WILEY FINANCE

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The New Science of Wealth in the Knowledge Economy

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John Wiley & Sons (Asia) Pte Ltd

Published in 2002 by John Wiley & Sons (Asia) Pte Ltd
2 Clementi Loop #02-01, Singapore 129809

■ Other Wiley Editorial Offices:
John Wiley & Sons, Inc., 605 Third Avenue, New York, NY 10158-0012, USA
John Wiley & Sons Ltd, Baffins Lane, Chichester, West Sussex PO19 1UD, England
John Wiley & Sons (Canada) Ltd, 22 Worcester Road, Rexdale, Ontario M9W 1L1, Canada
John Wiley & Sons Australia Ltd, 33 Park Road (PO Box 1226), Milton, Queensland 4064, Australia
Wiley – VCH, Pappelallee 3, 69469 Weinheim, Germany

■ Library of Congress Cataloging in Publication Data
ISBN 0-470-82056-X

Typeset in 11 points, Times New Roman by Paul Lim.
Printed in Singapore by Fabulous Printers Pte Ltd.
10 9 8 7 6 5 4 3 2 1

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The New Science of Wealth in the Knowledge Economy

Foreword

In the New Economy, many of the old classical rules of economics no longer apply.

– *Time,* December 31, 1958[1]

Time magazine really *did* make this remark about the "new economy" over four decades ago. So what's new? Enormous innovation has taken place in the way that equity markets are structured and operated. Equity markets of 1958 were clubby, floor trading affairs, and any information (outside of public filings with the U.S. Securities and Exchange Commission, or SEC) was sold for a substantial sum by research departments at giant brokerage firms. The personal computer was a gleam in Jack Kilby's eye,[2] a used envelope was the preferred spreadsheet processor, and webs were found in dark corners and on duck's feet.

Four decades later, floor trading is nearly dead, financial information is nearly free, and stock trading has been the most notable success of Web-based retailing. The innovations of the last four decades have played a crucial role in the way that the markets now set prices. This book attempts to describe some of these effects, in order to determine how contemporary equity market behavior influences our valuation calculations.

Whether we are managers, economists, politicians, or financial analysts, our decisions ultimately rest on the methods of Generally Accepted Accounting Principles (GAAP). These are still much the same as they were in the industrial economy of the 1950s, before the advent of modern computing equipment. GAAP's shortcomings have alarmed the SEC, which recently convened experts from business, finance, accounting,

and the academic community to suggest new ways to measure the performance of knowledge-intensive businesses. The SEC realizes that changes in the world's industrial structure are threatening to make current accounting standards obsolete. Similarly, the Financial Accounting Standards Board (FASB) said that it would undertake four projects on non-financial metrics and intangible assets in response to the SEC's challenge.

We tend to manage what we can measure – market share, profit, revenue, stock price. History, for the most part, has been molded by the economics of scarcity – scarcity of manpower, machines, materials, or money. In contrast, the present and future are being molded by an economics of abundance – abundance of technology, knowledge, tangible assets, acquaintances, attention, and leisure. Too often we measure the scarce resources of an industrial economy – materials, labor, and machines – when we *should* be measuring the scarce resources of the knowledge-intensive world of technology – attention, intellectual property, and knowledge capital.

This book puts forth my thoughts for the next stage in the development of tools and techniques that are needed to guide investors and managers in the as yet inadequately charted realms of the technology-intensive, knowledge-centric industries of the twenty-first century.

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[1] *Time*, December 31, 1958, quoted by Peter L. Bernstein in *Capital Ideas* (New York: Free Press, 1992), p. 159.

[2] Jack S. Kilby's Patent No. 3,138,743, awarded in 1959, invented the monolithic integrated circuit, which initiated the personal computer revolution two decades later.

Contents

CHAPTER 1

Wealth and Knowledge

Innovations in information technology alter the manner in which we do business and create value, often in ways that were not readily foreseeable even five years ago.

– Alan Greenspan[1]

Call it the US$8 trillion dot-com investing lesson. Nearly $8 trillion in U.S. market value evaporated in less than a year. The market value of 280 stocks alone in the Bloomberg U.S. Internet Index lost US$1.755 trillion, most of it between March and September 2000. These dramatic reversals happened in the absence of new information about the businesses themselves; in a market that academics had long touted as "efficient" – that is, one that reflects all public information instantly into the market price. In the wake of the crash, there have been lawsuits and bad publicity across the securities industry over dot-com research flogging, artificially low initial public offering (IPO) prices, and other abuses. The Association of Investment Management and Research has had to recommend a new set of "research objectivity standards," and the industry faced hearings before the U.S. Congress in June 2001 concerning conflicts of interest in the wake of three probes into faulty underwriting by the U.S. Securities and Exchange Comission and the National Association of Securities Dealers, a criminal investigation by Manhattan prosecutors,

and a host of class-action lawsuits.[2] How could investors have been so far off the mark?

About the only people who didn't suffer from the fallout were the brokers sitting on a decade of commissions earned through over-optimistic stock price valuations. Jay R. Ritter, Cordell Professor of Finance at the University of Florida, observes that "these analysts are hustling for underwriting fees, when they're supposed to be making objective calls."[3] Ritter cited one indication of the magnitude of manipulation – the so-called "money left on the table." These are the profits available for favored clients allocated shares in an IPO that soared on the first day of trading, alleged to reflect a deliberate underpricing of issues. Though official underwriting revenues were US$7.3 billion in 1999–2000, the "money left on the table" amounted to US$66 billion, some of it recovered, it is alleged, in subsequent commissions.[4]

In theory, the accounting profession should provide the "independent" audits that keep these tendencies in check. But the accounting profession has changed radically in the past two decades – 98% of audits of large U.S. and European companies are now performed by the "Big 5" accounting firms. "Accounting firm" is a misnomer, as all of the firms now earn the majority of their income from non-audit consulting business. Clients supplied $2.69 in consulting and other non-audit fees for every dollar they paid out for their audits. In 2000, the Marriott International hotel chain paid Arthur Andersen US$1 million for its audit and US$30.3 million for other services; Motorola paid KPMG US$3.9 million for its audit and US$62.3 million for other services. Since management is often rewarded for profits and stock price appreciation, accountants who rely on a growing level of consulting revenue are likely to be less "independent." I will argue in this book that current approaches to corporate accounting and valuation allow wide latitude to support whatever valuation can bring either analysts or accountants the greatest share of business.

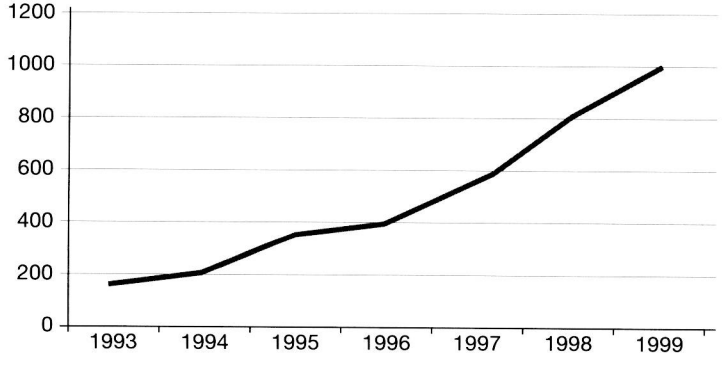
This book puts forth my answer to the question, "What is the value of a knowledge-intensive business?" Some of the material I present is quite new, and as such may still be controversial. But any intellectual endeavor is inherently a work in progress, and this book is no different. Knowledge capital – the scarce resource that fuels a technology company – has grown from insignificant to overwhelming economic value in just a few decades.

Over the last decade alone, failure to account for knowledge capital has meant that only about one-sixth of the average S&P 500 industrial firm's market value is reflected in its financial accounting statements. The situation is even more devastating for technology stocks, where uncertainty, risk, and equivocal property rights create levels of market volatility unheard of even a few years ago.

A WEALTH OF KNOWLEDGE

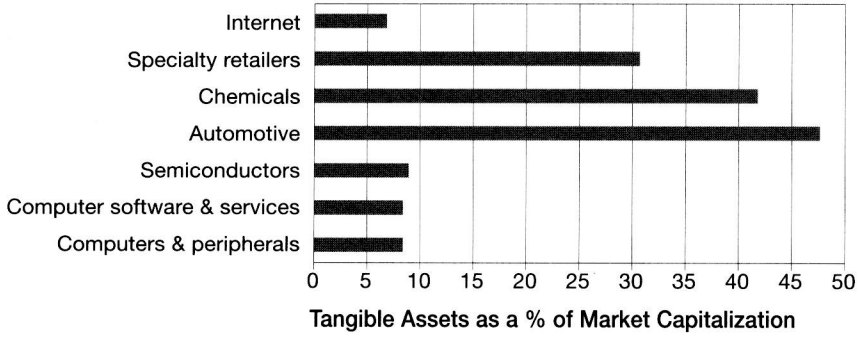
Increasingly, firms are finding that technology of one sort or another has become an integral part of their production, their products, and their supply and delivery channels. Generically, these firms have come to be known as technology firms. Yet the scope of business models underlying technology companies is wide – Ford Motors has completely automated its supply chain, as has General Electric, which makes a separate business out of its supply chain technologies (called GXS). Celera uses technologies acquired initially from firms such as IBM to deliver information crucial to the creation of human drugs to the likes of Eli Lilly and Merck. Some firms horde technology – for example, Walker Digital and Qualcomm, which make their money from licensing. Financial information services such as Morningstar and Bloomberg (technology companies in their own way) offer some guidance in their classification of technology businesses. Figure 1.1 shows the growth in importance of technology in business in recent years.

Figure 1.1 Number of firms labeled as technology firms, 1993–99[5]



Despite the wide variety of firms included under the Bloomberg "technology" rubric, there is a common denominator. These firms tend not to make significant investments in land, buildings, or other fixed assets. They generate the greater part of their wealth from off-balance sheet "intangible" assets. Figure 1.2 compares the proportion of market value contributed by the net tangible assets (that is, book value) in seven industries.

Figure 1.2 Proportion of market value contributed by the net tangible assets[6]



The last decade has seen the world move decisively from one governed by the economics of scarcity to one governed by the economics of information. The transformation has not been abrupt; by one argument, we have steadily been slipping out of the dominion of scarcity since the Industrial Revolution. If one point were chosen in recent history when this trend became obvious, then 1971 might herald this turning point. Daniel Bell, in his landmark *The Coming of Post-Industrial Society*,[7] noted that in 1971, after two years that resulted in a fourfold increase in world oil prices, heavy industries found themselves in global overcapacity. The steady rise in complexity of products and services had shifted value away from purely physical assets over the prior two decades. Bell marks this as the beginning of post-industrial society, to contrast it with previous agrarian and industrial societies. The rapid commercialization of the Internet since 1995 has accentuated the dramatic shift toward a post-industrial knowledge economy.

The statistics are revealing. Hal Varian and Peter Lyman[8] of the University of California at Berkeley estimated that 93% of the world's knowledge is now retained in digital form, and is being added to at the rate of one to two exabytes per year. (An exabyte is a billion-billion bytes.) Hitachi Data Systems estimates that for every $1 spent on data storage hardware, $10 is spent on software, and $70 is spent on managing the information on the hardware.[9] In an economy that spends hundreds of billions of dollars on databases, that translates into trillions of dollars on knowledge management. Over 80% of the wealth in developed countries is generated by information and service businesses – industries whose raw materials are neither land, machines, nor materials, but knowledge.

Intangible as they are, knowledge assets have grown to assume enormous social, economic, and political importance. The ability to properly assess and value technology-intensive projects has become an essential component of global competitiveness, and needs to be embraced at the governmental as well as corporate level. Economist Jeffrey Sachs[10] argues that the ownership of knowledge assets will increasingly provide the basis for national competitiveness in the twenty-first century, leading to a world divided not by ideology but by technology. Factors for generating wealth in this world are not evenly distributed. Only a small part of the globe, accounting for some 15% of the world's population, provides nearly all of the world's technology innovations. A second part, involving perhaps half of the world's population, is able to adopt these technologies in production and consumption. The remaining part, covering around a third of the world's population, is technologically disconnected, neither innovating at home nor adopting foreign technologies. Deloitte Research estimates that, even today, half the world's population has never placed a telephone call – a technology that is over a century old. Within the United States, the income gap between richest and poorest is 39.5% greater today than in the late 1970s.[11] The average salary for a U.S. high-tech employee is US$53,000, nearly 80% more than in the rest of the private sector.[12]

Similarly at the corporate level, the tools for wealth creation are unevenly distributed, even where they are available. Successful firms have embraced the new paradigm to restructure their businesses to compete on knowledge. Failed firms are often unaware of exactly what went wrong.

ASSESSING BUSINESS VALUE IN THE AGE OF KNOWLEDGE CAPITAL

The computer and the Internet have had an enormous influence on our ability to nurture complex products and businesses. In 2000, more than 16% of U.S. "personal consumption" dollars went to computers, software, and peripherals,[13] and the number of PCs installed worldwide surpassed 500 million.[14] The U.S. sends around 400 billion e-mail messages annually, and has access to around 800 million Web pages of information (though Web surfers spend 20% of their time at only ten of those 800 million sites).

Unfortunately, the tools that are most commonly used today for valuation date from long before personal computers, the World Wide Web, or commoditized data communications. Can we expect these relics from a simpler time to effectively address the myriad complexities of business in the twenty-first century?

Probably not. And this fact presents a real threat to managerial effectiveness. The first year of the new millennium was supposed to distinguish itself by ushering in the biggest computer disaster in history – the Y2K fiasco. Instead, it will most likely be remembered as the year the Internet bubble burst, and investors grew serious about assessing the value of high-tech businesses.

Modern investment analysis can be classified into two streams: financial investment analysis, which generates public information; and managerial investment analysis, which generates private information. Financial investment analysis includes information disseminated to parties that are not part of the enterprise proper – stockholders, creditors, customers, suppliers, regulatory commissions, financial analysts, and trade associations – although the information is also of interest to the company's officers and managers. Such information relates to the financial position, liquidity, and profitability of an enterprise.

Management, investors, and other stakeholders within corporations face a growing challenge in attempting to make financial sense of the knowledge economy. Formal valuation processes can assure transparency – that all of the stakeholders in the business are informed of opportunities and decisions. In the absence of a formal evaluation procedure for investment in products, businesses, and other opportunities, decision-making can become highly politicized. An environment rife with

personal proclivities and informal procedures invites project champions to arise, promote, and defend pet projects, leading to over-investment and under-performance.

There are many reasons today – though few good ones – for eschewing formal valuation procedures. To name just a few: "these are computationally difficult"; "existing procedures have insufficient scope to capture all of the value of an investment"; "errors in valuations are so great that almost any project value can be justified"; and so on. If seduced by such claims, firms are liable to delay valuing a project formally until an investment decision can no longer be deferred. This practice is myopic, and leads firms to under-invest in new ventures, and to under-utilize assets-in-place. Both rob shareholders of value.

WHAT'S DIFFERENT ABOUT THE KNOWLEDGE ECONOMY?

Advances in information and communications technologies in the past two decades have motivated a shift away from the economics of scarcity and resource allocation, toward an economics dominated by information, attention, and coordination. Scarcity and information have always played important economic roles. What we have witnessed with intensive automation of IT is the growth of a layer of the economy that now dwarfs that provided by tangible, physical goods. Figure 1.3 chronicles the transition of the U.S. economy from subsistence economy based on extractive products (grains, fishing, mining) to one scheduled around industrial production, to the largely information and services economy of today.

Figure 1.3 Percent of labor force employed in the U.S. economy, 1850–2000

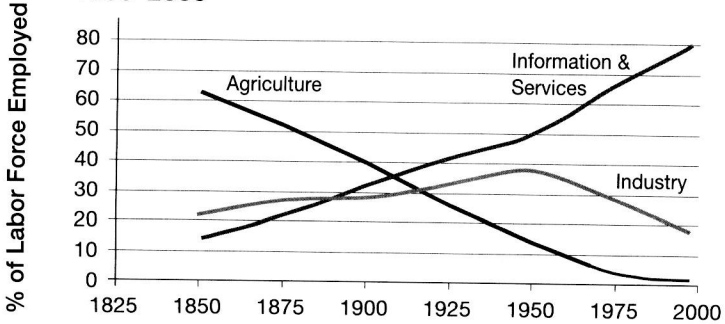
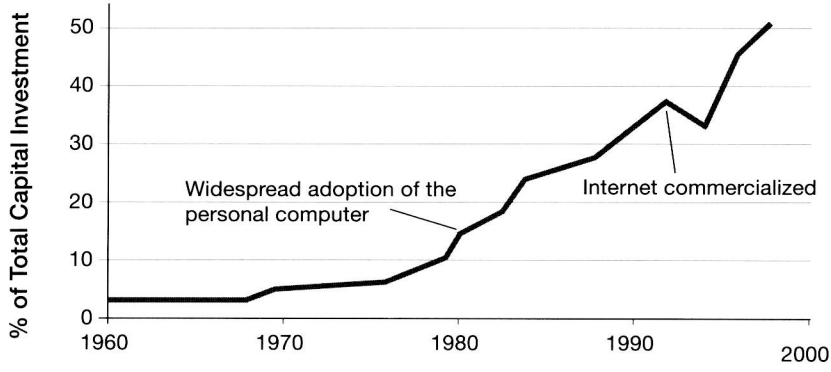


Figure 1.4 documents the more recent transition toward a knowledge economy. The graph depicts the spending by U.S. firms on computing. Computers are not an end in themselves; rather, they are a tool that is essential to the management of complexity in a knowledge economy. The increasing corporate expenditure on IT is a powerful surrogate for the growth of complex, knowledge-intensive business practices.

Figure 1.4 Percent of U.S. business investment in information technology, 1960–2000[15]



Information – the primary wealth-creating asset in the knowledge economy – obeys different economic laws than do resource-intensive physical goods. The knowledge economy exhibits four distinguishing traits.

I. *The transition from economics of scarcity to the economics of information; accompanied by a shift of managerial attention from supply- to demand-side wealth creation:* A firm's knowledge of external factors – product complements, supplements, market externalities, and so forth – has grown more important than resource control in managing the firm. Yet, financial accounting systems capture only around one-sixth of the value of firms because of the growth in importance of market-based demand-side factors. Consider just one example of how this shift influences management decision-making: a recent survey of consumer electronics manufacturers found that "time to market" and "packaging" had become the critical factors in product and production management; twenty years ago, it might

have been quality and cost control that were designated as "critical." The former factors are demand-side – they reflect consumer perceptions, marketing, and revenue generation. Quality and cost control are supply-side production factors; they may still be important, but as antes to enter into the game, rather than as features that ensure competitive advantage. This fact alone significantly undermines the usefulness of traditional accounting based on historical cost.

II. *Equivocal property rights over wealth-creating assets:* Knowledge assets can be shared by many people without diminishing their value to any one person. (Economists say that they are non-rival – that is, that one individual's consumption of the good does not reduce the quantity available to others.) Music in MP3 format, and films in MPEG format, can be freely exchanged without their consumers influencing each other's value. This creates exceptional problems for industries where the artist, producer, or distributor must bear the cost of production.

III. *Intrinsic uncertainty:* The acceleration of new developments in technology (described in Chapter 4) makes it increasingly difficult to predict the shape of products or production in any fixed time frame into the future. As a result, the historical measurements of financial accounting are far less relevant to forecasting and valuation of the firm's activities than in the past. Uncertainty also creates volatility in both end-product markets and stock markets, because competitive position, inventory value, and fixed asset value erode much more quickly than in the past.

IV. *Competitive strategy is held captive by government, market, and institutional infrastructure:* Complex products require smart employees and access to "invisible colleges" of shared expertise. This is why we see knowledge-intensive industries cluster in specific locations, despite their theoretical ability to locate anyplace in the world – for example, multimedia clusters in Hollywood; chip and software design in Silicon Valley; auto design and production in Detroit; and computer chips and circuit production in Hsinchu City. This is also why countries with first-rate education systems and expensive labor can still compete effectively with countries whose labor rates are substantially lower.

ELUSIVE VALUE

Former Enron president Jeffrey K. Skilling noted that "In today's world, you have to bring intellectual content to the product, or you will not earn a fair rate of return."[16] Knowledge is intangible. Knowledge is often only valuable in conjunction with a particular process or bundle of property rights. And knowledge management costs are increasingly IT-driven in a networked economy.

A good portion of the one to two exabytes of digital data being added annually to databases takes advantage of the immediacy of the Internet. For example, there are 16 million résumés online, and about 1200 Web sites are dedicated to career-related topics.[17] Surely this will increase as jobs become more and more transitory and project-oriented. For mundane tasks such as income taxes, electronic returns can save natural resources. Twenty percent of U.S. taxpayers filed their returns electronically in 1997; the IRS expects that figure to reach 80% by 2007, sparing entire forests of paper.[18]

Unfortunately, not all of this information is easily accessible, nor is it apparently valuable. NEC Research estimates that the top twelve search engines together cover only about 42% of the Web's indexable pages. The situation is much worse for proprietary databases, creating a huge problem of "fugitive" information – information that is theoretically available for decision-making, but which cannot be accessed in real time at reasonable cost.

Off-balance sheet intangible assets like corporate databases now account for over 70% of the valuation of firms, and among "high-tech" firms the proportion is even more extreme. Figure 1.5 tracks the deterioration over the past twenty years of financial accounting's ability to compute the value of a business.