



# **Centerprise**

The Center for Real Estate Enterprise Management

## **Background Briefing Series**

### **Note on Technology<sup>1</sup>**

**By John McMahan**

The last ten years have witnessed major changes in America's workplace environment, particularly as it relates to the use of office space. One of the major reasons has been rapidly changing technology. This note reviews the history and background of some of these changes.

#### **EARLY BUILDING BLOCKS**

In the mid to late 1990's, the United States experienced an unprecedented increase in economic growth, employment, and personal financial wealth. The building blocks for this phenomenon had been established several years earlier because of changes in public policy, the private business sector, and technology.

Public policy influences included the end of the Cold War, a worldwide reduction in trade barriers, deregulation of America's financial system, the Federal Reserve's close monitoring of monetary policy, and a federal fiscal policy focused on deficit reduction.

In the private sector, a major shift occurred in public perception. Often disdained in the 1960's and 1970's, business firms and people became "heroes" to the American public in the 1980's and 1990's, particularly those who chose to become entrepreneurs. Buoyed by an increasing willingness to accept investment risk, billions of dollars came out of personal savings and poured into the stock market, creating one of the biggest and longest bull markets in US history. The seemingly endless increases in market values created a growing feeling of personal wealth, helping to foster a consumer-spending boom.

#### **DEVELOPMENTS IN TECHNOLOGY**

The growth in the stock market was based on a major expansion in corporate earnings, largely fueled by unprecedented increases in worker productivity. These increases

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emerged primarily because of a confluence of technological innovation, which had been in the development process for many years but finally came on stream in the 1990's.

The development and refinement of the personal computer provided individual employees with a powerful tool to do their jobs better. The continuing miniaturization of silicon chip technology not only reduced the cost and improved the performance of computers but also allowed the imbedding of computer chips in virtually all types of machines, appliances, transportation vehicles, and other integral tools of American society.

Telecommunications technology also made major progress. The development and deployment of an extensive worldwide satellite system made it possible to transmit wireless voice and data to virtually every corner of the globe, almost instantaneously. With the dissolution of the Communist Empire, many newly freed countries found themselves with little existing telecommunications infrastructure and increasingly turned to emerging wireless technology as a relatively simple, broad-based solution.

Considerable technological progress also occurred in wire-based technology, particularly utilizing fiber-optic cables. Each of these technologies had their problems, however, with wireless transmission often uncertain and wired transmission with insufficient bandwidth to handle the load generated by the considerably faster data and voice generation systems.

Despite these problems, the public continued to flock to new telecommunication technologies: the number of worldwide wireless Internet users increased 187% in 2000 and the number of US DSL and cable-modem connections was up 88%.<sup>2</sup>

By 2000, the technology sector had become the largest sector of US Gross Domestic Product, larger than housing, automobiles, or food. By 2006, technology is expected to employ 50% of all US workers.<sup>3</sup> Investors also recognized the importance of intellectual property in determining value. In 1981, market value and book value were essentially the same; by 2000, market value was 4.2 times book value.<sup>4</sup>

In the late 1990's, all of these seemingly independent technologies became increasingly integrated through the evolution of the Internet or "Worldwide Web." The Internet was not entirely new – it had been originally introduced over 30 years ago as ARPAnet, a communication system established by the US Department of Defense and several major universities to enable their mainframes to communicate more efficiently. With the development of the desktop computer in the 1980's, the writing of new Worldwide Web software in the early 1990's, and the introduction of the web browser in 1994, the web subsequently established itself as a means of exchanging and sharing data among an almost unlimited number of users, at very little cost.

The web also allowed individuals and organizations to communicate instantaneously through electronic mail. Email has subsequently become so ubiquitous that it is now the

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<sup>2</sup> *The Industry Standard*

<sup>3</sup> US Department of Commerce; includes hardware, software, and telecommunications.

<sup>4</sup> Arthur Andersen

preferred means of communication for a large part of the world.<sup>5</sup> While still primarily sent through the personal computer, email is increasingly finding applications in telephones, handheld personal organizers, and home appliances.

## **E-BUSINESS**

Sensing an opportunity, businesses began developing commercial applications for the web. Increasingly, business managers learned that the web could dramatically reduce operating costs through higher employee productivity, the need for fewer employees, better inventory control, and more direct distribution channels.

Using an “*intranet*,” linking far-flung employees to headquarters and to each other, firms also were able to expedite the day-to-day communications required to run their organization more efficiently. Using an “*extranet*,” firms could communicate directly with outside vendors and suppliers in a similar fashion.

In fact, the web was revolutionizing the manufacturing process itself. Firms, unable to finely tune customer-purchasing needs, have traditionally had to produce large amounts of inventory that doesn't sell during the business year. This not only increases inventory-holding costs but also results in heavy discounts as unsold inventory is liquidated. Utilizing the web, customers can design, order, and pay for the product that they want, sometimes before it even goes into production.

The economic benefits of the web can be further enhanced by the use of auction-type “exchanges” to facilitate information flow between firms and to execute the transaction at the lowest possible price. As of spring 2001, many industries such as autos, airplanes, energy, building materials, and others were in the process of organizing exchanges to tap this opportunity.

Recognizing the revolutionary aspects of this breakthrough, Jack Welch, CEO of General Electric, vowed to “transform GE into an Internet company.” Many other major American manufacturers are now moving in the same direction. In 2000, expenditures for B2B commerce were \$213 billion, up 120% over 1999.<sup>6</sup> By 2010, one third of the world's B2B economy is expected to be online, with one third of the B2B e-commerce to be auction based. Over ten thousand new B2B companies are expected to emerge over the next 10 years.<sup>7</sup>

## **TECHNOLOGICAL INNOVATION**

Financing for the technological innovation came largely from corporate investment in new technology, the NASDAQ exchange, and venture capital investment funds. The usual pattern was for venture firms to fund start up costs and then be taken out of most or all of their investment position by an IPO, usually offered on NASDAQ. With the

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<sup>5</sup> In 2000, an average of 9.7 billion email messages were sent daily worldwide, up 64% over 1999. Source: *The Industry Standard*

<sup>6</sup> *The Industry Standard*

<sup>7</sup> IBM; Legg Mason; The Gartner Group

public's insatiable thirst for new technology issues, there appeared to be an unlimited source of capital available to fuel the technological innovation.

In 2000, venture capital firms raised a record \$92.3 billion, much of it from pension funds, for investment in Internet and other technology-related companies over the next three to five years.<sup>8</sup> This represented a 54% increase over the \$60 billion raised the previous year, but was down considerably in the fourth quarter, as concern developed over the economic value of many Internet start-up companies.

The financing nirvana began crumbling in early 2000. From a peak in the first quarter, the NASDAQ index declined over 34% by year-end.<sup>9</sup> Major technology firms were significantly depressed from previous highs and were continuing to report missed earnings projections into 2001. Several companies, trading for less than \$1 per share, were under active consideration for de-listing; many were heading into bankruptcy. The B2C sector was particularly impacted. Firms that failed to achieve profitability had their market valuations slashed by as much as 95% between 1999 and 2001.

Lacking a take-out option, many venture firms began reevaluating their positions. The first step was to suspend future funding for start-up companies until they could get a better fix on when the company could expect to become profitable. Underwriting standards were tightened regarding additional capital and new investments were largely deferred until the situation clarified. Many firms were urged or pushed to consolidate with other firms to preserve remaining capital. Many that wouldn't or couldn't consolidate went bankrupt. By the second quarter of 2000, the pre-IPO evaluation of e.commerce startups had dropped 75%.<sup>10</sup>

Many of the venture firms concluded that surplus funds had encouraged unwise investments in questionable businesses. As a Director of Dell Ventures put it,

“There were a lot of businesses getting funded that weren't really businesses at all. There were really just interesting features on a Web site.”<sup>11</sup>

In retrospect, most observers agreed that the collapse of the dot.com financing bubble did not change the magnitude of the fundamental changes occurring in the world's way of doing business, nor did it alter the significant investment opportunities that these changes would offer investors over the longer term.

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<sup>8</sup> Venture Economics

<sup>9</sup> Economy.com

<sup>10</sup> *The Industry Standard*

<sup>11</sup> San Francisco Chronicle, February 23, 2001