

PETER S. COHAN

THE TECHNOLOGY LEADERS

**How America's
Most Profitable
High-Tech Companies
Innovate Their Way
to Success**

"Stop the off-site planning meetings, tear up the strategic plan, and buy everyone in your company a copy of this book. "

—Kevin R. Compton, general partner, Kleiner Perkins Caufield & Byers



30802872

802872

The Technology Leaders

How America's Most Profitable
High-Tech Companies Innovate
Their Way to Success

Peter S. Cohan



Jossey-Bass Publishers • San Francisco

578208

Copyright © 1997 by Jossey-Bass Inc., Publishers, 350 Sansome Street, San Francisco, California 94104.


All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of the publisher.

The comments of George Heilmeier are reprinted in Chapters Two and Seven by permission of Bell Communications Research, Inc.

Substantial discounts on bulk quantities of Jossey-Bass books are available to corporations, professional associations, and other organizations. For details and discount information, contact the special sales department at Jossey-Bass Inc., Publishers (415) 433-1740; Fax (800) 605-2665.

For sales outside the United States, please contact your local Simon & Schuster International Office.

Jossey-Bass Web address: <http://www.josseybass.com>

 Manufactured in the United States of America on Lyons Falls Turin Book. This paper is acid-free and 100 percent totally chlorine-free.

Library of Congress Cataloging-in-Publication Data

Cohan, Peter S., date.

The technology leaders: how America's most profitable high-tech companies innovate their way to success / Peter S. Cohan.

p. cm.—(The Jossey-Bass business & management series)

Includes bibliographical references and index.

ISBN 0-7879-1072-4 (alk. paper)

1. High technology industries—United States—Management.

2. Technological innovations—Economic aspects—United States.

I. Title. II. Series

HD62.37.C64 1997

620'.0068—dc21

97-11674
CIP

FIRST EDITION

HB Printing 10 9 8 7 6 5 4 3 2 1

The Jossey-Bass
Business & Management Series

To Robin, Sarah, and Adam

Preface

In the Darwinian struggle for profitable growth, we can learn from America's most highly evolved companies. Companies that come out on top of the fastest-growing, most rapidly changing, and most intellectually demanding markets have something to teach the rest of the business world.

America's most highly evolved companies are *technology leaders*. Technology permeates industry. It is the basis for many commercial and consumer products and is a key enabler for providing services. However, great technology alone is not enough to create a successful business. Uncounted billions have been spent developing technology that ultimately did not generate positive cash flows. On the other hand, a select group of technology entrepreneurs has become wealthy, converting tiny investments into vast personal fortunes. Part of this dynamic is a natural outgrowth of capitalism's cycle of creative destruction.

As they develop, many companies go through fairly predictable phases. Initially company founders rely on at most three sources of cash: personal money, paying customers, and possibly investment capital. To maintain positive cash flow they focus on external factors, such as changing customer needs, advances in technology, competitor strategies, and investor requirements. As these companies grow, they borrow money from banks, issue stock, create divisions, and acquire businesses and divest others. An unintended side-effect of their success is a distraction from the very behavior that created the success in the first place: the focus on maintaining positive cash flow by adapting to the needs of the marketplace.

In many cases, key decision makers delegate the responsibility for adapting the company to changing customer needs, advances in technology, and evolving competitor strategies. These executives spend increasing amounts of time mediating disputes over transfer

pricing, arguing over executive compensation, trading businesses, redrawing organization charts, and catering to the needs of powerful board members.

The executives of the large company thus create an opportunity for a new generation of entrepreneurs to take away their customers. By the time they notice that anything has changed, they are years behind the "value propositions" offered by the new generation of entrepreneurs. Although these large companies are able to survive, often for many years, they have lost the strategic initiative in their industries and can only rely on cost reduction, not revenue growth, to enhance profitability.

Some large companies are able to transcend this cycle, however. Consider the recent histories of IBM and Hewlett-Packard (HP). Over the last decade, dramatic changes occurred in their markets, including the growing importance of the personal computer, the change from proprietary mainframe-based corporate computer systems to open client-server architectures, and the increased role of applications software.

IBM was unable to respond to these changes effectively. It remained dependent on the less robust proprietary mainframe business, ceded the personal computer operating system and application market to Microsoft, and focused management attention on internal reorganizations. Its senior executives were replaced, and its stock price, having peaked at 180 in 1987, dropped as low as 40 in 1993. Although IBM's financial position has recovered significantly under its new CEO, it remains to be seen whether the company will be able to retake the strategic initiative that it formerly enjoyed.

In contrast, HP combined its discovery of inkjet technology with an aggressive marketing strategy to build a 60 percent share of the \$10 billion worldwide market for laser printers. HP also built a fast-growing line of UNIX-based computers to act as servers for networks of personal computers and workstations. Its share of the personal computer market is continuing to rise, with 90 percent of HP's revenues derived from products introduced within the last four years. Between 1991 and 1995, HP's stock price increased 480 percent.

What does HP do that IBM did not? This book explores how twenty technology companies, including HP, have sustained their success. The twenty companies were selected from a sample of 1,309 U.S. companies, based on their high R&D as a percentage of sales,

their leading five-year average return on equity relative to their industry, and their reputation for innovative products and services.

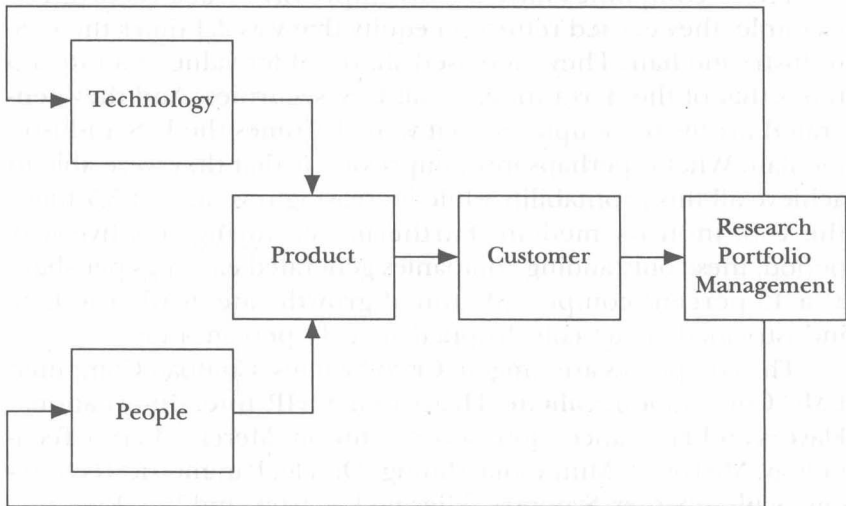
These companies have a truly impressive track record. For example, they earned return on equity that was 2.4 times the U.S. industry median. They increased shareholder value at a rate 4.5 times that of the Barra Index of all U.S. securities. And they generated profits per employee that were 4.1 times the U.S. industry median. What is perhaps most impressive is that they were able to achieve all this profitability while increasing revenues at 5.7 times the U.S. industry median. Furthermore, during this five-year period, these outstanding companies generated earnings per share at a 43 percent compound annual growth rate, while the U.S. industry median actually dropped at an 11 percent rate.

The companies are Amgen, Cisco Systems, Compaq Computer, EMC Corporation, Gillette, Heartstream, HP, Intel, International Flavors and Fragrances, Johnson & Johnson, Merck, Micron Technology, Microsoft, Minnesota Mining, Oracle, Parametric Technology, Schlumberger, Synopsys, Thermo Electron, and U.S. Robotics.

The most important factor that keeps these twenty companies ahead of the pack is the way they adapt to change. Rather than deny that change is taking place, these technology leaders look for ways to exploit change for the benefit of their customers. If this change means that some products must become obsolete, the firms cannibalize ruthlessly. And technology leaders don't just cannibalize their products, they even uproot their most fundamental business processes.

Technology leaders work with a mental model that guides their strategic decisions. In this model (see Figure P.1), people and technology are combined to create products that customers are eager to buy. These products generate capital and insight: the capital comes from the products' operating profit, and the insight is the result of feedback from customers and competitors and the firm's success in its core business processes (such as, new product development and product supply). Through resource allocation, technology leaders channel this capital and insight into new product development projects and business process redesign.

By optimizing this model, technology leaders create a success cycle that leads to ever greater levels of capital and insight. Technology leaders expand this success cycle through four sources of

Figure P.1. Technology Leaders: Flow of Capital and Insight.

advantage, which are the critical management practices that drive their superior performance.

1. *Entrepreneurial leadership.* Technology leaders identify, attract, and motivate the smartest people to perform to the limits of their ability. How do they do this? They have CEOs who combine a deep understanding of technology with an intense drive to make money. They use values-based visions that grab smart people and pull them in the right direction. This contrasts with peer companies who try to motivate people by exhorting them to “maximize shareholder value.” Technology leaders have open organizations and take a humanistic approach to managing people. However, technology leaders have some hard edges. They are highly competitive, and they pay people to perform. They often balance below-average cash compensation with stock options that are valuable only if the company’s stock price keeps going up.

2. *Open technologies.* Technology leaders get the technology that meets the needs of their customers. In this pursuit, they often pay for quick access. If they have the technology inside the company, they will invest to make it even more valuable to customers. If the technology is available from outside the firm, they will get access

to it. This access could range from acquiring a company to licensing the technology from the people who developed it. Technology leaders seek a strong market position in specific “leverage-point technologies” that will allow them to organize third parties in pursuit of an industry standard. And technology leaders assign people to monitor new technologies before they become a dangerous threat. At the same time, they catalog their noncore technologies and outpace them, while selectively “renting” technologies that are needed only for specific projects.

3. *Boundaryless product development.* Technology leaders combine their people and technology in a process that generates superior value for customers. They form cross-functional teams. They work with early adopters to understand their unmet needs. They develop prototypes based on these needs. And they modify these prototypes based on customer feedback. Furthermore, they create “product supply” capabilities that enable them to meet mass-market demand while maintaining high product quality and delivery-time standards.

4. *Disciplined resource allocation.* Technology leaders use the capital and insight that results from their successful products to expand their success cycles. They use resource allocation to spread organizational learning. They screen projects using portfolio grids. They build project time lines for the most attractive projects, being sure to incorporate specific exit ramps. They estimate success probabilities and incremental net cash flows between decision nodes. And they systematically reallocate resources to the projects with the greatest expected value.

Target Audience

This book is intended to help practitioners understand these four sources of advantage. CEOs, chief technology officers, division managers, product managers, scientists, and engineers in technology-intensive industries can use this understanding to help them manage the linkages between technology and markets. Venture capitalists, investment and commercial bankers, and other investors and financial intermediaries can use the findings of this book to help identify potentially valuable technology investments. CEOs, division managers, and product managers in industries that are less technology-

intensive can also use the strategies presented here to help them increase their return on innovation.

Overview of the Contents

Chapter One explores the key opportunities and threats that face technology-intensive industries, highlighting how these trends affect technology organizations, from the CEO to the engineers. It details the analytical approach used to select the twenty technology leaders. The chapter also explores the four sources of advantage that drive the companies' outstanding performance and shows how these sources of advantage contribute to their ever-expanding economic value.

Chapter Two examines the first key source of advantage *entrepreneurial leadership*. It provides insights into the leadership styles of David Packard (HP), Roy Vagelos (Merck), and Bill Gates (Microsoft). The chapter explores the evolution of effective decentralization through examples from HP, Cisco Systems, and 3Com. It describes how Cisco Systems and others attract and retain top people. And it illustrates the powerful financial incentives that enable Thermo Electron and Microsoft to create valuable new businesses. Chapter Two concludes by describing a process that CEOs can follow to embed these principles in their own organizations.

Chapter Three scrutinizes the second source of advantage that distinguishes technology leaders: *open technology*. Technology leaders follow a five-step process that enables them to nourish and renew the technology essential to their ability to compete. The chapter shows how technology leaders Cisco Systems and Compaq forge industry standards and illustrates how Synopsys, Johnson & Johnson, Merck, and HP monitor new technologies. It describes how Microsoft and Cisco Systems partner or acquire (or both) to close the capability gap. Chapter Three concludes by outlining a change process that CEOs can use to adopt the practices that are so effective for technology leaders.

Chapter Four explores how technology leaders “rent” technologies that they need for a specific project, presenting examples from Amgen and Intel. It uses an example from Louis Dreyfus to illustrate the principle that managing technology is a form of arbitrage. The chapter shows how technology leaders structure “rental

agreements” that give them access to technologies that enable them to pursue a business opportunity with transient value—without requiring a permanent investment. It highlights the many pitfalls to such arrangements and presents a road map that describes how best to manage them. Chapter Four concludes by showing how this road map has contributed to the outstanding performance of Cisco Systems.

Chapter Five shows how technology leaders blend their people and technology through the third source of advantage: *boundaryless product development*. It describes a five-step process that enables technology leaders to get new products to market that customers want to buy. The chapter shows how this process has helped HP, Microsoft, Schlumberger, Gillette, and U.S. Robotics achieve great results. It explores how mechanical and semiconductor product companies have achieved quantum improvements in product cycle times through the use of prototyping software developed by Parametric Technology and Synopsys. And it shows how CEOs can incorporate what works for technology leaders into their own companies.

Chapter Six zooms in on the most critical element of boundaryless product development: how technology leaders *create value for customers*. This chapter introduces the concept of the “value triangle.” It argues that the way companies connect the corners of the value triangle determines their product’s success. The chapter illustrates this principle with examples from EMC Corporation, International Flavors and Fragrances, and Heartstream. Chapter Six concludes by describing a process that technology leaders follow to create value for customers, illustrated with examples from 3Com and Cisco Systems.

Chapter Seven examines the fourth source of advantage: *disciplined resource allocation*. Technology leaders view resource allocation as a process of betting under uncertainty. All the capital and insight generated by the other three sources of advantage are invested through the resource allocation process. To win the game, technology leaders follow five principles that help them manage the risks in their research portfolios. Chapter Seven illustrates these principles using an example from the pharmaceutical industry, based on one company’s actual experience. And it shows how technology leaders make each of these principles work.

Chapter Eight integrates the first seven chapters by presenting an *Innovation Scorecard* comprising clusters of questions that can

help readers see how their own organizations compare to those of technology leaders. Readers will be able to gauge their company's relative performance in terms of return on innovation, leadership, technology, product development, and resource allocation. The chapter also suggests some of the ways companies can collect the data needed to answer these questions. It concludes by describing an approach that CEOs can use to make their organizations more innovative.

Chapter Nine offers some thoughts on the future. It discusses how technology leaders may change the general business landscape and describes the implications of these changes for managers, workers, consumers, and financiers.

My Relevant Experience

My interest in this topic springs from more than fifteen years of experience consulting to technology developers and users. I have worked with clients in software, telecommunications, semiconductors, on-line information services, biotechnology, chemicals, oil refining and marketing, and oil services. I have helped these clients address such issues as market and product development, R&D portfolio management, joint venture design and implementation, and technology licensing. I have worked with clients that sell technology and have managed teams that use technology to make business processes respond more effectively to customers.

In my experience, the major cause of failed technology ventures is the inability or unwillingness of technologists to appreciate how their products will create value for customers. The importance of this issue parallels the switch in the computer industry from proprietary to open operating systems. When technological skill was scarce, companies that controlled it could dictate the direction of their markets—customers would have no choice but to buy what the engineers designed. As computing power was decentralized, technological skill was more widely dispersed. Because of their large embedded bases, many technology companies needed to experience a serious crisis to become aware of the fundamental shift in their markets from technology-push to customer-pull. Many of my consulting projects have been intended to help clients cope with this shift.

In 1995, I worked on a research report that studied a set of R&D leaders, the objective being to learn how these R&D leaders addressed certain key issues. The study explored how to strike the appropriate balance between the business and technology sides of an enterprise, how to introduce profitable products ahead of competitors, how to value technology resources, how to maximize the productivity of the R&D organization, and how to optimize the value of the R&D portfolio.

The success of this project motivated me to further explore these fundamental business issues. I wanted to test the validity of these findings on a larger set of companies across a broader spectrum of industries. And I hoped to distill from this research a set of principles that could be vividly illustrated to help managers in all industries.

Acknowledgments

This book could not have been written without the help of many people. I am grateful to all the executives and venture capitalists who offered me their views on the topics discussed here, including Dean Morton (HP); Bob Saldich and John Midgeley (Raychem); William Draper (Draper International); Kevin Compton (Kleiner, Perkins); Geoff Yang (International Venture Partners); John Morgridge (Cisco Systems); Victor Grijalva, Brian Clark, and Bernard Gremillet (all of Schlumberger); Michael Griffith (In-Stat); Alan Levy (Heartstream); John Bush (Gillette); George Heilmeier (Bellcore); Eric Benhamou (3Com); Aart de Geus, Kurt Keutzer, and Paul Lippe (all of Synopsys); Maureen Lawrence (Whitetree); and Andy Clark (Eastman Chemical).

I also appreciate the help of my colleagues Bruce Henderson (Matrix USA), Bob Stringer (Sherbrooke Associates), Jeff Coburn (Coburn Consulting), Geoff Fenwick (Renaissance Solutions), Tom Lynch (Lazard Frères), Eric Stang (Raychem), Ryan Englund (Monsanto), Dennis Harp (Alex. Brown), Peter Laino (K-III Communications), Jake Wesner (McKinsey & Company), Mordechai Fester (Cisco Systems), Richard Yanowitch (VeriSign), and Chuck Roush. And I am very grateful for the support and encouragement throughout this project of Cedric Crocker, Cheryl Greenway, and Byron Schneider of Jossey-Bass.

Finally, I would like to offer special thanks to my wife, Robin, who patiently reviewed each chapter of this book and offered many insightful comments from her experience in the trenches.

May 1997

PETER S. COHAN
East Marlborough, Massachusetts

The Author

PETER S. COHAN is president of Peter S. Cohan & Associates, a management consulting firm. His strategy consulting practice helps companies in technology-intensive industries identify, evaluate, and exploit new business opportunities. The firm's services include proprietary research reports, management development, and process facilitation. Clients are global leaders in such industries as telecommunications, on-line information services, computer networking, biotechnology, pharmaceuticals, and oil services.

Cohan's investment consulting practice works in partnership with leading private-equity investment firms to capitalize on specific "industry buildup" strategies. For example, in a sector of the financial services industry, his firm is executing a strategy to acquire companies, consolidate operations, and distribute products through a low-cost channel. He has also made seed capital investments in the Internet software business.

Cohan worked at CSC/Index with James A. Champy, coauthor of *Reengineering the Corporation*, and at the Monitor Company, a strategy consulting firm cofounded by Michael E. Porter of the Harvard Business School. Cohan also worked as an internal consultant in the banking and insurance industries.

Cohan received an M.B.A. degree (1985) from the Wharton School; did graduate work in computer science at the Massachusetts Institute of Technology, where he studied with Dr. Michael Hammer; and earned a B.S. degree (1980) in electrical engineering from Swarthmore College.

Cohan can be contacted at Peter-Cohan@msn.com.

The Technology Leaders