The Emergence of Post-Modern Strategic Management

Mel Horwitch

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I. Introduction

This article focuses on the current transformation of the strategic management field and the rise of a significant new era in strategy. This new phase, called "Post-Modern", has key features which distinguish it from previous periods of strategy thinking. Consequently, the rules of the game in strategy have changed in major ways. The path to sustained strategic success for the manager requires a deep understanding of the characteristics of Post-Modern Strategy in order to recognize and implement those management practices that tend to be effective in this new situation.

This article, therefore, has three objectives. First, to provide an historical context for Post-Modern Strategy and position and contrast it with other forms of strategic management that comprised the post-World War II evolution of corporate strategy. A second aim is to delineate the major characteristics of Post-Modern Strategy and to identify the underlying forces which led to its emergence. A final goal is to introduce some new perspectives and guidelines for strategic managers, which hopefully will enhance their effectiveness in modern-day strategic decision making.
II. The Evolution of Strategic Management

The evolution of strategic management is presented in Figure 1. Briefly, strategy's first phase, which comprised the 1950s and much of the 1960s, can be called the General Management Era of strategic management. This phase emphasized the notions associated with what can be termed the "implicit" side of strategy, which is informal and instinctual. The General Management Era focused on leadership qualities, the general role of the CEO and other top managers, interpersonal relationships, the importance of values, and the capacity of informal and formal internal processes, systems, and structure to support strategy.

Based on the works of Chester Barnard, Philip Selznick, Kenneth Andrews, and others, a key assumption underlying the General Management Era in the early postwar period is that successful top executives are really effective general managers in the broadest sense. They are multifaceted leaders with responsibilities to a whole range of constituencies, including the shareholders, employees, customers, and members of the larger community. According to the General Management heritage, the criteria used for assessing the performance of a CEO and strategy generally are usually broad-based and long term in nature. For example, Barnard emphasized cooperation as a critical "function of the executive" and he also believed that strategy—the long-term direction of an enterprise—is only possible with an emotional, as well as rational, commitment and with sound and "moral" leadership. Similarly, Selznick focused on the process of "institutionalization"—which is to "infuse
Figure 1

The Postwar Evolution of Strategic Management

Phase I: 1950s-Late 1960s

The General Management Era

- The Importance of Leadership
- Universal Managerial Characteristics
- The Universal Professional Manager
- View the Firm as a Whole
- Optimism
- Top Management Oriented
- Implicit Strategic Management

Phase II: Late 1960s-1980s

The Golden Age of Strategic Planning

- The Rise of Analysis
- Strategic Approaches
- Strategic Portfolio
- Incorporation of Industrial Organization and Micro-Economic Approaches
- Viewing the Firm as Made Up of Component Business That Have Different Strategic Roles
- The Rise of Support Industries and Institutions, e.g. Strategic Consulting Firms, Business Schools, and Strategic Databases
- The Emergence of a New Function, Profession and Unit: The Strategic Planning Staff
- Formulation Oriented
- Staff Oriented
- The Centralization and Growth of Power of Strategic Planning
- Explicit Strategic Management

Phase III: 1980

Post-Modern Strategic Management

- Reaction to Strategic Planning
- Renewed Interest in Implementation
- Emphasis on the Role of Culture and History in Determining a Firm's Strategy
- The Rise of Global Strategy
- Targeted and Advanced Analytical Strategy
- The Concurrent Use of Multiple Kinds of Strategic Support Systems, Processes, and Structure
- The Elevation of Technology to a Strategic Variable
- The Use of Interorganization Networks and Linkages in Strategy
- The Simultaneous Deployment of Multiple Strategic Approaches - Blending Implicit and Explicit Strategy
an organziation with value" beyond the technical requirements for the immediate task at hand. This action can be effectively accomplished only with appropriate strategic leadership. Selznick argued that key tasks for an institutional leader are defining the institutional mission and role, embodying the institution's purpose, defending the institution's integrity, moderating internal conflict, and setting priorities. For Selznick, such overarching strategic concerns are more important than even pure efficiency or effectiveness, organizational structure, or group cohesion. Kenneth Andrews, a professor at the Harvard Business School -- which was the center of General Management thinking for much of the postwar period, also presents a broad and complex view of the top manager's job. To Andrews, the CEO has several simultaneous roles at the personal, administrative, strategic, and even ethical levels. Andrews usefully distinguishes three important kinds of top-level leadership: personal, organizational, and "architect of organizational purpose," with this last category of leadership representing the truly strategic dimension of top management decision making. Going beyond routine and personal attributes, he calls the CEO the "custodian of corporate objectives."

The heritage of the General Management tradition has enduring significance for the corporate strategy field. Strategic decision making cannot be sanitized. The starting point for strategy is a long-term and multifaceted view of corporate objectives. There is also a bias in favor of action, not irrelevant or even counter-productive analysis or elegance, for dealing with the challenges of strategic opportunities and threats. For example, in a intriguingly subtle but ambiguous statement, Andrews writes, "Generalizing about how to make an effective [strategic] match is less rewarding than working at it." These themes--a broad view of the firm, the importance of
leadership, and the need for effective implementation—-are constantly being rediscovered and are as relevant in the 1980s as they were in the 1960s. This first attribute of strategy, the necessity of broad and committed leadership, provides a permanent link between the earlier General Management Era of the 1950s and 1960s and the Post-Modern phase that began in the 1980s.

By the late 1960s, a new school of strategic management conceptualization and practice began to surface. It became a strong rival to the General Management tradition, and quite rapidly in the 1970s this new stream emerged as the dominant mode of strategic thinking and decision making. This second phase in strategic management, the Golden Age of Strategic Planning, lasted from the late 1960s to about 1980. During this period, strategic planning flowered and gained enormous status. By the 1970s, what can be termed "explicit" strategic management, the formal, systematic, and analytical side of strategy, dominated the entire field. Strategic planning developed into a profession and a management function. A large and influential support and service sector, made up of strategic consulting firms, business information data sources, an increasingly infatuated business press, and business schools, had grown to support and develop strategic planning. Various techniques and approaches also rapidly spread overseas. Strategic planning was both prestigious and avant-garde.

This transition to a focus on professional strategic management was exemplified by the work of the business historian, Alfred D. Chandler, in particular his book *Strategy and Structure*, which was published in 1962. This work dealt with the rise of diversification strategy and the emergence of the multidivisional structure to support this strategy in the post-World War I period in the United States. But, like much historical writing, Chandler also reflected and anticipated the concerns and ideas of his own time, the 1960s.
Chandler triggered major conceptualization in strategic management in four critical ways: (1) refinement and modification of the general management notions of leadership; (2) the identification of a major issue that acted as a stimulus for strategic decision making: diversification; (3) recognition that the various internal support systems --including structure-- need to be appropriately designed and in place for effective strategy; and (4) the identification of strategic management as something distinct from operational business concerns.  

Chandler's insights and uncovering of professional management and systematic managerial techniques and methods matched well with some of the key trends that were occurring in the corporate world in the late 1960s and the 1970s. Corporations continued to grow in size, expanded geographically, and increasingly entered multiple lines of business. The terms "diversification" and "multidivisional structure", while still true in a general sense, were becoming less helpful in accurately describing and assessing the evolution and actions of giant business enterprises. New concepts, techniques, and managerial roles began to emerge to deal with this new complexity and growth of the late 1960s and the 1970s. Most of this new development can be grouped under the category of strategic planning, and this activity experienced a kind of "Golden Age" during the late 1960s-1980 period.  

The development of a rich array of strategic planning methods and viewpoints and structural innovations during the 1970s profoundly influenced strategy making and the practice of management. The new techniques included the statistical analysis of strategic-level databases, such as the PIMS [Profit Impact on Market Strategies] model, the increasing application of strategic portfolios developed by the Boston Consulting Group, Arthur D. Little, McKinsey, and other consulting firms and strategic planning units, and,
by the end of the 1970s, the incorporation into strategic planning of industrial organization theory from economics. In addition, new structural innovations were developed, including, first, the SBU [Strategic Business Unit] within the firm and, later, strategic groups within an industry. These achievements enhanced management's capability to run large enterprises while also creating their own set of difficulties.

In fact, the barrowing of ideas from the industrial organization area demonstrated the adaptive and dynamic characteristics of strategic planning. By the beginning of the 1980s, this function was becoming a less monolithic, more flexible, and contingent activity within the firm. The late wave of strategic planning became known as "Competitive Strategy", taking the same title as the most influential book of this school by Michael Porter, which was published in 1980. Among other things, Porter highlights three aspects of competitive strategy: "structural analysis" of industries, generic strategies, and strategic groups. Clearly, one of the greatest benefits of structural analysis—which included delineating the actions of competitors, buyers, sellers, the threat of substitutes, and new entrants—was that it forced the strategist to view the industry broadly, not just in terms of current competitors. In identifying three generic strategies for possible use (low-cost leadership, differentiation, and focus), Porter offered alternative avenues to strategic success. He and his colleagues enlarged the discussion of strategic choices and provided strategists with new conceptual degrees of freedom.

Similarly, by employing the idea of strategic groups (essentially a cluster of competitors in an industry that are following the same or similar strategies as defined by a designated set of dimensions), diverse generic strategies of firms in an entire industry can be viewed and mapped. The industry can then be usefully reconfigured for strategic planning purposes.
The contributions to strategic management of industrial organization theory and its spinoffs came in the latter stages of strategic planning's Golden Age. These approaches both complemented and helped remedy some of the problems associated with the earlier analytical techniques, such as PIMS and various strategic portfolios. The later methods added still another opportunity for creativity and flexibility in determining a firm's strategy.

Generally, strategic planning in its many forms appeared triumphant as the 1970s ended. Large numbers of professionally trained managers who were comfortable with analytical methods were graduating from business schools. A particularly key catalyst for this strong embrace of formal strategic planning approaches was the aggressive marketing and product development of strategic consulting companies. Newer more technically sophisticated approaches using, for example, concepts from finance appeared, and were marketed by new consulting firms like Strategic Planning Associates [SPA] and Marakon as well as by more established firms like BCG and McKinsey. Within corporations strategic planning became increasingly common and strategic planning staffs proliferated. By the late 1970s, 75 percent of all diversified companies in the Fortune 1000 were estimated to use portfolio planning in some form at the corporate level.

Moreover, we must be careful not stereotype strategic planning. Its actual practice was undergoing continuous change as it adapted to changing conditions. Strategic planning's Golden Age was ending by the early 1980s as strategy generally was becoming less monolithic, more pragmatic, more eclectic, and more grounded in specific business operations or industries. But the approaches developed during the Golden Age of the late 1960s and 1970s were not rejected. Instead, they were modified and adapted to specific contexts. This new humility and awareness of limits actually improved the usefulness of
strategic planning methods. If there was less confidence toward professional strategic planning *per se* by the 1980s, there was certainly greater sophistication, flexibility, and variety in the whole field of strategic management.
III. Reaction and the Transition to Post-Modern Strategic Management

In fact, it seemed highly unlikely that this Golden Age would come to an end. Strategic planning was widely practiced and found useful. The field was at least partially adaptive with approaches becoming more sophisticated and flexible. Michael Porter in his 1985 book, *Competitive Advantage*, demonstrated this once again by emphasizing the creation of value, maintenance of value, and differentiation in creating strategic success. The creation or transformation of value is a critical strategic theme in the 1980s. Strategic planning was also promoted and supported by a vast and powerful network of constituencies, service industries, and institutions. Yet, by 1980, the prestige and wholesale legitimacy of strategic planning practices was under attack. Strategic planning possessed that paradoxical quality of initially symbolizing the considerable strength of U.S. managerial prowess and later reflecting inherent weaknesses in U.S. management.

Doubts concerning the longrun influence and fundamental worth of the strategic planning and related analytical techniques of the 1970s, however, did not suddenly appear at the beginning of the next decade. Skepticism and even opposition had accompanied the growing dominance of strategic planning. The growing reassessment in the 1980s of strategic planning and its trappings was actually well-grounded in significant strands of strategy thinking from the previous General Management Era. In addition, some strategy scholars attempted to broaden and deepen the strategy field and to reconcile and integrate findings from a variety of disciplines. Even more damaging pressures on strategic planning emanated from outside the strategic management field altogether and involved a direct assault on the view that strategy should be developed separately from operations. This
critique of strategic planning was best articulated by those who believed that manufacturing and, later, technology had for too long been disregarded as strategic variables and that this neglect was a key factor in the alleged U.S. decline in global competition. According to this line thinking, manufacturing in the postwar period had become increasingly routine, narrow, and subordinate. Top executives in U.S. firms had become technology averse in making strategic decisions. Instead, there was at the highest level of the firm an infatuation with non-productive concerns, such as strategic planning, finance, and legal issues. In effect, CEOs had lost touch with the true lifeblood of business: technology and operations. It was time to reconnect the fundamentals of business with top management and strategic decision making.  

This kind of criticism was quickly followed in the 1980s by a growing, vigorous, and diverse wave of reassessment and new thinking in the strategy field. Many, like Thomas Peters and Robert Waterman, elaborated on the need for firms to stick to areas that they know. Peters and Waterman also stressed the need to be market- and user-oriented, and personified a return to the General Management heritage.  

Others emphasized the importance of corporate "culture", philosophy, and history in strategy. Global or multinational strategy became an increasingly important component of strategy in the early 1980s. Echoing Barnard, Selznick, and Andrews, the importance of leadership, the character of the CEO and other key executives, and the infusing of values within the organization were also rediscovered. Finally, technology and novel structures to promote innovation emerged in the 1980s as important elements of the strategic management. This massive broadside of revisionism in the strategic management field proved an enormously supportive backdrop for the rise of Post-Modern Strategy.
IV. The Characteristics of Post-Modern Strategy

Post-Modern strategy increasingly characterizes the cutting edge of strategic practice today. It blends certain features of General Management and strategic planning thinking while also exhibiting new concepts of its own. Moreover, it is both less universal and less elegant than its predecessors. It is more varied, contingent, and complicated in the way its diverse parts have been both disaggregated and re-integrated. It stresses such strategic matters as implementation, the creation of multiple organizational strategic support systems, processes, and pressures, the role of a firm's unique culture and history in setting and influencing strategy, internal entrepreneurial units, the increasing use of interorganization networks and linkages, the growing importance of what is now termed global strategy, advanced and targeted analytical strategic approaches, the relationship between corporate strategy and various functional strategies, and the strategic role of technology. A major challenge for large corporations belonging to the Post-Modern age is to develop the capability to generate simultaneously a number of diverse, and perhaps seemingly contradictory, strategic management approaches.

One way to understand Post-Modern Strategy is to view it from the vantage point of four different but complementary perspectives: historically evolutionary; current dimensions; dominant strategic objectives; and dominant strategic tasks. This multi-viewpoint approach is presented in Figure 2. The historical background for Post-Modern Strategy has already been discussed. From an evolutionary perspective, the current phase of strategic management has come about in order to deal with the inadequacies of previous practices. In doing so it has clearly incorporated the analytical power of many of the recent strategic planning approaches. It has also rediscovered and re-integrated
Figure 2

Post-Modern Strategic Management: A Multi-Perspective View

The Historical Evolution

The General Management Tradition (1950s and 1960s)

Development of Strategic Planning: The "Golden Age" of Strategic Planning (Late 1960s - 1970s)

Post-Modern Management (1980s - present)

Dominant Strategic Actions

- Disaggregation
- Complex Reintegration
- Simultaneity

Current Dimensions

- Style of Decision-Making Behavior
  - Implicit and Explicit
- Time Orientation
  - Present and Future
- Domain of Activity or Focus
  - Internal and External

Dominant Strategic Objectives

Previously: The Extension or Creation of Value

Now: Shift to the Creation or Transformation of Value

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valuable lessons from the General Management heritage. Finally, it has gone forward to develop new ideas, priorities, and methods.

The unique dimensions of Post-Modern Strategy, which encompass the characteristics of much of the current strategic decision-making patterns, as seen in Figure 3, indicate that much of Post-Modern strategic management consists of a set of subtle and ever-present balancing acts and tradeoff analyses involving the interplay of three sets of current dimensions: time orientation (present and future); domain of activity or focus (internal and external); and the style of decision-making behavior (explicit and implicit). As this delineation of dimensions implies, strategy now shows very little of the single-dimensional nature that it once frequently seemed to exhibit in either of its two previous postwar phases. Instead, the center of gravity now continually shifts or perhaps more accurately centers of gravity now coexist, often at multiple spots on the three-dimensional plane in Figure 3. There is usually no single "best" solution for reaching a strategic goal. Instead, there are diverse, often apparently contradictory, paths, which themselves change. The optimum strategic posture is often to possess a portfolio of choices.

What is the cause of such a major change in the configuration of strategic management? The answer clearly lies in the current transformation of competition, at least in the advanced economies. Today competitive success increasingly requires achieving higher value objectives, which often means satisfying a range of complex and often changing demands by the customer throughout the value chain. Consequently, the dominant strategic objectives are shifting. In the 1970s, extending and mining a product line via market-share dominance, for example, was as important a goal as creating new products and services. With the arrival of Post-Modern strategic management there is a move away from simply the extension of value and toward the creation and
Figure 3

Dimensions of Post-Modern Strategic Management

Strategic Decision-making Behavior

Present

Future

Time Orientation

Explicit

Implicit

Internal

External

Domain of Activity or Focus

- Formal organization structure
- Formal procedures
- Established support systems

- Leadership
- Culture / History

- Non-market stakeholders (including the government, the press, and public interest groups)

- Strategic planning
- Competitive strategic analysis

- Short-term incentives
- Strategic control procedures

- Long-term incentives
- Training and recruiting

- "Market Share" in the strategic portfolio

- "Growth" in the strategic portfolio

- Strategic control procedures

- Training and recruiting
transformation of value. Strategic actions that encourage value-intensive differentiation, such as increasing the importance of internal research and development, entering into joint ventures to design and create new products, disaggregating structure (to allow for flexibility and freedom of action in order to encourage innovation), and reintegrating structure in complex ways (to permit appropriate economies of scale and scope), assume higher priority. As we shall see, this important reorientation of major objectives is a key factor in the elevation of technology as a strategic variable and the creation of "new linkages" by corporations for technology acquisition.

By the mid-1980s, strategic management's historical evolution, strategy's more complex set of key current dimensions, and the growing concern in strategy over value-intensive objectives in a changing competitive environment all culminated in a new set of dominant strategic actions that tended to characterize much of Post-Modern strategic behavior. The first such action is disaggregation—the purposeful fragmentation, decentralization, and flattening of an enterprise in order to promote risk taking and innovation. In part, the new emphasis on disaggregation was a somewhat delayed reaction by large corporations to the dramatic and successful experience in the U.S. of small-firm high-technology entrepreneurialism and the continuing vigor of medium size companies, which tended to highlight the benefits of decentralized, small, and flat organizational structures.\(^1\) This kind of dominant strategic action is an important feature of Post-Modern strategic behavior and also has deep implications for the structure of the American firm. It actually represents a significant change of emphasis in the evolution of the large corporation. Instead of continuing to internalize transactions through coordination and administered hierarchies where appropriate, as large firms had been doing since the late nineteenth century, by the early 1980s these
enterprises were seeking ways to loosen up and operate in less coordinated smaller units.\(^6\)

At the same time, however, Post-Modern Strategy does not neglect the benefits of large size and the economies of scale and scope, when they can result value-intensive strategic success. Clearly, in many instances such traditional advantages of market power as volume production, mass marketing, and large industrial R&D facilities can lead to significant strategic achievement. Moreover, within Post-Modern Strategy a process of complex reintegration is also occurring, and this new method of assembling a high value critical mass is particularly effective in the current competitive environment. This type of action essentially permits not only the effective mobilizing of internal resources but also the selection of external sources for achieving strategic advantage. Complex reintegration allows make-versus-buy of high value resources. Therefore an important distinguishing feature of Post-Modern Strategy is a growing use of fluid and network-like interorganization structures--such as strategic alliances--as well as better and varied use of the traditional hierarchical corporate form.\(^7\) Consequently, Post-Modern Strategy is further modifying the shape of the U.S. corporation by actually promoting the externalization of transactions where appropriate.

As we have seen in discussing the key current dimensions of Post-Modern Strategy and as is abundantly clear in trying to envision the vigorous concurrent actions of disaggregation (in order to capture the benefits of flat organizations and an entrepreneurial zeal) and complex reintegration (in order to exploit the advantages of particular kinds of critical mass), the implementation of Post-Modern Strategy often requires the kind of action that permits the continuous blending and coexistence of seemingly opposite kinds of behavior and strategies. This crucial action in Post-Modern Strategy is termed
simultaneity, the simultaneous incorporation of diverse and often seemingly contradictory elements in order to achieve a larger set of strategic objectives. The ability to demonstrate simultaneity on an ongoing basis is increasingly critical for strategic success today.

V. The Practice of Post-Modern Strategy: Technology Strategy and Value Creation Networks as Cases in Point

Post-Modern Strategy is becoming increasingly pervasive. Its growing practice can be seen in the rising importance of technology strategy and of the related phenomenon of value creation networks. Both developments reflect the broad transition to Post-Modern Strategy.

Technology strategy today can be viewed as a kind of "leading indicator" for pinpointing key trends in strategy generally. For example, technology strategy is part of the growing concern for creating and maintaining increasingly higher value strategic actions. Technology strategy also focuses on the design and implementation of novel kinds of structures. Technology strategy confronts continuously the critical tradeoff between the benefits of large-scale-oriented economies of size, scope, and synergies and the benefits small-scale-oriented individual or decentralized entrepreneurialism, flat organizations, and fast response to users and the market. A key part of technology strategy also involves the challenge of creating the requisite set of "new linkages" with organizations external to the firm. Finally, in developing a way to put these and possibly other elements together technology strategy must cope with the probable need to manage concurrently inherent contradictions for the long-term strategic success of the enterprise.2

The recognition of technology as a top-level strategic concern for a corporation and technology's elevation to a strategic variable were due to the
convergence of many of the same historical forces that, by the 1980s, had created the need for Post-Modern strategic management as a whole. By that time, the full impact of such historical trends -- including the negative reaction to strategy planning, the success of the small high-technology firm, the increasingly strategic importance allocated to technology by foreign competition (particularly the Japanese), the related rise in status of manufacturing as a strategic weapon, and the supportive relevant thinking and research in the fields of strategic management and the management of technology-- was visible, widespread, and powerful. Technology strategy had emerged as an important and pace-setting management activity in the corporation.

The key characteristics of technology strategy that flowered during the 1980s are quite different from the distinguishing features of private-sector technological innovation that existed through approximately the 1970s. In that earlier era, private-sector U.S. technological innovation was segmented. By the early 1980s, however, as technology became increasingly strategic, the boundary between the two major forms of private-sector technological innovative activity-- small-firm and large-corporation innovation-- began to fade. This blending of these previously distinctive modes is a salient feature of modern technology strategy and a clear reflection of broader Post-Modern management trends.

Technology strategy is now a complex array of trade-offs, relationships, and linkages that must to be managed. The intensely Post-Modern nature of technology strategy can be seen Figure 4, which depicts the key dimensions of technology strategy. According to this framework, large modern technology-intensive corporations are making technology strategy decisions along three dimensions: competition vs. cooperation (competitive strategy);
Figure 4

Elements of Modern Technology Strategy

COOPERATION

COMPETITIVE
STRATEGY

COMPETITION

Traditional
Large
Corporation
Industrial
R&D

Decentralized
- Firm
Entrepreneurial
Technology
Development

INTERNAL

DOMAIN

EXTERNAL

(c) Mel Horwitch
internal vs. external development (domain); and traditional large corporation industrial R&D vs. decentralized entrepreneurial units (structure). Achieving the appropriate set of multiple trade-offs and locations along these dimensions is one of the major tasks in technology strategy today.

There is a substantial, varied, and ever-increasing empirical database that supports the general notion that technology strategy is part of the overall emergence of Post-Modern Strategy. One recent study examined the technology strategy of a representative set of firms from the population cohort consisting of those 97 U.S.-based Fortune 500 companies that had spent at least $80 million on R&D in 1982. Several methods for technology development and acquisition were identified, as seen in Figure 5. Technologies developed in the industrial R&D laboratory or in entrepreneurial subsidiaries represent the fruits of internal techniques of development. The remaining techniques can be considered external methods of technology development or acquisition. A review of both the Wall Street Journal Index citations and an indepth survey found that for the 1978-83 period there was a substantial increase in the practicing of modern technology strategy methods generally and, especially, in employing non-traditional decentralized structures and in using all the methods identified for external technology acquisition. Companies that have strong inhouse research capabilities have been using, at the same time, more of and a greater variety of internal and external sources for accessing technology, which is a clear illustration of simultaneity in action.

Similar trends can also be seen when viewing technology strategy from the perspective of specific technology-intensive industries. Such practices are increasingly common in a diverse set of technology-intensive sectors, including the personal computer industry, which experienced a prototypical evolutionary development, from a large number of small firms to competition among fewer large players; the permanently turbulent medical diagnostics industry; the
Figure 5

Technology Development and Acquisition Approaches

Internal

1. Technologies Developed Originally in the Central R&D Lab or Division
2. Technologies Developed Using Internal Venturing, Entrepreneurial Subsidiaries, Independent Business Units, etc.

External

3. Technologies Developed Through External Contracted Research
4. External Acquisitions of Firms for Primarily Technology-Acquisition Purposes
5. As a Licensee for Another Firm's Technology
6. Joint Ventures to Develop Technology
7. Equity Participation in Another Firm to Acquire or Monitor Technology
8. Other Approaches for Technology Development or Acquisition
restructured manufacturing technology sector; and the immediately strategic biotechnology industry.

To take a specific and startling example, technology strategy can even be documented in an industry that does not yet truly exist, the optoelectronic communication switching and computer industry. In fact, the advent of modern technology strategy in this industry is probably the most dramatic manifestation of technology's strategic importance. Optoelectronics still consists mostly of intensive R&D efforts by a host of U.S. and foreign firms and some government-sponsored programs. It is still more a vision based on assumptions and extrapolations of technical and market trends. Even without viable and accepted products, however, technology strategy is being vigorously practiced.

To pinpoint this industry is a particularly difficult task. The Japanese Optoelectronic Industry and Technology Development Association defined the general optoelectronic field as one "targeted at an effective use of various characteristics of light, such as high frequency, space information processing and phase information processing capability." A leading expert at Bell Laboratories defined the industry as including devices that emit or detect light, rather than using light simply for illumination. The foundation of this industry was the invention of the laser in 1960 at Bell Laboratories. The laser made possible the generation of a pure and strong light signal. Optical technology in theory offers several intriguing potential advantages over traditional electronic technology, having greater "band-width" and speed capacity for the transmission of information, possessing electronic immunity and thereby avoiding electronic tapping or jamming, and employing lighter and smaller transmission media using optical fiber instead of copper. Some of these characteristics have already led to a growing and increasingly
commodity-like optical fiber market for long-distance telecommunications and information transmission.

There is also the potential for higher value uses of optical technology in information processing and telecommunications when fused with electronics and related technologies. The use of optics in such a fashion could accelerate the processing rates and capacity in these sectors. Ultimately, optical technology could be used inside telecommunications switching equipment and computers to replace electronic integrated circuits, other semiconductors, and computer wiring. At least in theory, this kind of innovation could lead to mass markets for advanced video and information services and to a huge demand for a host of new products, including optically integrated chips (the so-called "optical chip"), the optical computer, and photonic telecommunication switches. It is this potential sector, defined by the use of optics in electronics, computers, and telecommunications switches—not for solely long-distance transmission, that is emerging as a rich domain for intense high value competition and modern technology strategy practices.

By the late 1970s, the possible application of optoelectronics in computing and telecommunications devices was already recognized. Bell Laboratories was researching integrated optoelectronics; dozens of other U.S. research laboratories were spending a total of about $50 million on optoelectronics; and MITI in Japan established in 1978 a joint $90 million optoelectronic research project with 13 companies. Also, several companies and small firms were exploring segments of this field.

By the mid-1980s, however, the set of industry participants had changed. A dual structure had emerged with three major Japanese computer companies heavily committed to optoelectronics as well as several other firms, mostly small ones, still staking out niches. Figure 6 shows this evolution. In order
Figure 6

Participants in the Optoelectronics Industry

<table>
<thead>
<tr>
<th>Type of Institution</th>
<th>1978</th>
<th>1984</th>
</tr>
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<tbody>
<tr>
<td>Integrated Computer</td>
<td>AT&amp;T</td>
<td>AT&amp;T ($33 Billion - Total</td>
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<tr>
<td>or Communications</td>
<td>Bell-Northern Research</td>
<td>Sales)</td>
</tr>
<tr>
<td>Company</td>
<td>IBM</td>
<td>NEC ($9 Billion - Total</td>
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<td></td>
<td></td>
<td>Sales)</td>
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<td></td>
<td></td>
<td>Fujitsu ($8 Billion - Total</td>
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<td></td>
<td></td>
<td>Sales)</td>
</tr>
<tr>
<td>Transmission</td>
<td>Hewlett-Packard</td>
<td>Boeing Electronic Company</td>
</tr>
<tr>
<td>Systems Supplier or</td>
<td>Texas Instruments</td>
<td>Sumitomo</td>
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<tr>
<td>Non-Telecommunications Integrated Company</td>
<td>RCA</td>
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<td>Vendor</td>
<td>Galileo Electro</td>
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<td>Multi-Firm Research</td>
<td>MITI</td>
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<td>Programs</td>
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<td>Battelle Memorial</td>
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</table>

to understand better this change and the strategic decisions being taken, two important and contrasting firms will be discussed, AT&T and NEC.

AT&T has been the clear leader in optoelectronics research. In 1985, at Bell Labs out of a total of 18,000 employees and 120 laboratories, about 225 scientists and parts of six laboratories (three wholly dedicated) were working on photonics research. At that time, Bell Labs spent a total of about $45 million annually on optoelectronics, $25 million on research and $20 million on development. However, Bell Labs' efforts in optoelectronics are rather unfocused and fragmented, reflecting the broad, and science-oriented research tradition of that organization. In 1985, its optoelectronics research budget had 33 percent allocated to lasers, 33 percent to detectors, switches, and bistable optical devices (for optical computing), and 33 percent to systems. But, meanwhile, the nature of competition had changed.

NEC is a formidable rival to AT&T in optoelectronics. 10 percent of its sales are invested in R&D (2 percent more than AT&T) with about 10 percent of its R&D budget allocated to optoelectronics, about $50 million in 1985. Optoelectronics R&D has grown about 10 percent annually since 1980. Optoelectronics R&D at NEC is consciously structured according to three categories: basic research, device research, and applications research. Research activities are given priorities within each category. Applied research is linked closely to production and marketing. NEC is already committed to produce efficiently small optoelectronics devices and is scheduled to dedicate a plant in 1988 that will produce optoelectronic devices, the first plant of its kind in the world. Clearly, NEC is much more explicitly strategic, coordinated, and integrated in its commitment to optoelectronics than AT&T.

Other Japanese firms are also strongly involved in developing an optoelectronics capability, including the computer company Fujitsu, which has a
general strategy of entering the high growth segments of telecommunications, and the cable firm Sumitomo, which is a leading producer of optical fiber and semiconductors. This company has also made a strong commitment to optoelectronics as part of its overall strategy to move into high-technology and international markets. Sumitomo is targeting high value components like optoelectronics modules. In the U.S., Boeing also has R&D activity in optoelectronics. The firm established the Boeing Electronics Company in 1985, as part of its strategy to diversify somewhat out of aerospace. In 1986, Boeing also created an optoelectronic research laboratory in its High Technology Center. This laboratory has received about $20 million in funding or about 20 percent of the Center's total budget (which, in turn, represents about 25 percent of Boeing's overall R&D allocation). Boeing's activities are more focused than either AT&T or NEC.

It is extremely hazardous to perform an assessment of the corporate strategies in this industry, where practically no truly significant products have been marketed. Still, certain trends and evaluations can be done. As seen in Figure 7, one comprehensive analysis of this industry concluded that both NEC and Fujitsu would maintain their high strategic position during the next decade, that Sumitomo and Boeing would improve moderately, and that AT&T would decline somewhat in relative strategic position due especially to its lack of explicit priority-setting within optoelectronics and the absence of strategic coordination and integration. Clearly, AT&T has excellent technology but not necessarily superior technology strategy.

Multi-firm activities are also an important aspect of the optoelectronics industry. In Japan, the nine-year, $90-million MITI joint research program on optical measurement and control systems, which started in 1979, still exists with 13 companies participating. In 1981, MITI also formed the Optoelectronics
## Figure 7

Strategic Position of Major Optoelectronics Firms

<table>
<thead>
<tr>
<th>Company</th>
<th>1986</th>
<th>1995</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT&amp;T</td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td>NEC</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Fujitsu</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Sumintomo</td>
<td>Low</td>
<td>Medium-Low</td>
</tr>
<tr>
<td>Boeing</td>
<td>Low</td>
<td>Medium-Low</td>
</tr>
</tbody>
</table>

Joint Research Laboratory to conduct basic research on optoelectronics devices for short-haul uses. MITI is also funding optoelectronics R&D at NEC, Fujitsu, Hitachi, Toshiba, and Mitsubishi. These firms, along with Sumitomo and three others, are also participating in the MITI optoelectronics laboratory. NEC is working with several Japanese materials and chemical firms and a U.S. firm on optoelectronics R&D. In the U.S., an optoelectronics research consortia was established by Battelle Memorial Institute in 1985 and had seven corporate sponsors, Boeing, Hewlett-Packard, ITT, Allied, Litton, AMP, and Dukane. Each firm contributed $600,000 for three years of research. Battelle ideally is aiming for 16 corporate members and a $12 million program. The U.S. Department of Defense also funded $20 million for optoelectronic research in 1985.

The remarkable aspect of the optoelectronic communication switching and computer industry is how strategic it is even before there are significant products on the market. A massive long-term R&D commitment is in place, a global perspective dominates, evaluations of long-term strategic capabilities and advantages are carried out, and a web of new linkages already exists. Amazingly, technology strategy and a Post-Modern condition have preceded the actual establishment of an ongoing industry.

Among the general lessons to be derived from a discussion of comparative technology strategy patterns at the industry level are, first, that a similar pattern of strategic decision making seems to have emerged, mostly without regard to the specific technology-intensive industry. Technology itself has become an increasingly important strategic concern in stereotypically high-tech sectors like personal computers, ultrasound medical diagnostic equipment, biotechnology, and optoelectronics and in seemingly mature industries like manufacturing technology. In addition, there is also clear evidence of the coexistence of multiple internal structures (such as industrial R&D and venturing), of large and small firms, of multi-firm
research efforts, and of new kinds of linkages in all of these industries, whether they are established (like manufacturing technology, personal computers, and ultrasound), new (like biotechnology), or not yet truly in place (like optoelectronics). Moreover, technology strategy methods are obviously being vigorously practiced on a global basis, particularly in the advanced economies. Finally, all these lessons point to a more general implication that Post-Modern Strategy practices are similarly not limited to either a small set of industries or countries.

The Post-Modern character of technology strategy can also be discerned by studying specific representative firms. One increasingly significant feature exhibited by many of these companies is the growing importance of diverse kinds of strategic alliances for the purpose of gaining access to needed technology. Obviously, such interorganizational relationships, which are termed value creation networks, are examples of the more general phenomenon, Post-Modern complex reintegration.

The prevalence of strategic alliances can be demonstrated by briefly reviewing the strategic configuration established by three representative technology-intensive large corporations: the linkages with a biotechnology focus of the Swiss-based pharmaceutical company, Hoffmann La-Roche; selected strategic alliances formed by the Japanese electronics giant, NEC; and the constellation of external relationships established by the U.S. automobile maker, General Motors.

The modern interorganizational structures associated with these three firms are presented in Figures 8 through 10. As can be seen, similar patterns of strategic linkages have occurred in spite of the fact that these firms possess different histories, cultures, and national origins and that they compete in industries with substantively different characteristics. All three
Figure 8
Hoffmann-La Roche: Selected Linkages With Biotechnology Focus

Basel Institute of Immunology

Hoffman-La-Roche

DOMESTIC

INTERNATIONAL

Roche Institute of Molecular Biology

Vega Biotechnology

Penn State

Technicleone

Princeton

BTC Diagnostics

Baylor

Genentech

Immunex

Centocor

Unigene

Takeda

Ajinomoto

Genetic Diagonostics

Damon

Alpha 1 Biomedicals

LEGEND

\[\text{Consortium}\]

\[\text{Large Firm}\]

\[\text{Small Firm}\]

\[\text{Govt. or other Institution}\]

\[\text{Extend Existing Value}\]

\[\text{Targeted Value}\]

\[\text{Creation/Transformation}\]

\[\text{Broad Value}\]

\[\text{Creation/Transformation}\]
Figure 9


LEGEND

- Consortium
- Large Firm
- Small Firm
- Govt. or other Institution
- Extend Existing Value
- Targeted Value
- Creation/Transformation
- Broad Value
- Creation/Transformation
Figure 10
General-Motors: Selected New Linkages With Technology Focus 1980-1985

LEGEND

△ Consortium
○ Large Firm
□ Small Firm
□ Govt. or other Institution

- Extend Existing Value
- Targeted Value
- Creation/Transformation
- Broad Value
- Creation/Transformation
firms are now clearly at the center of a hub of a vast and complex network of relationships.

The functions of these networks are clearly multiple. They include simply extending value for ongoing business activity and, increasingly, creating new value or radically transforming current value. Also, it is worth mentioning that the kinds of participants in these webs of linkages are extremely diverse. Large firms, small firms, multi-firm consortia, and governmental agencies or programs are all represented.

The actual types of linkages identified are also quite varied. They include licensing agreements, marketing or research contracts, acquisition, and minority equity holdings. With regard to this last type of linkage, for example, it is clear from Figure 10 that General Motors has a strategy of using a portfolio of minority equity investments at least partially to keep abreast of technological developments in such fields as vision systems, artificial intelligence, and expert systems.

Finally, it is obvious that these interorganizational relationships often cut across international boundaries and some of these linkages are truly global in scope. Hoffmann La-Roche has biotechnology-related agreements with three U.S. universities. NEC has ties with several U.S. firms and foreign governmental bodies. General Motor has foreign joint ventures with technology development objectives. GM’s partners include Fanuc, Isuzu, Alfa Romeo, and Toyota.

These remarkably similar patterns of strategic-alliance structures by such different corporations as Hoffmann La-Roche, NEC, and General Motors are not simply due to coincidence. Instead, they indicate a kind of convergence in the practice of Post Modern strategic management by technology-intensive corporations in the advanced economies. Many such firms are intensively
searching for effective higher value strategies, which often involves considering technology as the critical strategic variable. Increasingly, firms are willing to "buy" such value creating capability as well as investing in an internal capability to "make" high value creation.
V. A Generic Model for the Value-Creating Post-Modern Corporation

A major implication of technology strategy and overall Post-Modern Strategy, particularly with their penchant for both novel anti-hierarchical forms within the firm and for interorganizational linkages outside, is that they signify the emergence of at least partially a new corporate form.

What might be the configuration of this quasi-new entity? It is not simply a rational hierarchical institution, which was documented by Chandler and which was a supportive home for strategic planning methods. Nor is it the smaller, flatter, and more informal organization and style of either the General Management school or high-technology entrepreneurialism. Instead, it possesses features of both—with decentralized smaller units and continuing large-scale hierarchies, divisions, and functions.

In addition, a major part of such a corporation's strategic repertoire is a diverse set of external relationships that are established for the purpose of capturing still more value. In particular, the employment of interorganizational collaborative value creation networks are a key distinguishing feature of the strategic behavior of the Post-Modern corporation. Such moves can be viewed as essentially attempts to establish pipelines to outside resources that can enhance the value creation capability of an enterprise. The various types of linkages can be delineated in Figure 11, and it is argued that the emphasis is shifting to the second and third columns where the creation of value is largely occurring.
**Figure 11**

**Alternative External Collaborative Arrangements**

**Possible for the Large Corporation**

<table>
<thead>
<tr>
<th>Strategic Objective of Large Corporation</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Type of Partners/Sponsor Chosen</th>
<th>Creation or Transformation of</th>
<th>Creation or Transformation of</th>
</tr>
</thead>
<tbody>
<tr>
<td>Another Large Corporation</td>
<td>Extension of Established Value</td>
<td>Narrow or Targeted Value</td>
</tr>
<tr>
<td></td>
<td>Licensing</td>
<td>Joint Venture for New Product</td>
</tr>
<tr>
<td></td>
<td>Joint Venture for Manufacturing</td>
<td>Development or New Manufacturing Methods</td>
</tr>
<tr>
<td>Small Firm</td>
<td>Distributor for Limited Market</td>
<td>Contracted Research</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Joint Venture for New Product</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Development</td>
</tr>
<tr>
<td>Multiple Firms</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Government Programs</td>
<td>Governmental Research Program</td>
<td>Governmental Research Program</td>
</tr>
<tr>
<td>Others</td>
<td>University-Industry Association</td>
<td>University-Industry Association</td>
</tr>
</tbody>
</table>

Mel Horwitch
The emerging Post-Modern corporation can be modeled in order to facilitate a generic understanding of this increasingly significant institution. Figure 12 presents a model that represents how such a corporation might establish linkages for technology development. This model is instructive in several ways. First, from the perspective of the large firm, A, a vast number of different options are possible and several types of linkages are established. This firm has alliances with another large firm, B, several small firms, D, a large foreign firm, C, and a small foreign firm, E. It also has a strong association with an industry-wide consortium for technology development and a government-sponsored multi-firm R&D program. Moreover, the strength of these linkages is by no means uniform. Some of the relationships are quite strong, that is, they are relatively durable, difficult to break, and may be legally bound to last for a definite period or until some goal is achieved. Other relationships are quite easy to break, that is they can be quickly eliminated at almost any time, say, by selling stock or withdrawing funds arbitrarily. Many of these links are switchable, in the sense that they can be turned off and possibly turned on again. Notice also that this situation is global; the linkages are not simply limited to the domestic setting. In fact, firm A has R&D being done overseas by firm E. Notice also that another large firm, B, with which A maintains a weak tie, has its own set of linkages with firms at home and abroad that are large and small, D3, B3, C3, and E3.

These linkages may be controlled on monitored from different points within the formal internal organization of firm A, such as the CEO's office, the internal venture unit, or one of the operating divisions. Any one of these places may have linkages with outside firms, though it is likely that high-level corporate or division managers control the linkages with the industry-wide consortium or the government-sponsored program. The formal
internal organization itself is changing as a result of these linkages. Figure 12 shows how the boundaries can be stretched. Firm A has just acquired large domestic firm B1, small domestic firm D1, large foreign firm C1, and small foreign firm E1. Before the acquisitions firm A may have maintained other kinds of linkages with some of these companies. The opposite can also happen. Small firm D4 was once an internal venture that had incubated solely within firm A. Firm A decided to spin off this venture and just keep a piece of it.

In reality, Figure 12 portrays a flexible and malleable network of weak and strong relationships that may override the formal organizational boundaries of the firm. The job of strategy has changed. Previously the emphasis was on recognizing the opportunities and threats in the competitive environment and establishing within the firm the appropriate structure, systems, and processes. With the increasing importance of strategic networks, which have associations that pierce through the formal boundaries of a firm, the tasks of scanning, facilitating, and coordinating external entities assumes greater significance. In addition, the old make-vs-buy tradeoff, found originally in purchasing and manufacturing, takes on greater general meaning. The creation of strategic networks can encourage a policy in which external entities play a higher value strategic role, and the notion of shrinking or "de-massing" the internal structure gains enhanced legitimacy.

To repeat, as we have seen, both novel internal structures and external value-creation strategic alliances are part of the broader transition toward Post-Modern Strategy that is now underway in all of the advanced economies. This development requires a significant change of views concerning the fundamental conceptualization of strategic management. Defining the domain of corporations is no longer simple. The inside structure is quite complex. The outside environment is no longer merely competitive. The distinction and
Figure 12

Framework of New Linkages for Technology Development

Government-Sponsored Multi-Firm or R&D Program

Acquisition of Large Firm

Multi-Firm Consortium

Operating Divisions

Corporation - Internal Venture Capitalist

Internal Ventures

Acquisition of Small Firm

Another Large Corp.

R&D Contact

Acquisition of a Small Foreign Firm

Large Foreign Firm

Small Foreign Firm

Domestic

Overseas

(c) Mel Horwitch
boundaries between organization and environment are blurred. There are now a variety of ways to join forces with external actors. At least some of the linkages themselves can be changed or cancelled. The growing diversity of enterprise certainly presents new difficulties for strategic management. But it also can mean enhanced strategic degrees of freedom and choice. New paths are now available for achieving meaningful strategic success.
ENDNOTES


19. For the impact of small-firm high-technology entrepreneurialism and of the performance of medium size firms, see: Paul Freiberger and Michael Swaine, Fire in the Valley (Berkeley, Cal.: Osborne-McGraw Hill, 1984;


For a detailed discussion of technology strategy, see: John Friar and Mel Horwitch, "The Emergence of Technology Strategy".


For a more extensive discussion of the previous two separate modes for technological innovation and the current blending and blurring of them, see Mel Horwitch, "The Blending of Two Paradigms for Private-Sector Technology Strategy," in Jerry Dermer (ed.), Competitiveness Through Technology (Lexington, Mass.: Lexington Books, Inc., 1986).


For a detailed discussion of the evolution of technology strategy in the personal computer manufacturing technology/robotics, medical equipment and biotechnology industries, see: John Friar and Mel Horwitch, "The Emergence of Technology Strategy."

