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INNOVATION AND OBSOLESCENCE: THE SWORD THAT CUTS BOTH WAYS

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Creative Destruction is a theory of innovation in the study of economics which suggests that the transforming power of technology is perpetually making old ways of doing things obsolete through the introduction of new products and processes. In capitalistic economies, the presence of entrepreneurship, capital investment and competitiveness create an orientation to and acceptance of change as a necessary condition of living in a world where things get better and better.

What is paradoxical about modern manifestations of this old idea is the extent to which incessant innovation and the relentless destruction of those innovations are now perceived to be the basis for economic progress and the good life. But there is a serious downside. Displacement of whatever exists has become built into our new millennium institutions, aspirations and values. Nothing is ever good enough. Obsolescence is accelerated at such a pace that corporations can no longer afford to hold off on the introduction of new products and processes until public understanding and acceptance is in place. Acquisition has become so necessary to sustaining a high standard of living that consumption is thought to be a patriotic duty.

This paper examines three promising new millennium technologies gone awry: high definition television, broadband cable and open systems software. The examples illustrate the ways capitalist societies have come to count on technologies and their applications to bring improvements to work and leisure, commerce and community while producing great wealth. But when those same developments move too quickly or are mismanaged, they can have adverse social effects.

Example No. 1: Next-Generation Television Systems: When first introduced at the 1986 National Association of Broadcasters convention in Las Vegas NV in 1986, Sony Corp.'s new high definition television (HDTV) system was judged by critics to be a technological breakthrough of the century for media and consumer electronics. With its high quality images projected on a wide screen, HDTV was thought to be good enough to compete with 35mm film. And the Japanese were so far along in the development of this technology there was not a manufacturer in the world prepared to compete with it.

Sony was promoting HDTV as a new universal TV standard, a replacement for the NTSC, PAL and SECAM systems which used incompatible picture scanning

technologies operating at 525 and 626 lines. The Japanese HDTV format had twice as many lines (1125) and a wider (16:9) height-to-width aspect ratio for the TV screen.

Better pictures and the prospect for a single world TV standard generated a lot of attention, but the barriers were so imposing that the Japanese innovation was never adopted. The proposed system required top to-bottom conversion of production, transmission and viewing facilities, which could only be implemented at significant additional cost to all players. A further problem which did not show up until later was that the Japanese HDTV system was analog. Rather than accelerate its adoption, the race to digital only delayed its adoption.

Adoption of digital as a production/transmission format held great promise for broadcasters but its implementation set off unending battles between computer and TV set manufacturers, between television networks, cable operators and satellite providers and among networks and their own stations. Rather than push the industry toward a single line standard, digital systems opened the door to a proliferation of standards. Instead of simplicity, convenience and lower costs typically associated with digital, what emerged were systems that were unacceptably complex and expensive.

By government requirement, all commercial stations were expected to be on the air digitally by 2002. To make the change-over easier for viewers as well as broadcasters, every TV station in the United States was given a second 6 MHz channel, either VHF or UHF, making possible the simulcast of analog and digital signals until the year 2006, at which time a sufficient number of digital receivers were expected to be in the marketplace and the FCC would ask for the analog channel back.

Part of the legislative motivation for pushing this new technology was to bring broadcasting into the digital age, hoping to increase local competition and stimulate domestic growth in all sectors of media and telecommunications. The government also had an eye on the competitiveness of American computers, digital broadcast and cable equipment and software in the global market. The US had a chance to accomplish what Japan had failed to do.

The US Congress and the FCC needed broadcasters' agreement and full participation to accomplish such an ambitious agenda. As incentive, regulators not only made free spectrum available - estimated by some to be worth $70 billions of dollars to government coffers if auctioned, and gave tacit agreement to protect the broadcast industry. One of these protections was to insure that broadcasters' signals were carried by their multichannel competitors.

This move meant that the government agreed to resurrect and privilege an advertising-supported "free over-the-air TV" model for broadcasters that had, for the great majority of US households, ceased to exist. It seems unlikely that very many over-the-air antennas will still be up in 2006, when the last small market station is finally on air with a DTV signal. This will be true not because of the continuing erosion to their base audience but because over-the-air broadcasting will have ceased to be a profitable business.

The year 2002 was to have been the year all U.S. commercial TV stations would be on the air with a digital signal. Even by the close of 2002, less than half of stations be transmitting DTV signals, even fewer will be transmitting HDTV. HDTV looks increasingly like a niche service.

Example No.2: Next-Generation Cable Systems: When AT&T Corp. was broken up by order of the U.S. Department of Justice in 1984, AT&T was a $158 billion corporation, the largest in the world. AT&T enjoyed a virtual monopoly in local and long distance telephony and in telephone equipment manufacturing. With its guaranteed rates of return, AT&T hosted one of the greatest research labs of all time: Bell Laboratories.

In the divestiture decision, AT&T was allowed to keep its lucrative long distance business but found itself paying some 40 percent of its revenues to the local exchange carriers in connection fees to gain access to its former customers. When a new Telecom Act emerged from the US Congress in 1996 aimed at deregulating media businesses as well as telecommunication carriers, AT&T began investing in cable television systems as a way to gain more direct access to homes and businesses.

Within a year following the passage of 1996 Telecom Act, AT&T paid $52 billion to acquire Tele-Communications Inc., the U.S.'s largest cable system with almost 11 million subscribers. In April 1999, AT&T Corp. acquired cable operator MediaOne Inc. with 6 million subscribers. The MediaOne transaction cost AT&T $69.7 billion, about $4,700 for each of MediaOne's 6 million subscribers.

According to financial analysts Goldman, Sachs & Co, AT&T paid a 37 percent premium for MediaOne, some 19 times running-rate cash flow. For TCI, AT&T had paid an estimated 13 times cash flow. AT&T was also quick to announce that it would be spending several billions more upgrading the TCI and MediaOne cable infrastructure.

Why would one of the world's most profitable companies spend in excess of $120 billion to enter an entirely new line of business with a very different technological basis?

The answer comes from AT&T's view of the future. AT&T assumed a continued robust U.S. economy. AT&T assumed that public and business demand for media and telecom services would grow exponentially. It had decided that providing long distance telephony could not be sustained as a sufficiently profitable business, and that the real potential for revenue growth lay in Last Mile transactions and services. The way to tap the North American home and business market, it concluded, was through the technological power of all-digital systems interconnected to broadband networks.

AT&T's plan was to boldly embrace the future offering not only local and long distance telephony but cable television, interactive media services and high-speed Internet as a package deal.

By converting analog systems to digital and getting behind Internet protocol (IP) format as a universal standard, the company could deliver a greater diversity of content and services, more conveniently, more economically, and with very high quality. By making cable lines two-way, AT&T would provide voice and Internet as well as video with the expectation that the CATV networks would become the residential and small business pipelines of choice in the Last Mile. Even though AT&T customers would see a larger bill at the end of the month, their telephone, cable and Internet services would be bundled. Users would be getting more of what they wanted in a more convenient form. And AT&T would be saving much of the $6 billion it was paying annually in tolls for access to local telephone customers.

It seemed a perfect strategy. Some two-thirds of U.S. households were cable subscribers. With AT&T investments, cable customers would now be able to access the Internet, shop online, pay bills and perform other tasks on their TV screens, using cable modems built into their set top boxes. High definition television and movies on demand would be candidates for "always-on, all-band" access to home users.

AT&T proceeded to negotiate alliances with Time Warner and other cable operators, cutting deals which would assure that nearly half of all US cable homes would be potential customers for AT&T telephony services. Time Warner chair Gerald Levin announced that packages of services would be created that made the most sense to consumers using every product line available between the two companies. Levin was confident that the bundling of branded telephony services with more advanced digital video and high-speed Internet offerings would boost overall cable penetration.

AT&T's venture into cable made headlines. It's investment in interactive services and broadband Internet using cable lines was big enough to get vendors such as Lucent Technologies and Scientific Atlanta mass producing next-generation cable equipment at substantially lower prices.

But by mid-2000 the AT&T express train was slowing down. As attractive as AT&T's new IP-centric scenario was on paper, the company was having trouble with execution. The technology was unproven. The telco-turned-cable MSO found itself in trouble with its acquisitions. The properties AT&T bought were spread out all over the country, not at all well-linked to each other. Many were technically in poorer shape than AT&T had been led to believe. Sorting all this out was not easy, nor did all the cross-ownership issues make the Federal Communications Commission and Department of Justice approvals easier.

AT&T had moved too quickly and paid too much for its acquisitions, investors were impatient for evidence of profitability and the stock market was unforgiving. Having lost half its value during 2001-2002 and carrying a debt load of over $60 billion, AT&T could only retreat. To improve the value of its stock, AT&T backed away from some of the more innovative technological investments, initiated layoffs of personnel and proceeded to spit the company into four separate units: business (enterprise services), consumer (local, long distance and Internet services), broadband (cable services) and wireless

(mobile services). By 2002, AT&T Broadband, the cable initiative for which $120 billion had been paid, was sold to Comcast Corp. for $72 billion in stock and assumed debt.

Example No.3: Next-Generation Computer Operating Systems: The rights to DOS version 0.3 was bought by Microsoft Corp. founders Bill Gates and Paul Allen from Seattle Computer Products in 1981. Renamed MS-DOS, the disk operating system was installed for the first time in an IBM microcomputer, which IBM called the Personal Computer.

This IBM 5150 Personal Computer featured a 4.77 MHz Intel central processing unit (CPU), 64 KB Ram, 40 KB Rom, one 5.25-inch floppy drive, and PC-DOS 1.0 (Microsoft's MS-DOS), for $3,000.

For 20 years, from 1982 to 2002, Microsoft released a new generation operating system almost every year, each with increased speed and impressive new capabilities. MS-DOS 1.1 was released in 1982 for an IBM PC supporting 320 KB double-sided floppy disk drives. In 1983, MS DOS 2.0 featured a 10 MB hard drive and 360 KB floppy disks. This was the year that Windows was introduced with pull down menus. Microsoft released MS-DOS 2.1 for the IBM Pcjr in 1984. Later that year, MS-DOS 3.0 was announced for PCs which could host either 1.2 MB floppy disks or 10 MB hard disks.

In 1986, Microsoft brought to market MS-DOS 3.2 which supported a 3.5-inch 720 KB floppy disk drive, quickly followed by 3.25 and 3.3. Compaq shipped MS-DOS 3.31 supporting a 32 MB drive beginning in 1987. Microsoft included a graphical/mouse interface with its MS-DOS 4.0 in 1988. Windows 88 featured integrated Web browsing. Windows version 2.0 sported major new applications (such as Excel, Word for Windows, Corel Draw!, Ami, PageMaker and Micrografx Designer) supplied by independent software vendors.

Windows 3.0 (1990) was a complete overhaul of the Windows environment, resulting in more than 10 million copies sold. Windows 3.1, released in 1992 as an upgrade of Windows 3.0, sold over 3 million copies in its first two months on the market. Windows 95 software, which included MS-DOS version 7.0, took over from DOS completely after starting. By 1995, Windows had a completely revised user interface and hosted a 32-bit system capable of multitasking, advanced file systems and networking. Windows NT was Microsoft's new platform for high-end systems, intended for use in network servers and workstations. Windows NT 3.5 Workstation replaced Windows NT 3.1 in 1995.

Windows CE 2.0, which became available in early 1998, was designed to address problems experienced by earlier versions of Windows. CE 1.0 added features to the operating system that made it more viable for use by corporate users. Windows CE 3.0, which came available in 2000, enabled developers to build embedded devices for applications on the Internet. For home users, Microsoft released Windows Me, short for Millennium Edition, aimed at the home user. The Me operating system incorporated new multimedia features, such as an automated video editor.

Windows XP, with a home version and a professional version, was launched in October 2001. The Desktop XP 2002 hosts 128/256 MB RD-RAM and a Pentium 4 processor running at 1.7 MHz clock speed. The Gateway version of this machine comes installed with TV and radio tuner card, speakers and HPNA 2.0 networking capability.

With such an impressive record of relentless innovation in desktop computing, who could possibly find fault?

Consumers, rival corporations and the Department of Justice are among those troubled about the way this company does business. Microsoft has the reputation of being a rapacious competitor. Microsoft has demonstrated that it can and will use unethical, even illegal, means In its unremitting quest to capture and maintain market dominance for its operating systems software.

The Department of Justice and several states joined forces in 1998 to bring the largest of several lawsuits in United States v. Microsoft alleging monopolistic practices. The charge was that the dominance of Microsoft operating systems installed in 95 percent of the personal computers in use around the world was sustained by predatory practices, which had the effect of freezing out competitors and suppressing innovation. This case was successfully argued in U.S. Court with a finding that the Windows operating system held a monopoly in the PC market and that Microsoft violated the Sherman Anti-Trust Act by using its market clout to maintain its monopoly position.

This finding was later upheld by the U.S. Circuit Court of Appeals, although the ruling by Judge Thomas Penfield Jackson that Microsoft should be broken up was dismissed on technical grounds. The courts ruled that Microsoft should open its operating systems in such a way that others could use Windows as a platform for their own purposes, and that if Microsoft chose to offer its own applications and services, it should not reserve for itself a privileged technological position nor use exclusionary contracts to shut out rivals. Microsoft was to be denied future opportunities to design its operating systems so that competing products would be disabled or wold be harder to use or would run less efficiently.

After lengthy negotiations, the DOJ hammered out an agreement with Microsoft it felt met the principal complaints. But by 2002 additional lawsuits were on the docket. This was not the first time Microsoft had been in court facing similar allegations. The widely held view in the trade press was that, with its considerable financial and political clout, threats of lawsuit had little effect on Microsoft behavior. The company usually found loopholes around the law or simply ignored the legal rulings it didn't like.

In March 2002, the attorney generals of nine U.S. states dissatisfied with the DOJ settlement joined in a new lawsuit arguing that what had been agreed to did little to serve consumer interests and provided no remedy for keeping Microsoft from using its monopolistic power to undermine its competitors. Regional telephone company SBC Communications, media giant AOL Time Warner and software developer Sun

Microsystems supported this filing. Both AOL and SBC argued that the anti-competitive behaviors that had led to Microsoft controlling desktop computing remained virtually unchecked as it sought to move its dominance to the Internet.

Sun Microsystems simultaneously filed a private antitrust lawsuit alleging that Microsoft's .Net platform was designed to mimic the functions of Java. The Justice Department had raised no objections when Microsoft pulled Sun Microsystem's Java technology from Windows XP, the latest version of its desktop operating system, launched in 2001. This action meant that Web applications using Java would not run on Windows machines without additional software installation. According to Sun, the DOJ consent decree which barred Microsoft from including any feature in future operating systems that would undermine a competing software or program that served as a base for other applications had been blatantly ignored in XP.

Sun saw the dropping of the Virtual Java machine from the desktop as an obvious antitrust violation. It also charged that Microsoft had entered into exclusive deals and exclusionary agreements with independent software vendors such as Apple and Intel which would force its partners to distribute or use Microsoft-only products, a course of action which would fragment the Java platform and flood the market with incompatible applications. Sun was also seeking a permanent injunction requiring Microsoft to disclose and license proprietary interfaces, protocols and formats.

Creative Destruction: One way to understand what is transpiring in the three examples noted is to consider them in terms of the interrelationships between the concepts of innovation and obsolescence, things being created and things being sent to the dust bin.

First let's look at several assumptions related to the theory of creative destruction and some related questions which arise when national economies and their telecommunications and media enterprises pursue the goal of higher revenues and greater shareholder value under this banner:

- TECHNOLOGY TRANSFORMS: the assumption that the transforming power of technology perpetually makes old ways of doing things obsolete.

- CHANGE IS INEVITABLE: the assumption that human initiative in pursuit of profit, the investment of capital, the reaching across the boundaries of convention (thinking out of the box), the willingness to compete has created an orientation to and acceptance of change.

- TECHNOLOGICAL CHANGE IS NECESSARY: the assumption that capitalist societies have come to count on information and communication technologies and their applications to bring improvements to work and leisure, commerce and community, and to produce wealth.

- PUBLIC BENEFITS: the assumption that consumers will come to expect corporate products and services to be faster, cheaper, better. The society has bought into the idea

that the basis for economic progress and the good life is the creation of commercial products and services.

- TECHNOLOGICAL HUBRIS: the question of when innovation and the systematic destruction of innovations are and are not in the public interest? Even if the innovations are not themselves a mistake, perhaps some of their applications are. Perhaps also some of these developments have moved too quickly, are not really needed, or have been grossly mismanaged.

- CONSUMERISM: the question of what happens to societies when acquisition is so necessary to sustaining a high standard of living that consumption is thought to be a patriotic duty?

- MANUFACTURED DISSATISFACTION: The question of extent to which created demand, the result of pervasive marketing and selling aimed at turning today's technological wonders into tomorrow's trash, will accelerate depletion of Earth's resources and leave us with a throw-away society?

- LONG TERM EFFECTS: If today's way of doing business is built on displacement of whatever exists, is it likely that this can become a way of life as destabilizing for institutions, aspirations and values as it is for consumer goods and services? Does this have something to do with the generalizable feeling (among kids, parents, bosses, shareholders) that nothing accomplished is ever good enough? And that everything (even people) are expendable in pursuit of one's dreams (money, power, prestige)?.

The Two Sides: Let's face it. TV sets are better and 1) if the price was right, 2) if the kind of programming we liked was available, and 3) if the manufacturers wouldn't make our sets obsolete 6 months after we made the decision to buy, we would love to have a new HDTV.

A lot more of us already subscribe to cable and 1) if the price was right, 2) if we could get high-speed Internet and local and long distance telephony as well as news and entertainment, and 3) our cable operator would provide decent service, we could go for the bundle of services they are promoting with everything on one bill.

And even though we already have a computer, we might consider an upgrade 1) if the price is right, 2) if what we are getting is interoperable with other computers and whatever is on the Internet, and 3) if the manufacturer isn't jacking us around, limiting where we can go and what we can do, and making us needlessly vulnerable to hackers and harassing us with advertisements.

Let's face it. We benefit from a system which rewards basic research and we reap the harvests from the creative people who make useful things from basic science. No institution of our society was more prolific in ideas for improvements in communication and information technologies than the research scientists at AT&T Bell Laboratories.

Microelectronics (the transistor was an invention of Bell Labs researchers), digital systems, software and photonics were among the breakthrough concepts fathered there. Building applications from those seminal ideas continues to be enormously destructive of today's way of doing business.

It is the nature of innovation to be disruptive. Innovative companies take command of the physical (in some cases the economic, social and political) environment to develop the technological drivers that stimulate new venture enterprises and startups, facilitate production, help reduce time to market leading to commodities that benefit consumers. Within risky there can be failures, and in the pursuit of profit, greed can get the upper hand.

Observations Relating to I&O

Using the three case studies it is possible to consider several characteristics of Innovation and Obsolescence.

A. Technological Breakthroughs: Extraordinary developments in television, cable and computer networking technologies have been achieved within the past decade. One of the most dramatic of these is digital television.

To counter the threat of a totally new television system emerging on the world market not under U.S. control, the Federal Communications Commission in the early 1990s called on the major U.S. corporations with a stake in the outcome to join together in a Grand Alliance. The charge was to come up with the design for a new American HDTV system.

All of the early TV systems under consideration by the Grand Alliance, including the Japanese HDTV system, were analog systems. The lone exception was a proposal submitted by General Instrument, a company that had experience in the area of digital transmission. General Instrument brought to the table the concept of a digitally-based TV system featuring video compression for reducing the amount of bandwidth needed to create, store and transmit HDTV signals. This idea was so compelling that within months all proposals under consideration were digital.

The basic outlines of a new advanced television (ATV) standard had been agreed to by 1997. MPEG-2 was adopted as the standard for digital coding of interlace TV images compressing data of 270 MB down to 20 MB. This was a major technological breakthrough since, by this means, the rich picture information of HD could be made to fit within the existing 6 Mhz channel allocations of terrestrial TV stations.

The rapid convergence of voice, video and data applications on the Internet led AT&T in 1998 to think that the more robust cable TV pipeline might be a better way to offer customers a full bundle of information and communication services. Although the Internet was yet to be proven for the transmission of voice over Internet protocol (VoIP) and it was not entirely clear how the one-way cable lines currently running into homes

could be converted to two-way asymmetric carriers for telephone, high speed data and interactive multimedia services, AT&T was willing to bet the company on the idea.

Implementation of such a bold plan would take longer and cost more that AT&T had counted on but the integration of the here-to-fore separate industry sectors, namely telephony, cable TV and computer networking within a single environment was a conceptual breakthrough.

Similarly, the idea that the interconnection of computers by smart networks might be used to reduce the number of "fat PCs" has been a breakthrough of the last decade or so. Computers make work easier. Putting computers on networks make working at a distance easier. When the network is the Internet and just-in-time software can be downloaded with the application, computing can be performed faster, their reach can be more global and can cost less. When the task is done, the software is removed.

The PC operating system innovations, in which increasingly powerful processors drove increasingly capable software, so successfully shepherded along by Microsoft, hit a wall with the development of the Internet. Beginning in 1995, the "object-oriented" software of Sun Microsystems provided a language which allowed different kinds of computers and microprocessor-based equipment to intercommunicate, linking incompatible gear into a common network. Sun's Java software was designed to be sent easily over the Internet permitting programs to run anywhere. Developers were able to write applications with generic commands that could be managed from any type of computer, often without human intervention.

The idea that "shrink-wrapped" software, such as is needed to run each new generation of Windows, need not to be purchased and installed in every computer was an enormous technological breakthrough. Computers could be made simpler and smaller yet greatly enhanced in power and flexibility. In many cases, computers could disappear behind the scenes into so-called information appliances where specialized tasks are performed saving time and customer frustration.

B. Transformation of Business: For corporations as for nations, innovation is a way of gaining competitive advantage. Replacing old ways of doing things with more advanced communication and information technologies can help companies get more efficient and produce better products. Faster, cheaper, better products and services are what the market wants.

Late in the transition from analog to digital television, the computer industry began to wake up and realize the HDTV standards-setting process was going in absolutely the wrong direction from their point of view. It was not until 1997 that it dawned on computer manufacturers and computer software developers that future television sets would be digital, and that reaffirmation of interlace scanning would mean that the TV would be incompatible with the PC.

Computers scan pictures progressively (1,2,3,4) while TV's scan in interlace format

(2,4,6,8). Expensive conversions would be required to make PC images compatible with those on TVs. The computer industry began to lobby for the abandonment of interlace and adoption of progressive scan, which they could show was in several ways a superior approach. The hard-earned consensus among TV manufacturers to establish a single standard began to fall away. By 1998, it was clear that both digital interlace and digital progressive scan systems would be on the market.

This had the effect of slowing the rollout of HDTV, and put its public adoption as a common household appliance in doubt. Manufacturing TV sets which could perform interlace as well as progressive scans, or convert one to the other, would add greatly to the complexity and cost. The standards and the innovative technologies and processes by which this could be done affordably and in good quality would need to be developed.

In 2002 reality, HDTV is in the doldrums. Few sets are in the shops for sale and these are unacceptably expensive for public purchase. Formats have multiplied. Eighteen (18) different interlace and progressive standards are at some level of development. Among the big four commercial TV networks, CBS and NBC have chosen to broadcast in Interlace and ABC and Fox have chosen progressive. Among CBS and NBC stations currently broadcasting, most are transmitting at the highest HDTV standard 1080-I. ABC and Fox stations are concentrating on a lesser standard 720-P. All networks plan to limit their HDTV program offerings, focusing largely on primetime for highest quality images, and broadcast in a still lesser standard 480-I or 480-P for the bulk of their program day.

HDTV might in fact come to be regarded as a minor by-product of broadcast's system-wide conversion to digital. The real innovation, the one that will make the greatest long-term difference to businesses and their consumers, will not be the enhanced quality of the television picture, but the increased power and flexibility that come with digital. As future TVs take on the features of personal computers, enhanced applications in unanticipated forms can be expected to emerge in household and business appliances.

A similar transition is making its way in computing. The disruptive new technology forcing this change is the Internet.

The old-style software vendor, with Microsoft as its archetype, drove his revenues by assuring that his proprietary OS was the one used in all computers, and by regularly delivering product upgrades which promised lots of new features rendering old hardware obsolete. This approach worked well indeed. In 2001, Microsoft achieved profits of $7.8 billion on a market valuation of $323 billion, an achievement that made Microsoft co-founder William Gates the world's wealthiest man. MS was generating about $90 from every corporate PC which had Windows NT installed and about $45 per PC for Windows 98. Microsoft operating systems ran in an estimated 90 percent of the world's PCs.

The Internet has transformed work and living environments so rapidly that having the latest hardware is no longer the central barrier, since computing can be delivered directly to users. Like telephone systems, Internet systems require an end device that is very simple to use, thus complexity is pushed back into the network. Future business will be

transacted and information more widely accessed using networked computers. As Internet systems evolve, they will provide a lower-cost, higher-bandwidth environment for doing the kind of work that will be too expensive, too technically difficult and too slow to do any other way.

The Internet can turn local area networks (LANs) into wide area networks (WANs) that are global in scope. The driving force behind the nascent home-networking market is the interconnecting of home appliances, the telephone, the personal computer, the home entertainment center, security and utility systems for greater consumer comfort, enjoyment and control.

From the users' perspective, it matters little whether the basic service is provided by the cable or telephone company, whether the technologies are wireline or wireless, or who owns the operating systems and software. What users insist on is that the applications are carried out speedily, conveniently and with economy. When families, at-home workers or workers on the road cannot reach services they need because operators with proprietary technologies have locked them into closed systems they will not be happy consumers. This is why moves toward more open user systems will be seen on the global Internet, as well in local PC markets.

C. Walled Gardens: The walled garden is technological and marketing strategy used by numerous large corporations which involves acquiring both the content and the delivery system for satisfying user needs. Wherever possible, these companies and their affiliate partners will strive to be the single source for programming and for distribution, in effect building walls around consumers so competitors cannot get at them.

AT&T seemed genuinely surprised when non-affiliated Internet service providers wanted access to its new broadband cable networks, and many of AT&T's newly acquired subscribers were supporting their petitions. Prior to AT&T's arrival on the scene, TCI, Time Warner, MediaOne and other MSOs had made substantial investments in two ISPs, @Home and Road Runner. When cable subscribers learned they would need to drop their America Online and other ISP memberships, or pay extra, if they expected to benefit from AT&T's newly-upgraded high-speed lines, they were upset and complained to the local franchise authorities. These authorities one after another threatened not to transfer the TCI and MediaOne licenses to AT&T so long as its systems remained closed to competing ISPs.

AT&T was ultimately forced to back away from its position that it would not for business reasons and could not for technical reasons consider opening its broadband lines to competitors. AT&T argued that cable was not a "common carrier" in the fashion of the telephone companies, which were required by the Telecom ACT of 1966 to open their lines to competitors. With the kinds of money AT&T was spending on reconditioning its cable networks, it felt it was justified in deciding who could and could not access those lines.

The fallout from the "open access" debates was devastating for AT&T, and especially

for Excite@Home which was favored to be AT&T's sole Internet service provider. Citizen groups and franchise authorities were up in arms. The telcos were calling AT&T's position unfair, as was AOL and fellow ISPs. As a concession, AT&T agreed to a gradual phase in of one or more competing services under negotiated free market terms. Meanwhile Excite@Home, which had gone on a huge buying spree to acquire Internet content, found itself caught up in the dotcom meltdown. AT&T had to come to its rescue and lost millions.

By 2001, with the national economy in serious decline, AT&T was putting its cable upgrades on hold, laying off workers, shedding assets, and radically re-working its business plan. Even so, if AT&T could have wrapped a walled garden around its customers and the customers of its fellow cable operators, it would certainly have done so.

Microsoft was able to successfully fend off, buy out or eliminate its competitors from the world of desktop computing and apparently has every intention of doing so with its new Internet strategy. Having entered the competition late, Microsoft has been unable to catch up with American Online in numbers of Internet subscribers. But it is now putting its considerable technological talents and economic prowess to work ensuring that its software platform is the preferred method of delivering and managing future applications on the Internet.

The Web initially checked Microsoft's power by taking the action off the desktop, making Windows less necessary. To accommodate to a future when software will be sold as a service application rather than a packaged product, Microsoft has shifted the focus of its MSN portal to on line communications and electronic commerce. According to company announcements, the next generation Internet will need a way to seamlessly integrate today's standalone applications and Web sites which create islands of functionality and data. Microsoft's .Net initiative for Internet computing is aimed at enable constellations of PCs, servers, smart devices and IP-services to collaborate seamlessly.

Microsoft's stated goal is to be more than just an ISP. It wants to provide the operating system for the Internet. To this end, Microsoft has made investments totalling billions of dollars in key application service provider companies and in software and infrastructure development.

D. Threats to Innovation: Money can greatly boost innovation. And the lack of it can present big barriers to innovation. The reasons do not have to do only with incentives, money can assure staying power in sticking to the vision.

The cost of developing and implementing digital television is formidable. The Japanese lost millions of dollars and many years of heroic effort trying to establish their brand of HDTV as the new de facto standard for world television. Television set manufacturers have invested untold wealth trying to build TV sets that will accommodate

to the shifting expectations of those who set the standards, and the standards are not finalized almost 20 years after the technology was introduced. It is not clear even today that the broadcast stations who are looked to as the front line in bringing this innovation to the public will ever see their money returned.

For HDTV systems to work, modifications must be made at every level of the broadcast chain. The high-ticket items are the tower, transmitter, master control and digital encoders. For stations to be HDTV production-capable, to be more than a local retransmitter of distant signals, cameras, monitors, editing bays and even cabling must be replaced. Staff at every level will have to be retrained. The old and new systems will exist side by side for at least a decade, some analysts predict, even though the FCC rules call for return of the analog channel in the year 2006.

By FCC requirement, all commercial stations are expected to be on the air digitally by 2002. Public broadcast stations are given an additional year. While station managers have found transmitters and antennas to be available, problems have arisen with towers. Making modifications to towers, especially the erection of new towers, requires government permits. American communities have become intolerant to tower building and the broadcasters are not the only ones applying for permits. Finding crews to install towers was a problem for the early-installation stations.

Almost equal in importance to economic power is the support of governments. Regulators can through their actions create a supportive environment for innovations in communication and information technologies or they can find all kinds of ways to slow them down.

The U.S. government has a long history of keeping a watchful eye over the broadcast industry. As an industry trade group, the National Association of Broadcasters has a much-deserved reputation as one of the most successful lobbies in Washington. Because broadcasters control the airwaves which legislators must access to get elected, broadcasters usually get their way. In this case, the government wanted something and the broadcasters wanted something in return, and both got their wishes.

The government wanted to move the broadcasting sector into the digital age, thereby increase local competition and stimulate domestic growth in all sectors of media and telecommunications. Realizing that the U.S. market was large enough to shape international standards, the government also wanted to be sure American manufacturers of computers, digital broadcast and cable equipment and software were competitive in the global market.

The US Congress needed broadcasters' agreement and full participation to accomplish such an ambitious agenda. Thus, to make the change-over easier for broadcasters, and not disable viewers' existing receivers, every TV station in America was given a second 6 MHz channel, either VHF or UHF, so that both the old analog and the new digital signals could be simulcast. Regulators not only made the free spectrum available - estimated by some to be worth $70 billions of dollars to government coffers if auctioned, the

government gave tacit agreement to continuing certain protections on behalf of the industry. One of these protections was to insure that broadcasters' signals were carried by their multichannel competitors.

This move meant that the government agreed to resurrect and privilege an advertising-supported "free over-the-air TV" model for broadcasters that had, for the great majority of US households, ceased to exist. At the turn of the Century, less than one third of U.S. households had the equipment for receiving over-the-air signals. If viewers couldn't get broadcast signals directly from stations, cable, satellite and wireless providers would be required to deliver them.

The government handling of AT&T's moves on the cable industry and AOL's merger with Time Warner also sheds light on the issue of protecting innovation.

The FCC, under the Democratic administration, was counting on cable giving the telephone companies their first real competition in the local loop. From the government perspective, it appeared that AT&T was a company with sufficient resources and expertise to take on the Baby Bells, who seemed committed to maintaining their local monopolies. But AT&T's acquisitions had put it in violation of the FCC rule that said no one cable company could serve more than 30 percent of U.S. cable subscribers.

So, when local licensing authorities began placing "open access" conditions on AT&T Broadband transferring franchises from TCI and MediaOne, FCC chair William E. Kennard took AT&T's side. No conditions were placed because of the greater value given helping AT&T establish itself as a local competitor for telephony services. Under the George W. Bush administration, FCC Chair Michael Powell's position has been that cable operators have no obligations give their subscribers access to any Internet providers other than those they choose to do business with.

Concluding Thoughts:

The paradox of innovation is that hardly anyone likes change but in Western culture we require it of ourselves and expect it in others. We don't like having to learn new things but we do, and we know that we benefit from both the process and the actual result as individuals and as a society.

Some say innovation is as basic to human life as human survival and that innovation is just another word for tool-making. Obsolescence is the exchange of one workable instrument for another that's better, such as the replacement of the bow and arrow by the rifle using shot and gun powder, the replacement of prop planes by jets, the replacement of the abacus by the computer, the telegraph by the telephone, letters by e-mail.

New concepts can excite us but also scare us, like nuclear energy, space stations, bioengineering, nanotechnology, virtual reality, artificial intelligence, tracking software, data mining. Their value can be argued and their benefits demonstrated. Much of the resistance is in the fear of the unknown and loss of control. But survival teaches the

legitimacy of caution having to do with the preservation of life, the sustaining of culture, the protection of children, maintaining privacy and promoting competition and a level playing field.

Clearly, one of the great innovations of all time is the Internet, and the broadband Internet will bring changes to the media, to communication and to commerce like the world has never seen. By mid-decade, according to Allied Business Intelligence research, some 42 million U.S. Internet users can be expected to be high-speed access subscribers, up from 2.3 million at the turn of the millennium. These projections are based on an assumption of accelerating rollouts of broadband distribution systems using cable modems, xDSL copper, wireless and satellite networks with friendly connections to people where they live and work. Also assumed is an environment for healthy competition which will force providers to keep in touch with what consumers want and are willing to pay for in the way of products and services.

If these projections prove to be true, we can expect armies of salesmen knocking on our doors offering the latest networked solutions to our every need, and everywhere we go in the physical world or in cyberspace we will be bombarded with advertisements designed to influence how we use our time and money. Some of this we will welcome, some of it we can learn to ignore but much of it will be such an aggravation that we will seek relief.

We have the same ambivalence about government that we have about innovation. We don't like it, but we know we need to have it because certain disruptive technologies and certain applications of disruptive technologies are not in the public interest. Sometimes we have to pull back or slow down so that the things really important to us are not made obsolete.

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