding functions they perform well while outsourcing to others those functions at which they are not marketplace competitive.

The improved marketplace outcomes commonly produced by the unbundling of vertically-integrated enterprises are consistently so significant that it is important to remind ourselves that, until the Internet made it possible to “*virtually* integrate” the outputs of multiple dispersed independent suppliers, *vertical* integration – and the large, pyramidal, hierarchical, compartmentalized, authoritarian bureaucracies for which many of us have worked – were the most effective means by which we could mobilize large numbers of people for complex, purposeful endeavor. It is equally important to acknowledge that frictionless commerce on the Internet has – almost overnight – made vertical integration obsolete and noncompetitive as an

organizational form, and **changed outsourcing from a tactical option to a strategic necessity.**

(because Adam Smith was right)

In his original treatise on the *division of labor*, Adam Smith (1776) demonstrated the vastly-greater efficiency of having individual workers specialize in performing individual steps in a production process rather than having each worker make the entire product from scratch. Frictionless commerce on the Internet essentially permits enterprises to organize themselves on the basis of Smith's timeless, universal principle. Based on the efficiencies implicit in organizational specialization, it is likely that **within 10 years, only one-third of the human resources involved in the production of a major product or service will be full-time, career employees of the nominal producer of that product or service.** The remaining two-thirds of the human resources involved in the supply/production/distribution chain will be a combination of sub-contractor employees and/or leased, contingent, or self-employed workers.

Of course, if more than half of all the input to most consumer goods and services in the future will come from **outside** the producer of record, outsourcing agreements in the "New Economy" can't simply be conducted in the spirit of typical Industrial Era, arms-length, lowest price/minimum spec deals. Clearly, these will have to be much more collegial, collaborative relationships. For example, when IBM outsourced the assembly of its PCs to its distributors and retailers, participating dealers were offered IBM training for the employees they hired for assembly work. IBM also authorized a number of large dealer-assemblers to set up their operations in IBM factories, to piggyback on existing facilities and supply systems.

While the *physical* integration of outsourced functions in manufacturing can clearly contribute to productivity – as with VW/Brazil or IBM – it is **not** crucial for the successful outsourcing of most managerial and administrative services. *Informational* integration, on the other hand, is essential for the success of all outsourced enterprise. If contracted relationships are to result in predictable flows of sophisticated, error-free goods and services, those relationships must be supported by an unimpeded flow of detailed, error-free knowledge and information.

Specifically, in the keenly competitive, increasingly on-line, duty-free global marketplace – especially at a time of rapid technical innovation – primary enterprises will want to work with suppliers are not only willing to adopt "best practices" and new technology, but who are also willing to share with the organizations they supply their knowledge of opportunities and imperatives in their own fields of expertise. In other words, in order for an unbundled organization to fully realize the benefits of their superior outsourced functions, those functions must be *virtually integrated* with the core enterprise.

. . . for Virtual Integration

No matter how superior an outsourced function may be compared to the in-house function it supplants, it will add little to over-all performance – and, in fact, may subtract much – if there is not a purposeful exchange of information between the outsourcing enterprise and its contract suppliers. Indeed, William Vickery and James Mirlees shared the 1996 Nobel Prize in Economics for having demonstrated that marketplace transactions are most efficient – for the individual transactors **and** for the economy as a whole – when both the buyer and the seller are equally informed with respect to the detailed facts of the transactions.

The casual observer might cite this theory of “symmetrically-informed transactions” to support the continued reliance on integrated, in-house suppliers who should be more efficient collaborators than outsourced suppliers, since in-house suppliers, putatively, should be much better informed about an organization’s needs than outside suppliers can be. However, as maturing IT has increased the value – and price – of information, most major enterprises have made studies of the uses they make of their own “intellectual capital” – e.g., databases, experience-based expertise, etc. – and have universally discovered, among other things, that **there is very little in-house sharing of information within large organizations.**

Curing “Information Constipation”

A March 2000 study of 10 technology-intensive companies by the executive search firm, Korn-Ferry, International, produced results that are typical across all industries: “The majority of employees reported that knowledge-sharing rarely occurs. Only slightly more than one-quarter of the respondents report that knowledge is re-used across the company, and just over 10 percent say they actually have access to lessons learned elsewhere in their organization.” Fortunately, a remedy for the chronic “information constipation” of large organizations is at hand, in the form of a next-generation family of Netware – e.g., groupware, knowledge managers, and peer-to-peer file-sharing software – all designed specifically to facilitate on-line collaboration. Peer-to-peer (P2P) Netware, in particular, by making information sharing largely effortless, is widely expected to have multiple dramatic effects on organizational performance by reducing redundant effort, shortening employee learning curves, and accelerating problem solution cycles.

The same P2P software that can facilitate collaboration among an organization’s internal functions can, of course, also facilitate collaboration between that organization and one or more superior, outsourced functions. And it is this new capacity for “extra-preneurship” – to be able to mobilize collaborations of disparate superior performers and wed them to a set of competitive core competencies – that is widely expected serve as the basis for accelerated global economic growth in the coming decades. In his recent book, *Digital Capital*, Donald Tapscott describes these

extra-preneurial, on-line collaborations as “business webs,” while Grady Means and David Schneider call them “value-adding communities” in their book, *Metamarkets*. Both books make well-supported cases that businesses can achieve higher growth rates and profit margins by leveraging their operational expenditures through superior suppliers on-line.

Paradigm Shift: the Network as Enterprise

Tapscott (an IT consultant) and Means (a partner with Pricewaterhouse Coopers) also agree that the formula for marketplace success from now on will involve not simply abandoning internal self-sufficiency, but actively collaborating with suppliers **and with customers** in an ongoing value-adding process. In this vision of the corporate future, *the real boundary of the enterprise is the entire network of common collaborative endeavor*, from the raw material supplier, through production and distribution, to the unhappy-but-debriefed customer whose feedback becomes input to the supply chain. As Means and Grady write, “In the New Economy, the network will be the enterprise.”

The rapid adoption of frictionless transactions – which will produce substantial immediate efficiencies of its own – will also cultivate the propensity for on-line collaborations of an even more substantive kind, ultimately leading most large private and public sector organizations to evolve into distributed enterprises, or extrapreneurships, by 2010. To service the resulting explosion in on-line traffic, the annual operations of the Internet itself – including expenditures on infrastructure, applications and intermediate services – are projected to exceed annual U.S. expenditures on healthcare by 2003, making the Internet America’s largest industry, at US\$1.25 trillion per annum.

Some Reasonable Long-Term Assumptions Based on Recent Real-World Experience

Given the sustainable underlying efficiencies of frictionless commerce, it is reasonable to assume that the global economy will be able to maintain the average economic growth and prosperity improvement rates of the 20th Century throughout the 21st Century! (See Exhibits 1 and 2, following text.) In general, this means that the world GDP will grow from roughly US\$30 trillion in 2000 to US\$290 trillion by 2100 (+775%), while the U.N. projects world population will grow from 6.2 billion to between 10 and 12 billion by 2100, an increase of 60% to 90%. Because the world’s economic output will rise 8 to 12 times faster than the population, average per capita income worldwide will increase by 350% to 450%, while the ratio between the per capita incomes in the wealthiest nations and the poorest nations can be expected to drop from 30-to-1 today to 5 or 6-to-1 by the end of the century.

In consonance with this projected increase in economic well-being will come a concomitant rise in the indices of *cultural modernization*, including reduced infant mortality, and increased urbanization, salaried employment and levels of education – especially among women. And, as a nation’s level of cultural modernization rises, its birthrates fall, further reducing population growth rates and poverty, and increasing per capita income. Cultural modernization has been the single most important factor in reducing worldwide fertility rates during the past decade. U.N. global population forecasts for the year 2100 dropped from 11.6 billion (in 1991) to 9.9 billion today, and are likely to fall even further as the Century progresses and prosperity rises around the world.

[Authors’ Note: Unlike the relatively simple historic model upon which we based our rosy 1992 scenario for the U.S. economy, the foregoing projections from the Academy for Advanced and Strategic Studies in Washington, D.C., are based on a combination of data from the U.N., the World Energy Council, the U.S. Census Bureau, and the International Institute for the Application of Systems Analysis in Vienna. These projections assume no further breakthrough improvements in economic productivity beyond those derivable from existing technology and real world best practice. Our assumptions do not nearly reflect the plausibly realizable potential of our projected global population and resources through emerging technologies, such as genetic engineering, fusion power or nano-tech. Rather, our forecasts can fairly be regarded as the reasonably likely outlook for the world family of nations in the 21st Century, barring war or other natural or manmade catastrophe.]

Nothing Exceeds like Success

In the eyes of some people, of course, a century of global growth and commercial development would, itself, be an unparalleled manmade catastrophe, bringing with it a whole host of irreversible disasters, including global warming, widespread species extinction, resource depletion, the unknown risks of genetic engineering, and the obliteration of hundreds of local, traditional cultures by a single, secular, materialist, media-driven, global mono-culture. The principal problem with many of these sweeping condemnations of contemporary economic development is that they are right: without rigorous oversight, an unacceptably high percentage of marketplace enterprises will pollute the environment, exploit their employees and endanger their customers. What’s more, a preponderance of public opinion in most developed countries – between two-thirds and seven-eighths of adults surveyed – agree with the critics!

In past responses to their increasingly strident opponents, the promoters of economic growth through free-market capitalism have typically argued that the benefits to humankind of global industrial development have so far vastly outweighed the costs. In any event, the inexorable growth of global population has made continued development essential, which has made the debate – from the pro-

development point of view – largely academic. During the 1990s, however, scientific evidence mounted that global warming was real, and that human activity was its principal cause. Of much greater significance to business and government than the scientific research, however, was the amount of damage done by the increasingly-extreme weather linked to global warming, including not only hurricanes, typhoons and tornadoes, but floods and droughts, plus the forest and range fires caused by the droughts and avalanches triggered by warmer mountain air.

It's a Warm World After All

During the 1980s, according to the Worldwatch Institute, worldwide economic losses from extreme weather conditions averaged US\$5 billion per year. In the 1990s, however, annual weather-related losses leapt to an average US\$38 billion, rising from US\$15 billion per annum at the beginning of the decade to US\$90 billion at the end. In 1996, 31 of the world's largest insurance companies formally pledged to support any and all action by the U.N. to reduce global warming, concerned that, with more than US\$2 trillion of insured assets along North America's coastlines alone, "a few more major disasters caused by extreme climate events could literally bankrupt the insurance industry in the next decade." The fiscal viability of smaller nations is potentially at risk, as well. Honduras, for example, remains economically crippled today, three years after Hurricane Mitch did US\$4 billion damage to the Central American nation whose annual GDP is only US\$10 billion.

Meanwhile, for more than a decade, bio-scientists have been expressing concern about a different manifestation of global warming: the northward migration of tropical diseases. Today, for example, roughly 2 billion people around the world are at risk of contracting malaria. But researchers at three leading U.S. schools of public health have published forecasts that, given current rates of global temperature rise, an additional 620 million will be at risk by 2050. Indeed, both malaria and West Nile encephalitis have appeared in New York City in the past 36 months.

Not unreasonably, these tangible, immediate consequences of global warming – especially those with quantifiable financial implications – elicit more immediate concern from corporate and political leadership than do climatologists' distant fears of a five-degree rise in average global temperature and a five-inch rise in the oceans by the century's end. Faced with mounting scientific evidence and rising public concern, in August 2000, international bankers and corporate leaders at the World Economic Forum in Davos, Switzerland, voted **"global climate change the most pressing problem confronting world business."**

By the time that the nations of the world gathered at The Hague, in November 2000, to agree on an implementation plan for the 1997 Kyoto Protocol, even its most implacable opponents – U.S. corporate leadership – had begun to come around. On the eve of the meeting, the National Environment Trust reported that over one-third of the Fortune 1,000 companies executives were "very" or "somewhat" favorable to the

Kyoto agreement. Much to the distress of the international community, however, the United States blocked the adoption of a global warming treaty. And to the dismay of almost EVERYbody, the new U.S. president subsequently dismissed the entire agreement as unacceptable.

*[Authors' note: H.G. Wells, the British historian who first proposed the formal study of the future, put retrograde leadership into perspective by pointing out that even the **great** leaders and inventors of the past have not altered the course of history, but have simply sped progress up or slowed progress down. Real change in history, Wells argued, has always arisen from society's adaptation to their changing circumstances and opportunities. Assuming a continued acceleration in the multiple consequences of global warming, we can be reasonably certain that our changing climate-related circumstances will, in fact, provoke substantive international action to retard global warming well before the end of this decade.]*

Making the Earth a “Smart” Planet

Fortunately, all the time that the world family of nations has been struggling toward an agreement on greenhouse gas emissions, we have also been assembling the tools we will need to monitor and enforce any regimen to control global warming and other pollution. In 1995, the U.S. Department of Defense announced that it was retargeting much of its global data-gathering technology from military to environmental objectives. U.S. spy satellites began monitoring 500 diverse global habitats that are especially sensitive to climatic change. A year later, the U.S. Navy started sharing data from hundreds of undersea sensors – originally intended to track Soviet submarines – which are now tracking fish populations, measuring the temperature and salinity of the sea, and monitoring the speed and direction of ocean currents.

And in 1998, the U.S. space agency, NASA, launched the first of an ongoing series of satellites that will constitute a permanent Earth Observing System (EOS). The EOS is currently providing us, for the first time, accurate surface temperature measurements for the entire planet, and is monitoring changes in land vegetation, ocean biology and the make-up of our atmosphere. This input has already been instrumental in forging the scientific consensus over global warming. In the future, NASA envisions supplementing five or six large EOS satellites with dozens – eventually hundreds – of complementary “nano-satellites” – maneuverable, baseball-sized devices, capable of gathering evidence on individual sources of air and water pollution.

Our rapidly-improving capacity to accurately monitor human interaction with the environment, and to place marketplace costs on the consequences of climate change and other ecological degradation, assures that increasing public and private resources will be devoted to environmental amelioration from now on, especially with

respect to electric power generation and transportation. At the same time, considerable applied R&D will be devoted to making all industrial production more environmentally benign, **both** through the development of more eco-friendly fabrication materials and processes, **and** through the use of computer design to reduce the amounts of material and energy required to produce all durable goods, **plus** the use of computer algorithms to optimize all logistics systems, reducing the energy consumed in production, shipping and distribution.

As both our data and our comprehension of how ecosystems work get better and better, our expenditures to avoid the predictable future economic costs of environmental degradation will increase dramatically among all types of enterprise, in every economic sector, of every country, for essentially every product, process and activity. Environmental management, protection and amelioration will be a multi-US\$ trillion global industry by 2010, and is likely to become the world's largest industry during the second half of this century.

Lying Down with Oligops and Oligarchs

There is every reason to believe that, in the Century ahead, free market capitalism, liberated by falling trade barriers and invigorated by maturing IT, has the realistic potential to substantially improve the economic well-being of most of humankind, while simultaneously reducing – and ultimately reversing – the ecologic damage caused by human enterprise. But some opponents of global development want no part of a prosperous, environmentally-sound future *if it means concentrating economic and political power in a handful of multi-national corporations and supra-national bureaucracies*. Today's post-industrial anarchists believe that, in such a future, individuals, local communities and enterprises – in fact, all but the largest nations – would be powerless to determine their own destinies. Our personal and local desires, concerns and interests would be routinely ignored or discounted by actuaries, technocrats and lawyers in huge omnipotent institutions.

Just as the environmental concerns of anti-development protestors are entirely justified, so, too, are the concerns of those who are unwilling to trust our collective futures to distant decision-makers in ponderous private and public bureaucracies. The propensity of all mass markets for high-value products to become oligopolistic is well understood by economists. Thus, we can be reasonably certain that, as the removal of tariff barriers gradually consolidates all of the world's individual marketplaces into a single global, duty-free mega-market, most major lines of consumer goods and services – e.g., automotives and appliances, banking, insurance and investments, utilities (including the Internet), computers, aircraft and travel, etc. – will be dominated by a small number of makes, brands and retail outlets. (After all, how many bookstores does one global electronic village need?)

Of course, to assure that such concentrated marketplace power is not abused, there will need to be global regulatory agencies with supra-national investigative and

enforcement powers. In the eyes of those who oppose global development, the vision of a future filled with ever-larger private enterprises, regulated by ever-larger public bureaucracies, would simply be an extrapolation of the solutions developed in the 20th Century to solve the problems created by 19th Century industrialization. And, since the 20th Century industrial/institutional paradigm has caused considerable environmental degradation and cultural destruction, it is easy to understand why the anarchists find the current model an unacceptable basis for creating a better future. Unfortunately, because the opposition to economic globalization is made up of such a diverse variety of interest groups, they do not have a single, coherent alternative course of action to put on the negotiating table.

Globalization upsets not only environmentalists and anarchists, but business and professional groups from many developing nations, who are legitimately fearful of having to compete with powerful, branded multi-national service companies. Labor leaders from developed nations want their members protected from unfair competition by employers in developing nations who abuse and underpay their workers. And while environmentalists demand that all future economic development be ecologically benign, a growing number of academics and native peoples are demanding that all future economic development be *culturally benign*, as well. And as a backdrop to all of this, there is a chorus of economists who insist that the widening income gap between the wealthiest and the poorest nations can **only** be closed by long-term transfers of hundreds of billions of US\$ to the world's poorest peoples for infrastructure and human resource development.

vs. the “Third Way,” . . .

Over the past 36 months, this dialogue has migrated from the editorial pages to the front pages of the world press, as a direct result of the confrontational demonstrations and vandalism that have accompanied meetings of the World Bank, the G-7 (or 8), and other international economic gatherings since the December 1999 World Trade Organization meeting in Seattle. This dialogue has also been given rhetorical dimension by American futurist Amitai Etzioni, who has postulated the need for a “third way” into the future; an ethical path between the two extremes of unfettered, “winner-take-all” capitalism and the autarky of protectionist national regulations. The overarching objective, says Etzioni, a professor at George Washington University, should be to create a “good society” that balances the market and the state with “the community.”

A number of world leaders – e.g., Tony Blair, Kofi Annan, Alan Greenspan, etc. – have invoked the “third way” as a rhetorical symbol of the ineffable consensus that we must surely achieve if the human race and its habitat are to thrive and prosper in the future. But the institutional mechanisms for reaching such a global consensus are so fractious and interest-driven that they scarcely seem capable of creating a New Global Order to oversee and regulate the New Global Economy. Justifiably skeptical of the existing power structure's commitment to inventing its own replacement, Prof.

Etziona has called for a “grand dialogue,” endorsed by global leaders and facilitated by the media, to debate whether “material consumption and economic growth are the right basis for personal fulfillment.”

. . . vs. the NGOs!

Issue-attentive citizens around the world, equally skeptical of grand ideas and grand dialogues, and impatient with glacial pace of institutional change, are taking matters into their own hands through voluntary transnational associations. Wherever development exploits natural resources, damages the environment, or abuses human rights, developers are increasingly being confronted by a new type of self-appointed global “town constable” who exposes the activity to public view, civic indignation, political action and legal redress. The dramatic rise of these activist agencies and pressure groups – generally known as “non-governmental organizations” (NGOs) – reflects a gathering public consensus that, while free-market capitalism may be the fastest, most efficient way to a generally prosperous future for humanity, the very power of this economic tool means that there is an ethical imperative to hold business to account for the integrity of its marketplace conduct. Capitalism should be a means, these global vigilantes assert, not an end!

Ranging from large, high-profile organizations like *Greenpeace* or *Oxfam* to small, little known operations like *Global Witness* or *No Peace Without Justice*, the number of NGOs has risen from 1,400 in 1975 to nearly 30,000 today. Reminiscent of earlier citizen-based movements of the past two or three hundred years – e.g., abolition, trade unions, women’s suffrage, civil rights, environmental protection, gay liberation, etc. – these new activist groups also have roots in the populist revolutions of the past 50 years – e.g., passive resistance in India, the elimination of Apartheid, the fall of the Chilean, Filipino and Serbian dictatorships, and the overthrow of the eastern European communist regimes, etc.

Our Industrial Era traditions of citizen activism have merged into an NGO movement, global in scope, that sees itself as a distinct sector of the collective human enterprise which, *like government*, serves a multiplicity of essential socio-economic functions, but, *like business*, is entrepreneurial in raising capital, exploiting markets of opportunity, forming alliances, and (shamelessly) leveraging the media. They perceive their product to be human progress, in the form of a more “civil society.”

The behavior of the demonstrators in Seattle, Berlin and Sydney scarcely seems to bespeak a “civil society,” but the leaders of the new “citizen sector” say that such street theatre is the only way to draw public and political attention to the “behind-the-scenes’ realities of the globalizing economy **before** those realities become simultaneously indispensable and catastrophic. Global Witness is a typical NGO watchdog non-profit, with 14 employees and a US\$800,000 annual budget, that has been instrumental in getting the de Beers cartel to certify the provenance of its gems as a means of ending the black market in diamonds that has been the economic

basis for brutal West African insurrections. Global Witness also exposed the abusive labor practices involved in the production of Nike shoes in Indonesia and the unconscionable environmental impacts of Royal/Dutch Shell's Nigerian operations.

Until a truly effective rule of law has been established worldwide, a growing network of self-appointed watchdogs will be looking over the collective shoulders of corporate executives and government leaders, and sitting on the boards of a growing number of firms worldwide, reflecting in a very real sense the larger "boundaries" of 21st Century business, in which the entire supplier/producer/distributor/consumer network becomes the enterprise. In fact, it is entirely plausible that, over the next generation, NGO's will evolve from un-official, non-profits to being official agents of international governance, eventually becoming the **New Global Order**.

The Age of Mass Feedback

While NGOs existed before there was cyberspace, the Internet has clearly been instrumental to their phenomenal successes on shoestring budgets. Frictionless collaboration is just as productive for nonprofits as it is for business and government. But, frictionless collaboration also empowers *individual citizens* – as consumers, workers, constituents, clients, investors, etc. – perhaps more than it empowers anybody else. And the populist potential of the Internet represents a very worrisome "wild card" for the leaders of private and public enterprise around the world.

Because it is *interactive*, the Internet will not only give every enterprise in the world direct access to two billion people by 2005, it will also give two billion people direct access to any enterprise, and to each other. From now on, any dissatisfied customer, disgruntled employee, disillusioned constituent, or outraged patient, etc., will be able to go on-line, locate others with similar grievances, and mobilize collective action, including wildcat strikes, boycotts and class action law suits. And that's if you're lucky! If they're really unhappy with you, they could use the Internet to hack into your computer systems, doing irreparable damage. Or they could set up a "gripe site" on the Web.

A 1998 survey found that there were over 8,000 "gripe-sites" on line, largely targeted at the world's major producers of mass-market consumer goods and services. While many have been created by unhappy customers, others attack corporate ethics, labor practices, environmental behavior, etc. Using only off-the-shelf software, attack sites are often better looking than the actual corporate sites. Moreover, by frequently citing their corporate target's name on their Web page and embedding the target name in the gripe site's "meta-tag," attackers can guarantee that their page will be pulled up by the major search engines that consumers use to find the company's actual website.

The "I-Way" is not only a two-way street, it is also a two-edged sword. The Industrial Era mass media – newspapers and magazines, radio and television – are all

“one-way streets,” over which corporate and government information flows to the public in the form of advertising, press releases, interviews, planted stories, etc. The I-Way, on the other hand, permits consumers and constituents to generate their own information flows – to each other, to regulators, to the media and back to business and government institutions. What’s more, so long as the so-called “attack sites” report only factual personal experience, libel laws do not apply to such Internet activities. Thus, the “McSpotlight” anti-McDonalds gripe site continues to draw a million hits a month in 22 nations around the world in spite of years of legal action by the fast-food colossus to shut it down.

A Changing Balance of Power

The increased capacity of a few individuals on the Internet to mount sophisticated, Hollywood-quality mass media campaigns attacking the products and/or behavior of any large institution is just one facet of what constitutes **an increase in personal power unprecedented in recorded human history**. As Sun Microsystems co-founder, Bill Joy, reflected in his widely-referenced, disquieting speculation (“Why the Future Doesn’t Need Us,” *WIRED*, April 2000), “With nuclear weapons or bio-chemical warfare, we worried about *rogue states*; in the wired world, we must worry about *rogue individuals*.”

The Internet is already a violent place. Israelis and Arabs are sabotaging – or “cyber-tagging” – each other’s Websites, as are Serbs and Muslims in the Balkans; often simply defacing the sites, but sometimes actually “breaking and entering” computer systems, and destroying or stealing databases. Most of this activity appears not to be officially sanctioned, but is carried out by “very loosely organized” bands of individuals,” or “hacktivists,” who view their own actions as “patriotic” and entirely justified. But what some call political hactivism, others call an “info-war.”

In 1999, two Chinese army colonels published a best-selling book titled *Unrestricted War*, updating the classic Chinese treatise, *The Art of War*, by Sun Tsu, and stipulating that “the war of the future will be waged on many fronts at one time, including cyberspace.” As if to echo this thought, nine U.S. government and business Websites were vandalized or defaced with pro-Chinese symbols and messages during the first 10 days after the April 1st collision between U.S. and Chinese military aircraft over the South China Sea. Chinese message boards and chat rooms proclaimed, “Hack the USA!!! For our pilot Wang and for our China!!!” Most of the attacks on U.S. Websites were signed by “The Hackers Union of China.”

Professor Etzioni has applauded this transfer of international conflict from the battlefield to cyberspace as a positive development. Just as primitive cultures of the past have turned their tribal warfare into tribal rituals, the Internet is permitting us to convert our actual wars into virtual wars, replacing bullets and blood with special visual effects and computer scoring, to see who won. “If all wars could be so

converted, it would be wonderful,” he said in a recent interview, describing the anti-U.S. hacking as “cybergrafitti” ..., annoying but harmless.”

Other observers are much less sanguine about the growing pervasiveness of the Internet, and our dependence upon it. Within less than 10 years, the capacity to be a “rogue individual” will be more or less available to citizens in every nation. (Very egalitarian!). The notion of a rogue individual in cyberspace immediately evokes the image of a lone computer hacker: an on-line Unibomber seeding the Internet with a self-replicating “denial-of-service” virus – or even worse, an on-line equivalent of the Oklahoma City or U.S. Embassy bombings, like shutting down a nation’s air traffic control system or electric power grid. (Mr. Joy’s *WIRED* essay dwells on this very vision.)

The first international conference on cyber-crime (Paris, May 2000) adjourned with the conclusion that it would be many years – if ever – before virus attacks can be systematically prevented. On the other hand, new hardware and software promises to make the Web a much safer and more secure place for most people over the next 5 to 10 years. Most important of all, the arrival of cheap, verbally-accessible wireless broadband Internet service over the next 3 to 4 years will turn the Web into an affordable, general purpose “information utility” that will be of increasingly practical use to individuals and institutions around the world. And the means by which most people will access that utility will be their Personal Digital Assistant (PDA).

Since the fundamental function of the PDA will be to *link* us to the Internet, and through the Net, to link us to our family, our co-workers, and to personal and professional services, etc., we may increasingly begin to think of the PDA as our Personal Audio-visual Link, or PAL. For most businesses and government agencies, the really provocative innovation of the next decade will be our PAL’s.

A World of Citizen Reporter-Consumers

By 2010, most people won’t leave home without their PAL; a handy, combination cell phone/pager/Net terminal/digital video camera. Whether or not all of our public spaces are eventually going to be subject to television monitoring (a separate, hotly-debated issue for the decade ahead), we can be certain that most people will be able to record and report essentially everything and anything that they encounter in the course of daily life – at the mall or ticket counter, on the road, in the classroom, aboard a plane or with the plumber or policeman, etc. (In fact, some media experts believe that real-world footage of actual events, captured by eyewitnesses, will become the principal content of WebNet newscasts, whose viewership is expected to surpass the broadcast network news audiences within five years.)

We are about to enter a world in which every customer or client, every employee, every passer-by or trespasser will also be a potential investigative reporter,

who is only a click or two away from being an on-line tabloid publisher. **This is citizen/consumer empowerment beyond the dreams of Karl Marx or Ralph Nader!** As French President Jacques Chirac told the delegates to the Paris Conference on Cyber-Crime, “The Internet, whose construction was inspired by the universal ideals of freedom and solidarity, is testing our institutions.” To which one can only reply, “Of course it is. This is a revolution!”

Welcome to Revolutionary Times . . .

The principal purpose of this review of our moment in time has been to establish that humankind is currently passing through a genuine technology-driven, socio-economic revolution of historic proportions that will, **well within the lifetime of most people on earth today**, transform the collective character and direction of the human enterprise.

A companion purpose of this review has been to draw conclusions from the data describing past technology-driven transformations to suggest that this revolution has been underway for several decades, and now has the potential to dramatically alter the ways we all work and live in the decades ahead. This transformation, with reasonable attention, will be broadly beneficial to the great majority of humankind, both in terms of their economic well-being and their physical health and quality of life.

Our third purpose has been to suggest that the information technologies which will foster this rising tide of prosperity will also be used to reverse much of the Industrial Revolution’s damage to the natural environment. Over the next two decades, these activities will create a new global industry employing hundreds of millions worldwide, and driving down the cost of eco-treatments to the point that care for Nature will become as common as today’s food safety practices.

Our fourth purpose has been to provide a “heads up” warning regarding the next two decades, which will confront all enterprises with compelling opportunities – and necessities – for dramatic innovation. The past 20 years have not only produced discoveries that will permit an additional million-fold increase in computing and communicating capacities, but discoveries in bio-engineering that will permit a million-fold increase in genetic innovations over what is possible through traditional cross-breeding. With trillions of dollars of national resources committed to these and other science-based engines of technical creativity over the past several decades, most U.S. executives expect continuous technological innovation, and are braced to handle these kinds of changes.

By comparison, we have only just begun to realize the social and political changes that will result from the requirement for our institutions, both public and private, to reinvent themselves. As we have seen in the many failures of the dot.bomb bust, institutional innovation and change is much less predictable than the

relatively steady flow of technical improvements. We can reasonably assume that the construction of new institutions will be both highly political and uncontrollably global. This means that, from now on, successful institutional managers will have to be **both generalists and specialists**: generalists in understanding the potentialities of new developments in any area that may affect their organizations; and specialists in their pursuit of distinctive competitive advantage in a world where customers can buy from almost anyone else, anywhere, at any time.

Fifth and finally, we have tried to convey the degree to which the exploitation of our newly-matured information technologies will be crucial to the success of every enterprise. In order to prosper in revolutionary times, you must be revolutionary! Nothing less will do. The Internet is, in a very real sense, adding a fifth dimension to human existence: cyberspace. Only recently “discovered,” this dimension is now being “colonized.” And, although the Net today may already seem crowded, current projections for continued exponential increases in IT speeds, capacities, computing power and storage during the next five to ten years make it clear that the vast, undeveloped potentials of cyber-space stretch to the virtual horizon.

. . . and Counter-Revolutionary Times!

This is not to say that there are not those who would seek to limit our capacity to fully realize the Internet’s potential; there are. The world’s publishers, for example, and the producers of audio-visual entertainment have been vigorously promoting the strengthening and lengthening of copyright protections, while sharply narrowing the definitions of “fair use.” Some are even re-copyrighting material previously in public domain! In parallel, scientists and technologists from software producers to bio-engineers are patenting commonplace research processes and naturally-occurring phenomena. And we have all read news stories about the speculators who have registered hundreds of Web addresses in anticipation of being paid substantial sums by businesses, trade associations and famous people who want to use the address (or to keep others from using it). Such Web-squatting is now being prohibited, but this has emboldened powerful trademark holders to try to shut down any remotely similar-sounding domain name “in order to avoid customer confusion.”

At the same time that the publishers and producers are trying to secure ownership of all the existing content, the dominant suppliers of high-speed Internet access – the Baby Bells and the cable companies – are seeking to discourage competitive low-cost providers (in particular, wireless technologies) from entering the marketplace. And, in many parts of the developing world, including China, governments are seeking to restrict access to, and the content of, the Internet. It is entirely understandable that existing economic and political institutions fear the anarchic power of new technology. But their fears must not be permitted to legitimate significant limitations on the abilities of all citizens throughout the world – workers, scholars, children, farmers, school teachers, artists, accountants, nurses,

carpenters, AIDS patients and engineers, etc. – to collaborate on creating our common future.

e-Pluribus Humans

The Internet is not simply the only place where everybody in the world can all talk to each other; it is the only place in the world where strangers with common problems in different parts of the world can find one another, share personal knowledge and build the trust required of creative collaboration. And this will be crucial to the future of humankind because, while the research laboratories of North America, Europe and Asia will invent most of the *physical* technology of the 21st Century, it is we – “we, the people” of the world – who will have to invent the *social* technologies: the institutions, laws, marketplace mechanisms, codes of ethics and new local traditions by which we will manage the application of humankind’s new tools.

The wired global village will require trans-national social technologies with practical local presence. Such arrangements can best be conceptualized, organized, and refined on the Internet. In an even broader role, the Internet will permit people in every nation, industry and walk of life to collaborate with their counterparts around the world to adapt general-purpose hardware and software to apply productively to specific local problems. In a world that will soon be dominated by open architecture computer operating systems (like Gnu-Linux), the on-line creation of software and the on-line buying and selling of customized code and code segments will constitute the most valuable content on the Internet, vastly surpassing the value of on-line entertainment. Even more important than the economic value added by on-line collaboration will be the fact that, by facilitating local and individual adaptations of general-purpose technologies, high-speed wireless Internet will accelerate the effective application of cutting-edge technologies to specific local circumstances at all levels of society and throughout all parts of the world.

Having encountered both globalization and the Information Revolution at the same moment in time, humankind has suddenly been confronted with an enormous range of future potentialities that were not plausible just 25 years ago. Equipped with powerful new technologies and unconstrained by any single, overarching global vision of the future, humankind is free to make of the 21st Century pretty much whatever it wants. The Internet will be the international “collaboratory” in which we will develop the great institutions of our emerging global culture, and the creative commons on which we will build those institutions will be our future.