2. What Goes Up Must Come Down: The Political Economy of the US Internet Industry

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1. INTRODUCTION

The sheer magnitude of the Internet Bubble and subsequent technology stock market crash are a fascinating lens for examining the operation of the entrepreneurial portion of the US national system of innovation (NSI). The intense rapidity with which US firms commercialized the Internet and Worldwide Web (hereafter we refer to both as the 'Internet') is a prism for examining the creation of new economic spaces. If one includes the resulting crash, it also exposes some of the weaknesses of the US innovation system. This chapter draws upon the excellent work by Abbate (1999), Mowery and Simcoe (2002), and Berners-Lee (1999) which examines the pre- and early commercialization phases of the Internet. In building upon their work, we extend it in two ways. First, I situate the commercialization of the Internet in the US history of telecommunications deregulation and the entrepreneurial economy of US startup firms. Second, I describe the collapse of the Internet Bubble.

The Internet as a commercial proposition emerged during a period within which US industry was undergoing a profound rethinking of the firm's nature and competencies. Information technologies were one tool in a wave of restructuring, reengineering and reorganization. The firm was being reconceptualized as a 'modular' organization (Sturgeon, 2002). Moreover, there was a generalized belief that large firms were in danger of being outflanked by smaller, more entrepreneurial firms (Christensen, 1997). In this environment, the Internet and its perceived impact, driven by enormous hype, reached mythical dimensions, suggesting that it would change everything. Still, now that the hype has subsided, it is clear that in ten short years the Internet has become a significant artefact in both the office and home. There can be no doubt that it has opened what Schumpeter termed a 'new economic space'.

The Internet was commercialized during a period in which executives and management theorists were grappling with new ways of thinking about the firm. Firms were urged to consider their 'core competencies', while other management scholars were reconceptualizing the firm as a knowledge-based entity (Kogut and Zander, 1992; Nonaka and Takeuchi, 1995). The Internet, as an information technology-based medium that provided far richer and faster flows of information, resonated with these theoretical advances. Prior to the commercialization of the Internet, Reich (1991) reflected on the increased use of computers and involvement of managers in working with digital representations. He captured a movement to an information-based workplace in more popular terms when he wrote that 'symbolic analysts' were becoming the core of the US economy. In a more general way, Cohen et al. (2000) argued that the digital technologies were for the brain what, in an earlier time, the application of power and the removal of the tool from the workers' hands had been to physical production in a factory. Only rarely does a new technology emerge that can contribute, and even spark, both an intellectual reconsideration of the nature of the firm, the source of value creation, and the organization of an economy (Kenney and Curry, 2000).

The Internet evolved from a university-based, government-funded communication tool into a commercial system that many politicians, businesspersons, and academics believed would 'change everything.'[1] The readers will have to decide for themselves whether the Internet changed everything; certainly it has become a major new medium for communication and commerce. Carlsson, elsewhere in this book, argues that the Internet is one of those general-purpose technologies that 'exhibit pervasive innovational complementarities' (Rosenberg and Trajtenberg, 2002). As Chandler (1990) observed was the case with the telegraphy and railway systems, such technologies can be inputs and catalysts, permitting actors to reorganize entire business systems. As an example, drawing upon the insights of Chandler and others, Fields (2003) compares and contrasts the manner in which Dell Computer employed the Internet to reorganize its entire logistics systems to become the dominant PC manufacturer firm. The size and complexity of the US economy make it nearly impossible to grasp the dimensions of the commercialization process. National exceptionalism is a convenient argument, and evolutionary theory tells us that every NSI has a unique history of creating institutions differing from those in other nations. The US (or, at least, certain regions) has developed a powerful set of routines capable of encouraging the formation of new firms aimed at commercializing new technologies. In another venue, we argued that in the regions like Silicon Valley an entire sector or, what we term an 'Economy' had been formed, specializing in nurturing these firms (Kenney and von Burg, 1999).

The commercialization of the Internet is not the first example of this Economy creating new industries. For example, in the late 1970s and early 1980s, university-based biology research accompanied by enormous hype was converted into a biotechnology industry (Kenney, 1986). Also in this case, there was a bubble in biotechnology stocks that soon burst. The same institutions contributed to the rapid exploitation of the myriad possibilities that the Internet offered for commercial opportunity. With the benefit of hindsight, it is easy to conclude that some, if not most, of the investments made in attempting to commercialize the Internet were wasted. The more difficult question we will return to is whether, from a more distant perspective, these chaotic outbursts of new firm formations are wasteful.

This chapter is organized roughly in chronological order. The first section reviews the features of the macroeconomic environment that facilitated the rapid commercialization of the Internet. This section is wide-ranging as we discuss the peculiar configuration of the US telecommunications system, the diffusion of technologies necessary for Internet adoption, and the support system for entrepreneurship that facilitated its rapid commercialization. This is followed by a section that extends the research by Mowery and Simcoe (2002) on the diffusion of the Internet from the university to the larger economy and the reaction of various economic agents. Section 5 outlines the dimensions of the Internet Gold Rush and chronicles its subsequent collapse. The conclusion reflects upon the costs and benefits of the US innovation system with respect to the commercialization of the Internet.

2. THE MACROECONOMIC ENVIRONMENT

The governance system of the telecommunications industry was a critical backdrop for the trajectory and velocity of the Internet commercialization process. This section enumerates some basic aspects of the US political economy, arguing that they distinguish the US from other economies, and describes as well the commercialization process.

Despite the formation of the European Union, the US was (and remains) the largest single market united by common laws,[2] a common language, a common currency, and various features of a unified nation-state. A more prosaic, but nonetheless important, feature for the diffusion of the Internet was a well-developed telephone system with uniform rates and usage rules. Widespread credit card usage and the large number of US consumers comfortable in using their credit cards for telephone and catalogue sales meant that a payment system already existed.

At the technical level, during the entire period, the US had a larger installed base of computers than any other nation in the world. Though the US was

often the leader in inventing new computational and communication devices, it was certainly not always the leader. However, the rapid adoption and large installed base created positive feedback loops, reinforcing the US advantage. Though IBM was a global colossus, US antitrust enforcement ensured a semblance of competition and fettered IBM's ability to throttle new entrants: witness Microsoft, DEC or Sun Microsystems. In most other nations, one national champion for computing and another for telecommunications equipment was chosen and subsidized by the national government; other entrants were discouraged (Flamm, 1987). The evolution of the computer sector in the US was characterized by repeated waves of new entrants into the computing and data communications industry, whose innovations were more capable and/or less expensive than those of the dominant vendors in the previous generation. Thus, there was continuous turbulence – a feature not as common in Europe or Japan.

It was during the mid-1970s when personal computers and local area networking (LAN) systems emerged that the US became the leader in the development of what can be called distributed, networked computing. At each step of this evolution, US-based startups were the delivery mechanism for and the beneficiaries of the leaps in functionality caused by the creation of new evolutionary paths (Dosi, 1984; Garud and Karnoe, 2001). The rapid adoption and large installed base created positive feedback loops, as more Americans experimented with computers and networks, and therefore had greater opportunities to improve the technologies. Thus the computing and data networking systems evolved most rapidly in the US.

2.1 The US Telecommunications Industry

The distributed networked computing system articulated well with the relatively low-cost and open telecommunications system that had co-evolved with the US regulatory regime (Davies, 1994). Government policy toward AT&T, a private firm regulated by federal and various independent state regulatory commissions, differed markedly from those of other OECD nations where the telephone system was a government-operated monopoly (Fransman, 2001). The roots of this environment can be traced to a marketplace struggle during the first two decades of the twentieth century ending with the triumph of AT&T and the imposition of government regulation. Outcomes of this competition, the flat-rate price for local calls and 'universal service' became accepted norms and were enshrined in the regulatory structure (Lipartito, 1997; Kenney, 2003). This arrangement was stable for the next 50 years, despite the fact that telecommunications technology continually improved.

In the mid-1950s, AT&T owned and operated the entire phone system, from the consumer handsets to the network; it was a classic case of vertical

integration. The US government had no vested interest in the system, however, and was committed to encouraging competition. The process by which the AT&T monopoly was opened to competition can be understood as a disintegration of the telecommunications infrastructure into independent market layers, whereby each layer was gradually opened to competition (Moore, 1996).

This gradual deregulation accelerated competition and innovation. This should not be attributed to far-sighted government regulators and legislators; rather, it was entrepreneurs who pressed for deregulation, which, to their credit, government regulators and the courts did not strongly resist. Because AT&T was not a government-owned monopoly, deregulation was much easier and more gradual. This progressive deregulation allowed new firms to emerge in every aspect of telecommunications. Repeatedly, the new entrants ignited cut-throat competition, by rapidly decreasing costs and/or increasing functionality. The outcome of this gradual deregulation was a low-cost, relatively open market within which entrepreneurs could experiment with new business opportunities.

Flat rate service has a particularly interesting history. After AT&T's victory, it no longer supported a flat rate for local calls and agitated for regulatory relief, as the rate encouraged wanton use of the telephone with no further compensation. In the 1970s and 1980s this fostered the growth of computer bulletin boards that operated over the phone lines. Here, flat rate service stimulated increased use of local phone lines for data communications, and created an enormous base of home users who would rapidly adopt the Internet (Jimeniz and Greenstein, 1998). These computer bulletin boards transformed into Internet service providers and thus integrated the home user into the Web. When considered as a totality, this section has demonstrated that the telecommunications infrastructure was sufficiently open so as not to provide an insurmountable obstacle, the technical infrastructure was in existence, and there was a latent market for greater data communications services.

3. FROM THE UNIVERSITY TO INDUSTRY

The ARPANet, established in 1969 as a US Department of Defense project for interlinking defence researchers at various universities and military research establishments, was the beginning of the Internet (Abbate, 1999; Mowery and Simcoe, 2002; Rogers, 1998). Due to increasing non-military related demand, it was transferred in 1985 to the National Science Foundation (NSF) and renamed the NSFNET. To further diffuse usage, the NSFNET was opened to all universities with the requirement that they must make a connection 'available to all qualified users on campus' (quoted in Leiner et al., 2000). This spread e-mail and file-sharing to the rest of academia, enlarging the installed

base. In 1985, NSF also decreed that all NSF-related sites should use the TCP/IP protocol, which contributed to its establishment as the dominant data transmission protocol. Importantly, in the late 1980s, AT&T was uninterested in operating the NSF Internet backbones, creating an opportunity for startup Internet service providers such as UUNet and PSINet, both of which were funded by venture capitalists.

Even as the Internet grew, NSF began privatizing the NSFNET. In March 1991, some restrictions on commercial use were loosened. In September 1994, NSF announced its intention to discontinue subsidizing the Internet backbone effective in May 1995 (Ferguson, 1999; Howe, 2000). This privatization was significant, but was only related to infrastructure. The technological development that formed the basis of the Internet Bubble was the 1991 release of the Internet software and specifications by Timothy Berners-Lee of the CERN high-energy physics laboratory in Switzerland. These two unrelated developments combined to accelerate adoption and increase commercial interest. All the pieces were in place for what Usher (1954) termed a new synthesis.

In February 1993, Marc Andreessen and Eric Bina, working at the University of Illinois National Center for Supercomputer Applications, wrote the Mosaic Web browser for the Microsoft Windows platform. This user-friendly graphical browser simplified the use of the Internet. Moreover, by posting it on the Internet they made it freely available, and as a result millions of copies were downloaded in a few months. The rapid adoption of the Mosaic browser sparked consideration of the possible commercial potential of the Internet. The University of Illinois soon afterward licensed the Mosaic browser technology to the venture capital-funded firm Spyglass, and then later to Microsoft. The creation of Mosaic, the connection of commercially operated networks to the old NSF Internet, and the withdrawal of NSF, signalled the end of the precommercialization phase.

By early 1993, the technology was ready, and a few existing firms and several startups were experimenting with harnessing the technology for commercial purposes. And yet, industry and entrepreneurs were more interested in the implications of interactive television delivered through the cable system. In most respects, the Internet was still a university-driven technology, and for the users it was free. For businesspersons, the Internet was attractive, but it was difficult to decide whether there was a valid business model for its commercialization. The first significant report to the general public about the commercial implications of the Internet was the 8 December, 1993 *New York Times* article by John Markoff (1993) entitled 'A Free and Simple Computer Link'. Markoff described how firms were putting documentation on-line, preparing on-line magazines, and thinking about advertising applications. On-line sales were not mentioned.

The single largest concentration of users (that is, expertise) was in the universities. Given this expertise, it is not surprising that universities were the source of several early startups. Computer science students and faculties formed the vanguard, but in the later Internet Bubble, students in other departments and, particularly, in business schools began launching e-commerce startups. The ensuing 'dot.com' fever made entrepreneurship an important career goal for students and faculties; many ventures were first conceived and then launched from campus. From 1997 to early 2000, the enthusiasm was giddy. The career goals for MBA students changed from joining investment banks or consulting firms to establishing or joining a startup. By 2002, the Internet frenzy had subsided, and the severe environment for entrepreneurship had decreased. However, from the NSI perspective the transference of knowledge and capabilities within the university to the commercial sector had been accomplished.

4. THE COMMERCIAL TIDAL WAVE

The commercialization process bore a certain resemblance to the Oklahoma Land Rush memorialized in the 1934 movie *Cimmaron* (Kenney and Curry, 1999).[3] The commercialization process was remarkable on many dimensions. The first dimension was its rapid diffusion and adoption. In 1992 it was largely confined to university applications, however its diffusion rate resembled an epidemic as the ranks of users exploded. By 2001 over 102 million US households representing 58 percent of the population had Internet access from their homes (Macaluso, 2001) and 28 percent of the population had access from their workplaces (Taylor, 2001). These early adopters were ideal potential customers as they had higher than average incomes, used credit cards, and had fewer security fears. And yet, for businesses the question was still how this new tool could be used.

The Internet is such a fascinating economic space, because of its breadth. In their organizational ecology of the Internet firms, Hunt and Aldrich (1998) include a range of firms from AT&T to startups such as Amazon.com. While we might exclude the traditional telecommunications service providers, an argument could be made for their inclusion. In some ways, as with other general-purpose technologies, it is possible to cast the net even further and include on-line activities of existing firms in a wide variety of industries. The multilevel aspect of the Internet, combined with the wide variety of applications, meant that there were an enormous number of commercial opportunities. Given potential capital gains there was an enormous burst of firm formations, both with and without venture capital funding. As with any new eco-

nomic space, there was an enormous rush of entrants due to the low entry barriers (Utterback and Suarez, 1993).

4.1 Existing Firms and the Internet

The Internet had the potential to be a disruptive technology for existing businesses (Christensen, 1997). The first established firms to understand the implications of the Internet were Silicon Valley firms such as Cisco, Sun Microsystems, and Oracle; all of which had been financed by venture capitalists in the 1980s. This is not surprising, because they were infrastructure providers for organizations planning to utilize the Internet. In a sense, they resembled the merchants who supplied equipment to the miners in the Gold Rush. Cisco was particularly advantaged, since it produced the routers and switches that directed much of the Internet traffic (Mayer and Kenney, 2002). Sun, with its roots in the engineering and networking community, also experienced dramatic sales growth, as its servers became the standard for large Web sites. However, it was Oracle's database software that became the platform upon which most Web sites operated. These firms became critical Internet infrastructure firms.

Remarkably, it was not until 16 May 1995, with the release of Bill Gates' memo entitled 'The Internet Tidal Wave', that Microsoft demonstrated that it grasped the implications of the Internet (Ferguson, 1999). Given Microsoft's comparative tardiness, it is no surprise that in the period from 1995 to 1997 most non-technology firms were unaware of the impact that the Internet could potentially have on their businesses. IBM and Hewlett Packard were also slow to react, while DEC was very late. In DEC's case, this was particularly surprising because it owned Altavista, which was one of the most successful early search portals, and had been aware of the importance of the Internet in 1992 (Berners-Lee, 1999). Had DEC been more aggressive, it might have been able to create a successful portal and become a rival to startups such as Yahoo!

A comparison of two rival PC makers, Dell and Compaq, illustrates that management's awareness of the environment can affect technology adoption and competitive advantage. Dell rapidly transferred its build-to-order model to the Internet and was rewarded with lowered costs and increased sales. In contrast, Compaq, dependent as it was upon in-store retail channels for sales, found it difficult to convert its operations to the Internet. For Dell, the Internet became a powerful new competitive weapon, while for Compaq, the Internet proved to be a difficult medium to use effectively (Kenney and Curry, 2001; Fields, 2003). Although the Internet was a boom for many technology firms, it also created difficulties for firms that were ineffective in utilizing its potential.

For established firms, the Internet enabled the provision of new services to their customers, an opportunity to displace intermediaries, and/or a tool for

transforming old business processes. Sales would only be the most visible use of the Internet. Easily as important was the adoption of Internet-enabled business process customer service, passive information provision, and software downloading; all of which decreased costs and/or assisted in customer retention.

As with so many technologies, the Internet contributed to a change in the relative power balance between links in the value chain. For example, the airlines have used the Internet as a tool for decreasing their commissions to travel agents. Prior to the advent of customer self-service on the Internet, when a customer reserved through a traditional travel agent, the airlines paid a commission of between 15-20 percent of the total ticket price to the travel agent. In contrast, when the customer reserves on the airline's Web site, the cost is between 3-5 percent of the ticket price. These enormous savings allowed airlines to reward customers for booking on-line, and the percentage of tickets reserved on-line grew rapidly (Global Aviation Associates, 2002).

Technology also has many unforeseen impacts. It has been suggested that, though the Internet has allowed airlines to save on reservations, it has also allowed consumers – especially business travellers – to compare prices more effectively, thereby resulting in losses in revenue that exceed the savings made.

During the early days of commercialization, the potential impacts of the Internet were not fully apparent. Not entirely surprisingly, firms like Dell, FedEx, and Southwest Airlines that were already exploiting new business models were the earliest to experiment with the Internet. In retail, the pioneers include catalogue-based firms such as REI, Eddie Bauer, and Land's End. In general, store-based retailers trailed the early adopters and established Web sites only after 1998. The response of manufacturers varied widely. For example, Cisco and Intel began on-line customer service in 1995 and 1996, respectively. Other firms were less aggressive, but by 2002, having a Web site and using the Internet as an intranet was nearly universal. Adoption was a learning-by-doing process, whereby adopters gradually evolved ever more applications, which gradually deepened the adoption of Internet technologies.

The safest generalizations that can be made about the established firms are that the more technologically sophisticated they were, the closer they were to computer networking, and the more entrepreneurial they were, the more rapidly they adopted and experimented with the Internet. However, many established firms were passive until startups actually entered their market, threatening to replace or disintermediate them (if they were retail operations) or reorganize the value chain (if they were manufacturers). Though, in nearly all cases, the startups were unable to dislodge the incumbents who were able to draw on a host of complementary assets (Teece, 1986), their threat forced them to experiment rapidly with the new medium.

4.2 The Startups

The role of startups in the commercialization of the Internet did not begin with the Internet. The Internet data communications firms, PSINet and UUNet, were funded by venture capitalists in the late 1980s, as was the dial-up message board firm, AOL.[4] Still, it is accurate to say that outside of these firms, there were few Internet startups and few investments until 1994. This was a function of the time it took for entrepreneurs to comprehend the opportunities that the Internet represented and the delay in convincing venture capitalists that the Internet presented an investment opportunity. However, the lag was not long – especially in Silicon Valley – and by early 1994, venture capitalists began receiving business plans from entrepreneurs with ideas for the commercial exploitation of the Internet. Given the greater venture capital resources and large numbers of entrepreneurs, Silicon Valley quickly became the centre for Internet startups (Kenney, 2003; Zook, 2002).

With the release of Mosaic, some existing small firms began developing software such as browsers and web-editing tools for use on the Internet. A few of these were funded by venture capitalists, but most were self-financed. Netscape was one of the earliest Internet startups dedicated to exploiting the Internet, that received venture capital. It was established in April 1994 by Jim Clark, an ex-Stanford professor and founder of Silicon Graphics Inc., and Marc Andreessen, a former student at the University of Illinois and leader of the team that created Mosaic. After hiring the others on the Mosaic team, they rewrote Mosaic and rapidly captured the browser market (Cusumano and Yoffie, 1998). Netscape had an initial stock offering in August 1995 at a price that gave it a valuation of nearly one billion USD. This alerted every venture capitalist and entrepreneur to the capital gains they might reap in the Internet field. By 9 March, 2000, more than 370 self-identified Internet-related firms had gone public and their total valuation was $1.5 trillion, though they had only $40 billion in sales (Perkins, 2000).

As the number of users grew rapidly and new business ideas proliferated, the Internet became an economic space that continually expanded, providing further commercial opportunities. The greater the number of users, the more reason there was to create Web pages in order to increase content and reason to use the Internet. The result was a virtuous circle of increasing returns, or what has commonly been called ‘Metcalfe’s Law’. This provided opportunities for yet other startups to develop new software and Web-based services. For example, businesses could be built around searching and cataloguing other sites. There was an explosion of software tools firms, Web-hosting services, etc.[5] Each apparent success attracted more investors willing to fund entrepreneurs experimenting with yet other business models.

The rapidly growing user base, reinforced by the high valuations that Internet-related startups commanded in the stock market, unleashed a frenzy of venture investing. Naturally, this willingness to fund experiments encouraged ever more speculative experimentation. With public investors clamouring for shares in Internet firms, these experiments could be listed on the stock market for massive capital gains. Despite the scattered failures, the Internet sector burgeoned as more firms entered the space.

Investments in the pioneers returned excellent results as firms went public or were acquired. From 1995 to March 2000, the willingness of public markets to purchase the shares of newly formed Internet firms fluctuated, but in general the market was very positive and small firms were able to raise large amounts of capital. This illustrates how by mid-1999 there was what might be termed a full-scale investment panic as public investors drove the price of new issues skyward.[6] In 1999, the *average* return for early stage funds was 91.2 percent, the highest in history (NVCA, 2000a).[7] The returns for the most successful venture capital funds were astronomical. Table 2.1 shows that a number of funds had annual returns of 100 and even 400 percent per year. Rates of return of this magnitude, quite naturally, excite 'irrational exuberance' and excessive greed. This explains the increase in the amount of venture capital invested in Internet-related firms, which grew from a nearly negligible $12 million in the first quarter of 1995 to $31 billion in 1999 (NVCA, 2000b). In percentage terms, the increase was equally dramatic, growing from a negligible percentage in 1995 to over 60 percent of total investment in the fourth quarter of 1999 (NVCA, 2000b: 31).

Table 2.1 The returns for selected venture capital funds raised during the Internet boom

Firm	Date	Size (millions)	Annual IRR (%)
KPCB VII	1994	225	130
Benchmark	1995	101	236
Brentwood VII	1995	115	99
Matrix IV	1995	125	221
Accel V	1996	150	196
KPCB VIII	1996	299	350
Battery IV	1997	200	244
Benchmark II	1997	125	419

Source: Adapted from Lissom, 2001.

In this bubble, massive sums were committed to multiple firms intent on entering the same business segment, even when it was likely that only one firm could survive. Table 2.2 indicates the huge numbers of venture capital-

funded startups in different segments. However, if these investments are thought of as being experiments, it means that the US launched an enormous number of experiments. This large number, even if accompanied by foolishness and stupidity, increased the probability of having made a correct investment; indeed, a few of these startups have become global leaders. Just as important, this feverish investment alerted established firms to the potential of the Internet and forced them to react. In effect, these investments both created new firms and changed the environmental conditions for established firms.

Table 2.2 Companies receiving venture capital funding, 1997-2000

Sector	Number of Companies	Representative Firms
Switches etc.	73	Ciena Networks
Data communication components	135	Optimight Comm.
Communications processors	84	Broadcom
Local area networks	92	Cascade Comm.
Wireless components	76	Metaware Comm.
Web aggregation, portals, exchanges	141	VerticalNet
Ecommerce software	199	Kana Comm.
Internet communication & infra.	71	Akamai
Internet security/firewalls etc.	202	VeriSign
Software consulting services	134	CommerceOne

Source: Adapted from *Venture Economics*, April 2002

The sheer diversity of Internet-based business activities is remarkable. Many of these businesses could not exist if it were not for the Internet. Cyberspace is being 'settled' and people are building economic activities. Some of these activities, like retail sales, are directly analogous to those in physical space, while others are unique to cyberspace. For example, portals and search engines such as Yahoo!, Excite (now part of Excite@home), and Google are only possible because of the Internet.

Portals are the central nodes through which Internet users pass on their way to other destinations. The dominant portals were established during the earliest days of commercialization. Due to the US head start, nearly all of the dominant global portals such as Yahoo!, Excite, Altavista, and Infoseek were US-based.[8] By 2002, Yahoo!, AOL, and MSN were the global leaders. The dominance of the US-based portals was predicated on a number of advantages. The precocity of the US market and its large size meant that the vast preponderance of sites were and continue to be in English. Not surprisingly, this is an advantage to the US portals, not only in terms of content, but also in terms of an ability to capture scale advantages. As David (1986) and Arthur (1994) predict, in the case of portals winner-takes-all economics seem to be operating.

Early entrance allowed these US firms to establish global brand names before other sites could compete in the English-language market. In other countries, indigenous portals had to defend their language market from the US portals, which already controlled the English-language traffic. The US portals also translated their sites into foreign languages, while leveraging their existing architecture, software, server farms and technical talent.

Another group of sites, such as eBay and the now defunct Napster, links users together. These sites are not based on direct sales; rather, their profits come from other revenue sources such as advertising, subscriptions, commissions, referral fees, etc. The most successful example is the auction site eBay. eBay was established in September 1995 and grew rapidly to become the largest Internet auction site with net revenues of $289 million in the third quarter of 2002 and an income of $61 million. On-line gaming is another application in which a firm provides a platform for gamers. What is remarkable is the sheer diversity of games, which range from fantasy sports and gigantic role-playing games to simple two person games like chess. There are also a myriad of community sites that provide platforms for Web pages, chat, and other interaction. For example, AsianAvenue.com provides a social interaction platform for Asian Americans.

Portals, auction sites, on-line gaming and social platforms are examples of activities that have no direct analogues off-line. These new activities are fascinating because they are not shifting existing commerce on-line; rather, they are the outcomes of the opening of a field for experimentation. These on-line-only applications show that despite the collapse of the Internet Bubble the technology has become a part of everyday life.

4.3 Software Tools and Internet Services

The early and rapid development of e-commerce, the large number of leading-edge users, and an already strong position in software provided significant advantages to US firms intent upon developing software tools for Internet users. As von Hippel (1988) pointed out, the needs of cutting-edge users can alert toolmakers to marketable improvements, or what could be termed ‘learning from lead customers’. Further, the needs of customers such as Yahoo!, Amazon and/or eBay meant that software and services would be severely tested, thereby exposing limitations and problems. The intense competition among the users as they sought technological advantages meant that software innovators had a ready market. A symbiosis between software designers and leading-edge users developed, thus creating a virtuous circle in which improved tools accelerated the development of the Web sites and vice versa.

Rationalizing and transferring business processes and business-to-business (B-to-B) e-commerce to the Web-based protocols created significant new

demand for software, and many startups were funded by venture capitalists to meet this new demand. Venture capital-funded startups such as CommerceOne, Ariba, E.phiphany, and Kana Communications, to name only a few, became global competitors, and very often the US firms (which to a great extent had roots in Silicon Valley) were competing globally against each other. In the Internet services arena, US startups became global leaders in corporate web hosting. Other firms offered to manage corporate Web sites, e-mail, and a wide variety of other Internet-related functions. Other software firms such as Inktomi and Akamai developed software used for Internet infrastructure.

There were a number of *de novo* entrants initially, but later service entrants were actually incumbents in adjacent fields or firms that had previously offered a similar service without using the Internet. Christensen et al. (2003) show that as the Internet matured, other types of firms became significant players in Internet service provision. Some of these would be large European firms. However, US incumbent firms such as IBM Global Services, Accenture, etc. would be significant, not only due to their size, but also because they were able to draw upon the knowledge they had garnered in the US serving early adopters. It is quite possible that Internet service firms may disappear as an identifiable category and simply become part of the computing-related services industry, and the Internet will be a component of a larger solution (for further discussion of this point see Christensen, Chapter 8, this volume).

US firms have occupied nearly every important Internet-related software niche. These firms rapidly expanded their businesses into other countries, either by establishing offices or using their stock to purchase the much smaller international competitors. Whether American or foreign, most Web sites operate on US software and hardware. Regardless of the outcome of international competition concerning portals or e-commerce, or the different privacy issues and government policies, it will be US software toolmakers and service providers that will become the dominant vendors. Judging from the current situation, there will be fewer significant European and Asian firms. One possible exception to this scenario would be if mobile phones become a dominant Internet access device – an uncertain proposition (Kenney, 2003).

4.4 E-Commerce

Of all of the fields that received funding during the Internet frenzy, business-to-business and business-to-consumer e-commerce attracted the most attention from the media. There was a proliferation of startups predicated on extraordinarily risky business models. In the excitement of the moment many predicted that these platforms would entirely replace physical stores (bricks

and mortar). Put differently, the on-line operations were expected to disintermediate the traditional sales, retail and wholesale. Accomplishing this proved difficult. The first idea was to create e-malls, that is, retail sites like physical-world shopping malls, where retailers could 'locate' their shops. The proposition was that these business-to-consumer (B-to-C) sites would attract consumers because of the convenience of having a centralized on-line 'shopping centre'. These 'standalone' malls failed.

In July 1994, only a few months after the establishment of Netscape and Yahoo!, Amazon was established, and in July 1995, its on-line bookstore opened. Amazon's founder, Jeff Bezos, was not attracted to books, because he was interested in the book business per se; rather, he was searching for a retail sector that would be easy to penetrate. Books were chosen because they are an easy-to-ship, undifferentiated product. Moreover, there was an existing set of distributors that could be used for order fulfilment. From its inception, Amazon aimed to expand from books to other items, with the eventual goal of becoming a multiproduct retailer – in other words, Wal-Mart was the real target. Even though Amazon consistently lost money, and did not have the advantage of being the first on-line bookstore, it was able to grow rapidly and swamp its bookstore competitors because of the venture capital backing it received in June 1996. As of late 2002, Amazon was marginally profitable.

Amazon was a pioneer. Its fabulously successful listing on the NASDAQ ignited a frenzy of investment in other on-line retail startups. Very soon there were specialized sites selling groceries, pet supplies, air travel, vitamins, pharmaceutical prescriptions, stocks, CDs, electronics, PCs, home improvement supplies, and nearly every other commonly consumed item. In this investment frenzy, often four or five on-line firms were established in each product category. At times these firms would have different business models, but for the most part, they were simply clones. Of course, part of the problem was that the venture capitalists that funded this plethora of firms selling almost any product never recognized the fact that Amazon was not meant to end up as an on-line bookstore. It was meant to be an on-line Wal-Mart. When the IPO boom ended in early 2000, many of these e-retailers had not yet gone public and were not profitable. With no exit opportunity, their backers rejected entreaties for more funds, sparking a wave of distress mergers and bankruptcies. Many of those that had gone public in 1998 and 1999 had gone bankrupt by 2002.

The on-line retailers soon discovered the importance of complementary assets such as product line expertise. For example, they learned what offline retailers had always known: predicting demand is one of the most difficult skills in retailing. For example, in 1999 Amazon purchased the wrong toys and after Christmas it had to write off $35 million in unsold inventory. In response to these problems, in August 2000 Amazon.com entered a joint venture with Toysrus.com in which Toys'R'Us would be responsible for buying and manag-

ing the inventory, while Amazon would operate the Web site development, order fulfilment, and customer service for a new joint site (Farmer and Junnarkar, 2000). In effect, Amazon acknowledged the fact that it did not have the expertise to predict toy demand effectively, while Toys'R'Us conceded that it was not as successful in interfacing with Internet buyers and handling fulfilment.

Only six months to one year after the establishment of the first B-to-C firms, venture capitalists began funding entrepreneurs to establish Web sites aimed at becoming on-line marketplaces where businesses could buy and sell, i.e., B-to-B sites. The B-to-B market quickly outstripped B-to-C in sales, though most of these sales were through the Web sites of firms such as Dell, Cisco and Intel. However, by mid-1998, independent on-line marketplaces had been established for nearly every business imaginable. A 1999 report by a Robertson Coleman analyst listed 253 separate on-line B-to-B sites (Upin, 1999). By 2002, many of these had closed.

The history of a couple of the most important B-to-B firms provides an insight into the precipitous rise and collapse of this entire genre of Internet firms. One of the first independent B-to-B firms, VerticalNet, was established in October 1995, and by November 2000 it was operating more than 60 separate industry Web sites through which specific industrial commodities could be traded (VerticalNet, 2001). In October 1999, VerticalNet's stock reached $239 per share, but by October 2002 it had dropped to $.86 per share and was being delisted from the NASDAQ. Another firm, the Internet Capital Group (ICG), was established in 1996 with the express purpose of investing in fledgling B-to-B startups. Its investment record is directly correlated with the Internet Bubble. In 1996, ICG invested $14 million in startups, however by 1999 this had increased to $572 million. In 2000, it had planned to invest in excess of $1 billion, but this amount was dramatically reduced due to the collapse of ICG's stock price. By November 2002, ICG's stock had dropped to $.25 per share, and it was also scheduled for delisting. These two firms were clearly among the most visible of a cohort of what would prove to be a large number of delisted and bankrupt firms.

5. THE COLLAPSE OF THE BUBBLE

In March 2000, the NASDAQ Bubble that was driven by the technology stocks began to collapse. The first to drop were the profitless e-commerce firms (Pets.com, Eve.com, Boo.com ad infinitum). They were followed by the network equipment startups (e.g., Ciena, Sycamore, Extreme Networks), and then later in 2000 by the telecommunications firms (e.g., Qwest, Winstar, Global Crossing). As their stock prices fell, venture capitalists and corporate

insiders began unloading their large holdings at any price. At the same time, stock market analysts at the large investment banks recommended stocks that they were privately disparaging. By 2003, the stock market collapse would be the greatest since the Great Depression of the 1930s.

At the end of 2002, though usage of the Internet continues to increase – albeit at a far slower pace than previously – the shakeout in the industry continues, though at a slower rate. Webmergers (2002), which estimates that there are between 8,000 and 10,000 dot.com firms, has counted 862 failures of dot.com firms (this does not include mergers). It also found that the rate of failure slowed in 2002. Of course, investors, especially those that purchased stock after the initial public stock offerings, have lost hundreds of billions of dollars. With the exception of eBay, even firms that will survive, such as Amazon and Yahoo!, have experienced massive losses in value.

The startups were the most severely affected, but many established firms have also had severe difficulties. The magnitude of this downturn is such that many of these firms have lost 75 percent or more of their peak valuation. Telecommunications providers ranging from AT&T to Worldcom and Sprint faced severe difficulties, with Worldcom and Qwest collapsing into bankruptcy connected with fraud. High technology equipment providers – especially telecommunications equipment providers, such as Nortel and Lucent – were flirting with bankruptcy. For others such as Cisco and Sun Microsystems, layoffs and dramatic decrease in their stock valuations were the norm. The ulti-

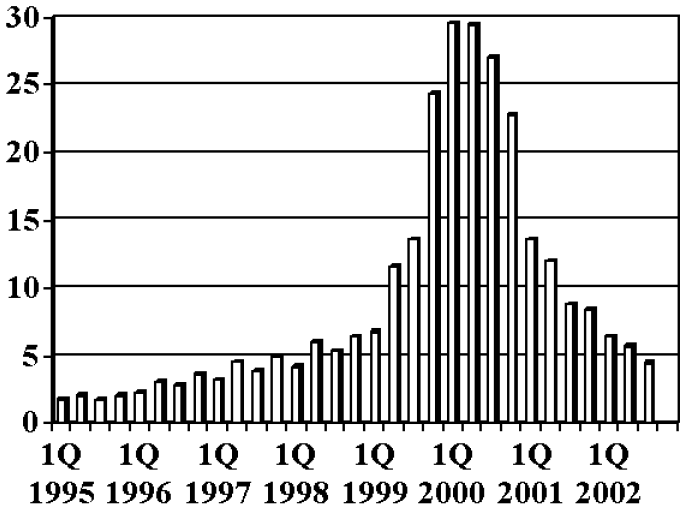

Figure 2.1 Venture capital investments per quarter from 1995 to 2002

mate fate of many of these firms rests with the length of the current high-technology depression.

The venture capital industry both fuelled and benefited from the Internet Bubble. Figure 2.1 shows that venture capital investment increased from approximately $2 billion per quarter in 1995 to a peak of nearly $30 billion in the second quarter of 2000. In 2002, investment had been reduced to under $5 billion in the third quarter, and it was generally expected to continue to decrease. This collapse has also been reflected in the returns on venture capital portfolios. For example, in the first quarter of 2002, the annualized rate of return for venture capital partnerships was –24.4 percent (NVCA, 2002). During the second quarter of 2002, for the first time in history, US venture capitalists have actually returned to their investors more money to investors than they received in new investments. Finally, the venture capitalists have an enormous 'overhang' of monies that are unlikely ever to be invested profitably.

There may be reasons to debate whether there ever was a 'New Economy'. Separating what has changed and what remains the same is not easy. However, it would be a mistake to treat the Bubble and the Collapse of the Bubble separately. The Bubble of the late 1990s expressed the strength and power of the US NSI. However, it is equally true that the Collapse provided an instructive lesson in the dangerous tendencies in the US NSI.

6. FINAL THOUGHTS

At this early date, writing about the commercialization of the Internet as history is fraught with uncertainty. Kindleberger (1978) noted that manias were frequently accompanied by swindles, frauds and other financial crimes, and the Internet Bubble confirms this conclusion. However, in contrast to many previous bubbles that were based on real estate, watered stock or tulip bulbs, real infrastructure was built and viable firms were created. In ten short years since the release of the Internet protocols, the Internet has become a part of everyday life. Without a doubt, the mania contributed to the rapid diffusion and commercialization of the Internet.

The enormous capital investments in everything from infrastructure through to the creation of e-commerce sites funded experimentation with new business models and activities of all sorts. The US NSI based on venture capital funding of startups turbocharged the formation of new firms, but also fed wild speculation. Despite, or possibly because of this excess, the US developed the strongest and broadest Internet industry in the world. These defining firms were supported by venture capital, and two important survivors, Yahoo! and Google, can be traced directly to US universities.

The Internet investment craze in the second half of the 1990s was extremely wasteful. Foolish business propositions of all sorts received funding. And yet, even after the evisceration of large amounts of this speculative capital, US firms remain dominant in nearly every area related to the Internet. From a systemic perspective, it is likely that in a decade hence we will reflect upon the Internet investment bubble and conclude that the willingness of investors to experiment resulted in US firms capturing a leadership role, and that the survivors gained the resources, experience, and market share that only a few firms in other nations were able to achieve.

Finally, the question of whether the US is in a 'New Economy' is difficult to answer, because it is too early to separate the Bubble-induced euphoria from real changes. If what is meant by a New Economy, is that the US economy would escape from capitalist business cycles, then it seems clear that there is no New Economy. However, if a New Economy refers to the implementation of a new communication system that allows the creation of new business models that may evolve so far as to change the organizational face of capitalism, then the question is still open. Unfortunately, the next decade is still before us, and only the immodest would confidently predict the future after such a tumultuous decade.

ACKNOWLEDGEMENTS

This chapter is a significantly revised version of a paper appearing in *The Global Internet Economy* edited by Bruce Kogut. The author would like to thank Suzy Iacono of the National Science Foundation and University of California Office of the President's Industry-University Cooperative Research Program for providing funding that supported aspects of the research reported here. He also thanks Jill Archer and Jens Frøslev Christensen for comments, suggestions and improvements.

NOTES

1. For one of the most cogent and prescient critiques of this technological millenarianism, see Brown and Duguid (2000).
2. It is worth noting that in the US, many different entities including state, county and city governments can affect e-commerce. These jurisdictions have different taxation schemes and laws pertaining to retail sales, particularly with respect to tobacco, firearms, alcohol and pornography. Despite these differences, it is accurate to call the US a unified market.
3. A salient expression of this was the individuals who rushed to occupy various URLs with no intention of using them. They then offered to sell the URLs. To translate this into the Land Rush metaphor, they 'staked a claim' to an address in cyberspace. One response to this was legislation forbidding 'cybersquatting,' a reference to the registration by entrepreneurs of addresses that were trademarks and/or established firms' names.

4. Venture capitalists had funded AOL in the 1980s as an on-line service; at the time its operations were unrelated to the Internet.
5. For a discussion of Internet service firms, see Christensen, Chapter 8, this volume.
6. This so-called under-pricing of securities allowed investment bankers to reward their customers with allocations of 'hot' IPOs, a practice that in late 2002 was being investigated as a possible corrupt practice.
7. The three-year compounded average annual return was a more modest 47.9 percent!
8. Microsoft and AOL are also leading destinations. AOL is successful because it has its captive audience of subscribers. Microsoft attracts visitors for many reasons; for instance, it is the default option on the Internet Explorer browser, and users need software assistance, etc.

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