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Managing for an Uncertain Future

A Systems View of Strategic Organizational Change

The need to manage strategic change in organizations facing uncertain futures challenges both management theorists and practitioners to develop better models of organizations that can lead to greater insights into processes that motivate and accomplish organizational change. In this paper, we introduce a view of *organizations as open systems* that leads to identification and clarification of some key issues in the dynamics of organizations as they try to respond to an uncertain and changing environment.

The systems properties of organizations attempting adaptive change have been studied by many researchers. Ashby's "law of requisite variety" (1956), for example, stipulated a basic requirement that a system must be capable of generating the "requisite variety" of responses to a changing environment in order to maintain its internal stability. Forrester's industrial dynamics approach (1961, 1968) laid important groundwork for the dynamic systems modeling of organizations, industries, and macroeconomies. Simon (1981) also proposed a number of basic properties of systems applicable to organizations.

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In the strategic management literature, Dierickx and Cool (1989) introduced a concept of organization resources as asset stocks created by resource flows that are subject to time-compression diseconomies, asset mass efficiencies, and other system effects. These system effects impose higher costs and time requirements on competitors that would duplicate an organization's asset stocks, thereby enabling that organization's current endowments of resources to earn economic rents over some time period. In a simpler but closely related argument, Teece, Pisano, and Shuen (1990) maintain that because organizational capabilities are dynamic—that is, they take time to develop—organizations with specific capabilities may enjoy competitive success while other organizations work to develop comparable rent-generating capabilities.

Drawing on papers by Sanchez and Heene (1996, 1997), we describe a model of organizations as goal-seeking open systems composed of various tangible and intangible assets. The open-system view developed here extends the model of a organization as a collection of asset stocks and flows (Dierickx and Cool, 1989) by explicitly recognizing the impacts on organizational change of

- Managerial cognitive processes *to determine what kinds of asset stocks and flows* an organization should try to achieve and *what uses* they will be applied to;
- Managerial abilities *to coordinate intraorganizational and interorganizational flows* of assets and capabilities in processes of organizational change;
- Managerial abilities *to support organizational learning and to manage existing knowledge assets* effectively in processes for qualitatively changing an organization's asset stocks and flows.

By addressing these three dimensions of organizational change, the system model tries to provide a framework for recognizing both the future uncertainties inherent in strategic change and the cognitive limitations of managers (and everyone else) as they confront and try to manage the causal ambiguities raised by those uncertainties. After introducing the basic concepts in the systems model, we explore each of these dimensions of strategic organizational change through more detailed applications of the systems model to the problem of managing for an uncertain future.

The open systems view of organizations

As suggested in figure 1, in the Sanchez and Heene open-systems model of organizations, both tangible and intangible assets are organized according to the organization's *strategic logic*, which represents the organization's operative rationale for achieving its goals. The concept of an organization's strategic logic is not intended to represent only the ideas of top managers, but rather is intended to represent the sum of the ideas motivating all decision makers in an organization who exercise significant influence on resource flows. Thus, in one organization the strategic logic may consist of a detailed strategic plan that is strictly followed by managers exercising tight organizational control through a centralized system for monitoring and managing resource flows. Equally possible is a strategic logic that resides largely in a corporate culture whose values and practices are embodied in a "flat" organization in which teams have broad authority to make decisions about resource flows. Whatever the organizational arrangement, the model in figure 1 is intended to suggest that cognitive frameworks of decision makers—whom we refer to simply as *managers*—are critical organizational assets and that the collective strategic logic of an organization's managers determines the organization's deployments of resources carried out through its management processes.

A key aspect of this strategic logic is the set of *management processes* the organization adopts to coordinate the assets and capabilities it can access and deploy in its efforts to achieve its goals. An organization functions as an open system in that it must constantly replenish its stocks of tangible and intangible assets (including knowledge and capabilities) through its own internal development efforts and through many kinds of interfaces with other organizations and markets. When organizations compete for limited supplies of input resources and for demand for their outputs in markets for products and services, they become systemically interrelated. Organizations competing in market segments, product markets, and industries are therefore embedded in progressively larger open systems of interacting organizations.

In the model of the organization as an open system, the organization's operations are treated as a stock of specific activities or organizational routines (Nelson and Winter, 1982). The market's responses to the organization's products produce flows of sales revenues and data relating to the sales of the organization's products in the market. Data on

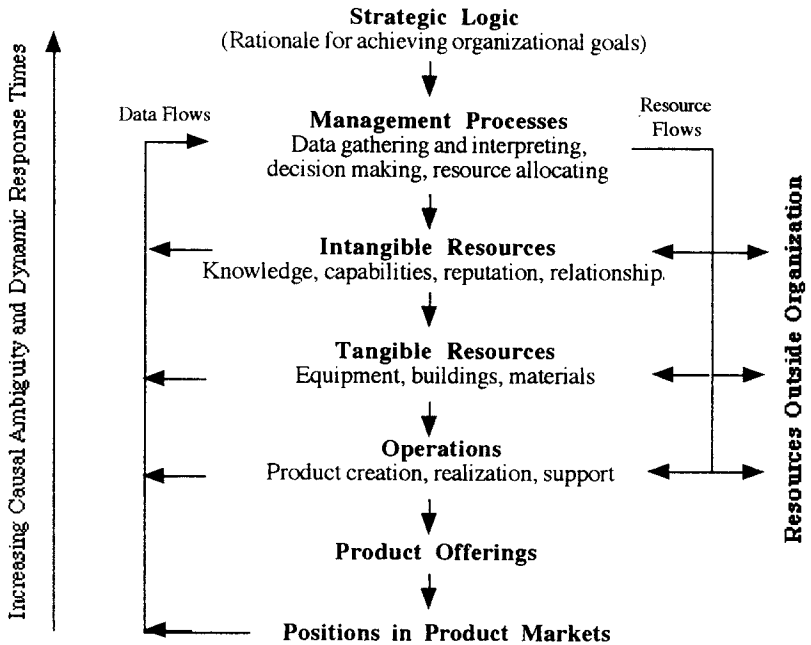


Figure 1 An Open Systems Model of Organizations (adapted from Sanchez and Heene, 1996, 1997)

the organization's products, operations, and tangible assets are also gathered and flow to the decision-making processes within the organization's management processes. The organization may also gather various kinds of data internally and externally to be used in assessing the condition of the organization's higher system elements (intangible assets, management processes, and strategic logic).

From the organization's management processes emanate the specific decisions, rules, procedures, guidelines, and norms that direct the flows of the organization's financial and other resources to the various internal *systems elements* of operations, tangible assets, intangible assets, management resources, and strategic logic. The organization also exchanges resources within competence alliances and in resource markets to convert them into flows of desired tangible and intangible resources directed to the organization's operations and other system elements.

Within this systems model of organizations, strategic change is motivated by perceptions by managers and other decision makers that *strategic gaps* exist between the perceived current states of the assets and capabilities comprising the system elements within the organization and the desired states of those assets and capabilities (i.e., the states required to enable the organization to achieve its goals). Perceptions of needs to change asset stocks and flows within an organization are derived from feedback loops through which managers and others try to monitor the condition of the organization's system elements. The various means that managers employ for "feeding back" information on systems elements are termed *control loops*.

Within the bottom-to-top ordering of systems elements shown in figure 1, the data conveyed to managers about these systems elements through control loops are subject to *increasing causal ambiguities*. In other words, it becomes progressively more difficult to discover clear cause-and-effect relationships affecting or affected by systems elements that are higher in the ordering of systems elements shown in figure 1. For example, finding clear causal relationships in an organization's "operations" system element (e.g., the impact of alternative maintenance policies on equipment breakdown rates) is more feasible than at the level of an organization's strategic logic or management processes (e.g., what is the contribution of each of several aspects of a given strategy to an organization's success or failure in a given market?). Thus, this notion of increasing causal ambiguity in the Sanchez and Heene systems view suggests that managing "higher-order" organizational change in dynamic environments begins with a search by managers for *implied* strategic gaps in the organization's higher order system elements.

In the Sanchez and Heene model, the higher system elements in figure 1 are also subject to increasing *dynamic response times* as an organization tries to undertake strategic change. Essentially, higher-order, cognition-based system elements like strategic logic and management processes are often more difficult to change—and thus will take longer to change—than lower system elements like tangible assets and current operations. The consequence of this posited property of organizations as systems is that the time required to change an organization's stocks of higher system elements imposes strategically important dynamic limitations on an organization's ability to change in a dynamic uncertain environment.

Finally, Sanchez and Heene suggest that managing causal ambiguity and dynamic system effects in a dynamic and uncertain environment requires creating organizational *strategic flexibilities* to generate a range of responses to changing environmental conditions. Sanchez (1995, 1997) proposes that acquiring flexible resources can help managers to compensate for the causal ambiguities that limit managers' abilities to predict future strategic resource requirements precisely. Managers may also be able to counteract the tendency toward increasing dynamic response times in higher system elements by developing flexible coordination abilities that can be used in redeploying an organization's (flexible) existing or new resources quickly in response to changes in the environment.

Three properties of organizations as open systems

This view of organizations as a system proposes three systems properties of organizations that have important impacts on an organization's ability to adapt to the changing requirements of an uncertain future.

Ordering of causal relationships

In the model shown in figure 1, *causal relationships* between system elements essentially flow from top to bottom, as suggested by the downward arrows between system elements in the model. In the first downward flow of influence, an organization's strategic logic influences the organization's management processes, which comprise an organization's processes for gathering data, frameworks for interpreting data, methods for identifying strategic gaps, and rules, procedures, and incentive structures for allocating resources to gap-closing actions. The organization's management processes, acting in accordance with the organization's strategic logic, in turn direct flows of resources to the organization's intangible assets, tangible assets, and operations and thereby determine the level and composition of the organization's asset stocks and flows. Similarly, the nature of the organization's intangible assets (capabilities and knowledge) determine the uses to which the organization's tangible assets can be applied in its operations.

Causal ambiguities

Perceptions of managers about states of the organization's system elements and possible needs for gap-closing actions are formed by man-

agers who use their cognitive frameworks to interpret data gathered about the organization's system elements and about the world outside the organization. Efforts of managers to interpret data the organization may gather, however, are subject to varying degrees of causal ambiguity. Data about the state of a given system element are *causally ambiguous* to the extent that gathered data support alternative interpretations whether that system element is currently contributing effectively to goal attainment by the organization. Some data may appear to be relatively unambiguous, like data showing increasing sales. Nevertheless, managers' interpretations could still differ about the relative contribution of the organization's operations or another system element to the observed increases in sales.

The open-system model in figure 1 proposes that data about system elements are subject to increasing causal ambiguity as system elements ascend from bottom to top of the array of system elements. For example, even "hard" quantitative data indicating low capacity utilization rates might support several alternative interpretations of the current state of the organization's production assets, including inadequate maintenance leading to frequent machine breakdowns, production slowdowns carried out by dissatisfied workers, ineffective production scheduling by plant managers, or low demand for a plant's products resulting from low quality or inappropriate product designs.

As one moves up the array of system variables to the organization's stocks of intangible resources, management processes, and strategic logic, data become increasingly ambiguous and may support a large number of alternative interpretations. Many forms of ambiguous data may have to be gathered and evaluated to discover any dominant patterns of data that would lend support to one interpretation or a limited number of interpretations of the state of a higher system element. For a high-order system element like a organization's strategic logic, the ambiguities in available data are unlikely to be definitively resolved no matter how much and how many kinds of data are gathered. Thus, in assessing higher system elements, the best outcome to managers' interpretive processes may often be simply a reduction in the number of alternative plausible interpretations of available data.

Dynamic properties

In the open-systems model of figure 1, the *dynamic response times* required to change the composition of system elements increases from

the bottom to the top of the array of system elements. This ordering of dynamic response times suggests that an organization can change its mix of products more readily than it can change the way it operates, may change its operations more readily than its tangible assets, may change its tangible assets more readily than its intangible assets (such as knowledge and capabilities), and may change its intangible assets more readily than its management processes and strategic logic.

This asserted property of increasing dynamic response times follows from two suppositions. First, it will generally take longer to change the *ideas* organizations use than the *things* organizations use. Thus, managerial cognitions and managers' approaches to coordinating are likely to be harder to change than stocks of tangible resources like machines and buildings, or the organization's current operations or products. Second, most resources required to effect changes in lower system elements are likely to be relatively readily obtainable from markets or competence alliances, while sources of resources for changing stocks of managerial cognitions or management processes are likely to be more difficult to identify, evaluate, and obtain. For these two reasons, as one moves from the bottom to the top of the array of system elements in figure 1, the ability of the organization to change stocks of system elements in the short run diminishes.

A systems view of managerial cognitive processes

Fundamental to the ability of an organization to respond effectively to an evolving environment are the processes by which managers perceive opportunities or needs for strategic change and undertake to create new flows of resources useful in responding to changing circumstances. Thus, in the model of organizations as *open systems*, the processes of *managerial cognition* are critical in determining what kinds of resources an organization will try to develop or access in order to respond to changing circumstances. The concept of *causal ambiguity* is incorporated in the systems model to represent the cognitive limits of managers trying to understand the usefulness of resources and capabilities in a complex and uncertain environment. Environmental complexity makes it difficult for managers to determine clear cause-and-effect relationships between uses of resources and the possible outcomes of those uses. Environmental uncertainty and change

make it even more difficult for managers to determine which kinds of resources and capabilities might be useful to an organization in the future. How managers attempt to manage these causal ambiguities greatly affects an organization's processes for developing and deploying resources as the future unfolds.

An organization's managerial decision making can be characterized as a process driven by the feedback mechanisms or *control loops* through which an organization's managers try to monitor its internal conditions and aspects of its external environment, to identify the changing array of resources and resource deployments that will bring desired benefits to the organization, to direct and regulate the organization's efforts to acquire and use resources, and thereby to adapt the organization to a changing environment. An organization undergoes *strategic change* when its managers seek significant quantitative or qualitative adjustments in the organization's *system elements* through effecting change in its stocks and flows of resources. An organization's system elements include its operations, tangible and intangible assets, management processes, strategic logic, and their associated flows of input resources, products, data, information, and decisions.

In the open-systems model, changes in the states of an organization's system elements are motivated by managers' perceptions of unacceptable *strategic gaps* between the perceived and desired states of the organization's system elements. Managers may perceive strategic gaps in any or all system elements of an organization, and they may take various kinds of actions to try to close the gaps they perceive. Sanchez and Thomas (1996) suggest that fundamental differences in the strategic responses of organizations to evolving environmental change and uncertainty result from differences in the kinds of strategic gaps their managers perceive and in the kinds of actions managers undertake to close strategic gaps. In this regard, differing strategic behaviors of organizations are therefore likely to arise from differences in the ways managers in different organizations form perceptions of strategic gaps and appropriate corrective actions.

We next consider two kinds of feedback mechanisms or *control loops* through which managers may try to gather and interpret data on systems elements in their efforts to adapt their organizations to a changing environment.

Use of lower-order control loops to drive adaptation

Managers in some organizations may be less skillful than other managers in discovering patterns suggestive of causal relationships in the highly ambiguous data about higher system elements. Such managers may direct the organization efforts to gathering data about lower system elements for which ostensibly unambiguous, “hard” quantified data are available. Readily quantifiable data are most easily obtained about an organization’s products, operations, and tangible assets, and managers preferring such data will be likely therefore to focus on asset stocks and flows directly related to production operations and marketing of current products.

The pattern of data gathering, interpretation, and resource allocation driven by data and resource flows in lower system elements is shown in figure 2a.

The control loops bringing managers system feedback in the form of current operating data may tend to behave like positive feedback loops in organizations. Current market acceptance of the organization’s existing products may generate data on profitability, revenues, and market share that managers interpret in a positive manner, increasing their confidence in the appropriateness of the organization’s current operations and stocks of tangible and intangible assets, its management processes, and its strategic logic. Thus, current market acceptance of the organization’s products may lead to rising levels of managerial confidence in the current states of all the organization’s system elements. This confidence may lead managers to expand current operations quantitatively. If expanding operations lead to more sales and profits, managers may become even more strongly persuaded that the organization’s current stocks of resources and capabilities are adequate for meeting the future demands of the organization’s environment. As they continue to carry out their current strategic logic for managing the organization, success may well breed success—as long as the organization continues to attract necessary inputs of resources and as long as the market continues to respond favorably to the organization’s current products and services.

What happens, however, if competing products appear in the market and lead to a decline in the market’s acceptance of the organization’s products? The data gathered through lower-order control loops should begin to yield evidence of a deterioration of the organization’s current

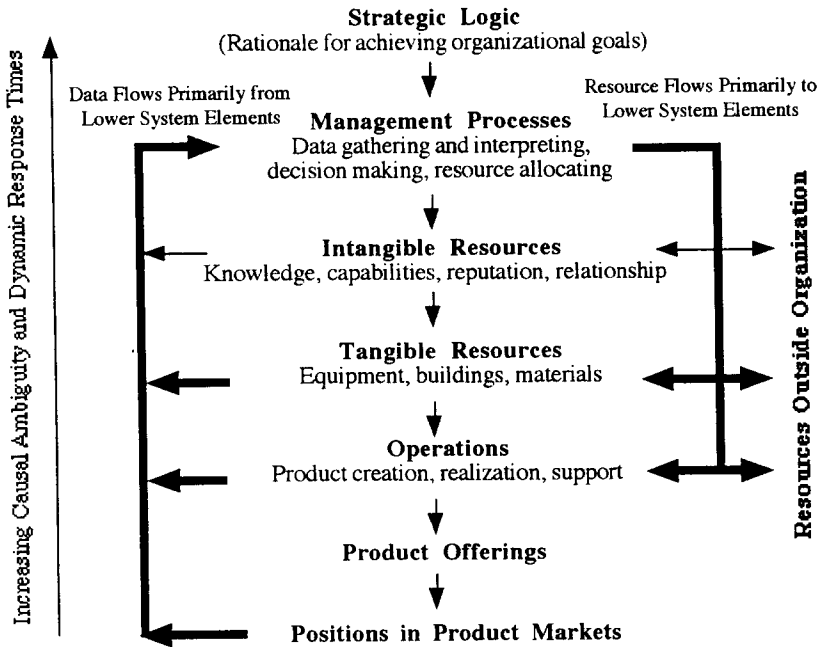


Figure 2a “Bottom–Up” Adaptation Through Lower-Order Control Loops (adapted from Sanchez and Heene, 1996)

market share and profitability. Managers’ first response to such data is likely to be a growing perception of a strategic gap in lower system elements, leading managers to scrutinize current production and marketing (especially sales) activities. If deterioration in current operating data continues, however, managers may eventually begin to doubt the appropriateness of the organization’s higher system elements and begin to look for strategic gaps in current management processes and perhaps even in their own strategic logic.

As suggested in figure 1, however, higher system elements have longer dynamic response times—that is, changing stocks of assets in higher system elements is likely to take longer than changing asset stocks in lower system elements. Thus, managers may first try to reverse any deterioration in current operating data by changing asset stocks and flows in lower system elements with relatively short dynamic response times. Managers are unlikely to pursue possible changes in higher elements if adjustments in lower system elements

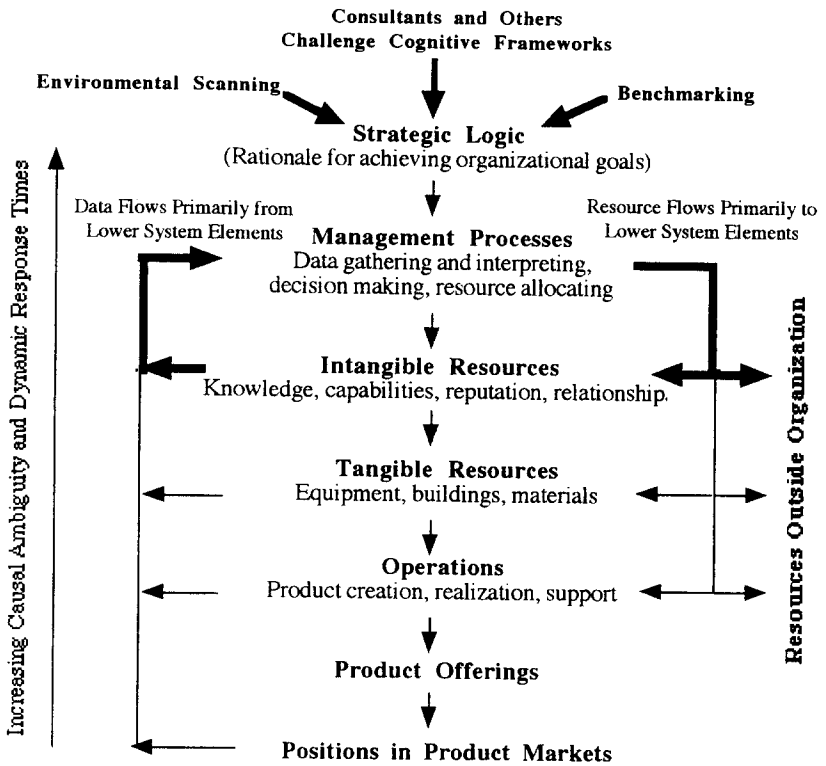


Figure 2b “Top-Down” Adaptation Through Higher-Order Control Loops
(adapted from Sanchez and Heene, 1996)

appear to reverse the deterioration in current operating data. If closing perceived gaps in lower system elements does not improve current operating data, however, managers may try to change progressively higher system elements until they reach some level of gap-closing action that appears to reverse the deterioration in data about current operations.

Managers are likely to encounter two basic and perhaps insurmountable difficulties in trying to manage adaptive change “from the bottom up”—that is, through lower-order control loops driven by current operating data. First, changes in current operating data do not usually provide adequate clues to identify deteriorations in current operating data that are the result of fundamental environmental changes that must be remedied through changes in higher system elements. As a result,

when important environmental changes do occur, managers may invest precious time and resources in misdirected efforts to change lower system elements, while needed changes in higher system elements go undetected and unaddressed. Further, when fundamental change does occur in the environment, an organization with deteriorating profitability and revenues may not have sufficient resources or time to effect changes in higher system elements with long dynamic response times.

These limitations of lower-order control loops as drivers of “bottom-up” adaptation suggest that establishing and using higher-order control loops is necessary for managing organizational change in an uncertain environment.

Use of higher-order control loops to drive adaptation

To assess the appropriateness of an organization’s higher system elements, managers must try to interpret often highly ambiguous data in an effort to discover plausible interpretations about the states of the organization’s higher system elements. This effort will lead to patterns of data gathering and interpreting suggested by the higher-order control loops in figure 2b.

Like lower-order control loops, these higher-order control loops behave like positive feedback loops, in that an increase in managers’ confidence in the appropriateness of their strategic logic is likely to lead to increases in their confidence in the organization’s management processes, intangible assets, and other system elements. Thus, even when current operating data indicate current profitability and a strong market position, strategic managers should continually challenge their confidence in the organization’s strategic logic and other higher system elements. Three approaches to challenging managers’ perceptions about the state of higher system elements are suggested at the top of figure 2b and summarized below.

Benchmarking

Various forms of benchmarking or benchtrending may be used to assess the strengths and weaknesses of an organization’s strategic logic, management processes, intangible assets, and other system elements. To be effective in discovering opportunities or needs for change, however, benchmarking must go beyond comparisons of aggregate operating data to benchmark specific aspects of higher system elements

against superior performing organizations both inside and outside the organization's industry. Product creation, product realization, technologies, organization designs, incentive plans, information systems, and even the basic ideas underpinning an organization's strategic logic may be compared against their counterparts in best-in-world companies in any industry.

Such comparisons may help managers to discover *implied strategic gaps* in their organization's higher system elements. For example, an implied strategic gap might be perceived when an organization compares well against competitors in its industry, but falls short when compared with a superior performing organization in another industry. Discovering implied strategic gaps may stimulate managers to take gap-closing actions in higher-order system elements before deterioration in an organization's current operations becomes evident through lower-order control loops.

Environmental scanning

Technological, organizational, and market scanning are essential means of challenging the appropriateness of an organization's strategic logic for applying technological and organizational capabilities to market opportunities. Managers may scan the environment for possible changes in available or feasible technologies, for innovative approaches to organizing, and for emerging market trends. Managerial perceptions of possible technological, organizational, or market changes may stimulate decisions to build up *qualitatively* new stocks of resources in anticipation of environmental changes in the future.

Challenging cognitive frameworks

Managers may also seek to challenge their cognitive frameworks by exposing them to alternative viewpoints and new conceptual frameworks by hiring consultants or advisers who can tell them about new strategic logics for competing in their industry or in other industries. An organization may also hire new managers from other organizations or other industries to bring new perspectives for assessing its current strategic logic and management processes. Managers may also try to foster diversity in cognitive frameworks within an organization by seeking diversity in the backgrounds of its managers. Some organizations may cultivate a confrontational, "no-holds-barred" culture in which any-

one is free to question the basic assumptions in the organization's strategies. These and other means of challenging their strategic logic may help managers to perceive implied strategic gaps that suggest opportunities for changes in an organization's higher system elements and to take gap-closing action in advance of deteriorations in current operations.

The cognitive challenge in managing organizational adaptation

In a world of perfect information and unbounded rationality, managers would readily detect and act to close strategic gaps in any of an organization's system elements. In the complex real world inhabited by real organizations, however, real managers have only partial and imperfect information. These limitations of information lead to significant causal ambiguities (Lippman and Rumelt, 1982) as managers try to discover the causal relationships that would enable them to determine what the state of a given system element is or ought to be. As the systems model in figure 1 suggests, causal ambiguities about the states of an organization's system elements increase as managers try to identify strategic gaps in higher system elements like an organization's intangible assets (e.g., knowledge and capabilities), its management processes, or managers' own strategic logic.

One important consequence of the intrinsic difficulty of assessing the state of higher system elements is that managers may tend to avoid grappling with the ambiguities of higher system elements and instead direct their attention to using lower-order control loops to monitor data about the states of lower system elements, like stocks and flows of money, products, and tangible assets. Managers who adopt this focus will naturally tend to perceive gaps primarily (or perhaps exclusively) in an organization's lower system elements, and their gap-closing actions are likely to be directed to effecting changes in those system elements. To overcome this cognitive bias and the resulting tendency to pay excessive attention to managing lower-order system elements, managers must make explicit efforts to establish higher-order control loops to gather and attempt to interpret ambiguous data about technological and market trends and other aspects of the organization's environment that may give clues as to the adequacy of the organization's higher system elements.

Managerial efforts to confront and wrestle with causal ambiguity are

especially critical in managing the organization's system elements that are most directly affected by the *cognitions of managers* themselves: its strategic logic, management processes, and intangible assets. In particular, to perform their function within the organization-as-a-system, strategic managers face the unique challenge of continuously learning how better to manage their own cognitive processes by challenging their own preconceptions and assumptions.

Coordinating organizational adaptation through intraorganizational and interorganizational flows of resources

Important differences in the patterns of actions organizations undertake to close strategic gaps are likely to arise from differences in the ways managers in different organizations perceive strategic gaps. Relying on bottom-up versus top-down approaches to managing strategic adaptation, for example, will lead to significantly different patterns of gap-closing actions. Managers focused on closing perceived gaps in products, operations, and tangible assets, as suggested in figure 2a, are likely to concentrate on gap-closing actions that do not lead the organization very far from the organization's existing competences and inter-firm relationships. Use of lower-order control loops as drivers of organizational adaptation may deepen an organization's current capabilities through accumulations of incremental learning, achieving success in stable environments by progressively reducing costs and improving efficiency. Excessive reliance on lower-order control loops, however, may result in an organization's current "core capabilities" becoming "core rigidities" (Leonard-Barton, 1992), because organizations managed through lower-order control loops are likely to be unable to identify opportunities to become product innovators, to adopt new technologies, or to experiment with new organizational forms.

Managers who actively gather and interpret data through higher-order control loops may be better able to identify strategic gaps and to pursue gap-closing actions for intangible assets, management processes, and strategic logics, leading to qualitative changes in these higher system elements. In this case, an organization's actions to acquire new resources for higher system elements are likely to require extensive interorganizational flows to acquire or access new kinds of resources as the organization tries to identify and develop new ways of competing.

Thus, *strategic learning* leading to changes in an organization's higher system elements is likely to be a process in which other organizations play important roles in the "perception-forming, direction-setting, decision-making, process-coordinating, and change-inducing activities of decision makers that result in an organization's distinctive patterns of competence building and leveraging over time" (Sanchez and Heene, 1996).

Managing the flexibility of the organization as an open system

Managers of organizations facing uncertain futures must struggle with a conundrum of strategic management in a dynamic and uncertain environment: Imperfectly predictable changes in the organization's environment may invite rapid changes in higher system elements, but those elements are characterized by long dynamic response times and high levels of causal ambiguity. Given those system properties, how can managers rationally formulate strategic plans when the data needed to develop such a plan are highly ambiguous and when assets that may be urgently needed in the future are likely to take substantial time to identify, acquire, and deploy?

The Sanchez and Heene open-systems model proposes that strategic management of future uncertainties becomes a more feasible undertaking when managers understand how to help their organizations-as-systems develop *strategic flexibilities* that can mediate (at least to some extent) the causal ambiguities and long dynamic response times characteristic of higher system elements. The concept of strategic flexibility is discussed more fully elsewhere (Sanchez, 1993, 1995, 1997), but to complete our discussion of the Sanchez and Heene model, we summarize here the flexibility properties of the organization-as-a-system that improve the ability of the organization to respond to significant changes in technologies, markets, and other environmental factors. We also note that the strategic flexibility of the organization-as-a-system depends jointly on the *flexibilities of the resources* that make up each system element of the organization and on the *coordination flexibilities* of managers in using the organization's available resources.

Resource flexibility

The flexibility of a resource can be defined along three dimensions, increasing as the range of uses to which a resource can be applied

increases, as the time required to switch a resource from one use to another decreases, and as the cost of switching from one use to another decreases. In other words, flexible resources have more than one use and can be switched from one use to another quickly and inexpensively, while inflexible resources are specific-use resources that either cannot be switched to other uses or can only be switched with significant cost, difficulty, and/or time.

Creating stocks of flexible resources in the organization's system elements may provide at least a partial solution to the puzzle of how to manage strategically in a dynamic and uncertain environment. The ability to identify and choose flexible resources helps overcome the cognitive problem resulting from ambiguity about which assets and capabilities will be strategically useful in the future. While it may be impossible for managers to determine which specific-use assets will be most useful in an uncertain future, choosing flexible assets that can be applied to alternative uses may give the organization a better chance of responding effectively to a larger range of future changes. Moreover, once flexible assets have been acquired, their flexibility to be switched quickly between alternative uses may help overcome the problem of the long dynamic response times usually encountered in changing higher system elements. From a systems perspective, therefore, resource flexibility is a critically important property of the resources comprising a system element, because flexible resources may help counteract the system effects of long dynamic response times and high levels of causal ambiguities in higher system elements.

Coordination flexibility

Because an organization's system elements are interdependent, the flexibility that can be realized from the resources making up a given system element will depend on the flexibilities realized from other system elements. The joint interdependencies of an organization's system elements mean that the inflexibilities of the least flexible system element will act as a bottleneck that limits the overall flexibility of the organization as a system to respond to change (Sanchez, 1995). Thus, the flexibility in the organization as a system depends not only on the minimum levels of flexibility in the tangible resources in the organization as a system, but also on the flexibilities of an organization's managers in deploying and coordinating those and other resources in

alternative uses. The concept of *coordination flexibility* therefore represents the abilities of managers to coordinate new strategic uses for resources by redirecting, reconfiguring, and redeploying the resources available to the organization.

Recent applications of the open-systems model

A number of researchers and practitioners have applied and evaluated the Sanchez and Heene open-system model of organizations. We note below some recent examples.

Wallin (1997) examines relationships between the organization-as-a-system and its customers, which he characterizes in terms of interacting “value-creation systems.”

Christensen and Foss (1997) investigate the concepts of asset interconnectedness and dynamic complementarities between activities within a organization to develop a concept of corporate coherence in competence-building processes.

Løwendahl and Haanes (1997) adopt an open-system view of the organization to analyze “units of activity” that span organization boundaries in competence-building processes.

Black and Boal (1997) investigate the relationships between resources within organizations that improve the flexibilities of an organization’s coordination capabilities.

Cremer and Meschi (1997) investigate the competence-building program of Merlin Gerin, a large (15,000 employee) French organization in the Groupe Schneider companies, which has developed an effective approach to managing organizational competence building and leveraging processes so as to “improve and harmonize the collective competences embedded in the diverse functions” of the organization as a system. Providing an unusually detailed look into one organization’s competence building process, they describe several phases in creating effective mechanisms for coordinating a wide range of diverse activities involved in corporate competence building.

Chiesa and Manzini (1997) extend the Sanchez and Heene model’s hierarchical ordering of system elements by proposing that competences created within this hierarchy exist at three levels. The most basic level of competence is an organization’s ability to use its capabilities to provide marketable outputs, which they characterize as the operations level of the organization. The second level of competence

involves the deployment of specific sets of knowledge and skills in ways that enable the organization to create value for its customers in distinctive ways. The highest level of competence represents an organization's ability to imagine the evolution of the characteristics, boundaries, and actors of its competitive context, and to develop management principles that are appropriate to its evolving context.

Conclusion: A systems view of organizational "stretch and leverage"

Managers, through their collective impact on the strategic logic and management processes of an organization, guide the behavior of the organization as an open system. In organizations facing significant future uncertainties, a critical dimension of the work of strategic managers (Sanchez, 1993) is *perceiving possibilities* for new strategic logics, new management processes, and new kinds of tangible and intangible resources. Thus, the essential task of strategic managers will be a process of *continuous learning* at a conceptual level that makes possible identification of possible qualitative changes in an organization's system elements.

Bottom-up adaptation through lower-order control loops may be useful and perhaps even essential for making incremental qualitative adjustments to lower system elements in a organization. Top-down management of adaptation through higher-order control loops, however, may be the most effective means of achieving significant qualitative changes in an organization's system elements.

The task of inducing adaptive change through higher-order control loops will necessarily be an exercise in "strategy as stretch" (Prahalad and Hamel, 1993). Leading an organization to stretch beyond its current capabilities first requires the *stretch of managerial imagination* to envision strategic logics, management processes, and resources that are not like those currently making up the system elements of the organization. The systems view of organizations also suggests that success in achieving "strategy as leverage" (Prahalad and Hamel, 1993) may depend on managers' abilities to identify and acquire the use of flexible resources and flexible coordination abilities that enable a organization to respond broadly and quickly to future opportunities. Thus, the systems view of organizations provides a framework for improving organizational capacities for stretch and leverage in responding to an uncertain future.

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