

**Research in Organizational Design:
The Capacity for Innovation in Large,
Complex Organizations Title**

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There is no more delicate matter to take in hand, nor more dangerous to conduct, nor more doubtful in its success, than to be a leader in the introduction of changes. For he who innovates will have for enemies all those who are well off under the old order of things, and only lukewarm supporters in those who might be better off under the new.

Machiavelli²

How can large, complex organizations be more effectively innovative? Machiavelli's caution for innovative leaders in the Renaissance rings true for managers in our global, information age. Are there insights and concepts for introducing change that can help to illuminate the process of innovation, and address the concerns of modern Machiavellis in designing and developing innovative organizations? With a view to developing a capacity for innovation, this paper reviews recent literature on organizational theory and design as described in the fields of organization theory and business management. The content includes recent approaches and case studies from industry that emphasize innovation in large, complex organizations.

Attention here is focused on systemic concepts for organizing to innovate, rather than developing a list of best practices. Thinking about innovation from a whole system perspective is consistent with the definitions of innovation in the business literature discussed by writers on organization theory such as Charles Prather and Lisa Gundry. Prather and Gundry define innovation as the implementation of viable business ideas that result from an organization's creativity-supporting culture and structures (Prather and Gundry, 1995, p. 12). Organization theorist and engineer Watts Humphrey also views innovation from a whole-system perspective. He distinguishes between creativity and innovation (Humphrey, 1997, p. 137). For Humphrey, creativity is thinking up new things -- innovation is doing new things or turning a new idea into a business success. In Humphrey's conception, the role of innovation is to economically couple creative technology to the needs of the marketplace. Thus, innovation is viewed as a process that occurs in each phase of production -- from research and development, through projects and program development, through manufacturing, to marketing. Prather and Gundry also present innovation as a journey, or process, that proceeds in stages from market and customer-based needs assessments, to idea generation, project development, and production, or new product launch (Prather and Gundry, 1995, p. 86).

This paper's conclusions will include propositions for further research on the design and implementation of organization changes that would encourage innovation in a large complex organization. The conclusion also recommends additional research concerning the conceptual and practical difficulties of assessing innovation.

Fundamentally, this paper features a general systems approach. Gareth Morgan's general profile of organizational characteristics provides a method for identifying the key features of an organization's subsystems (Morgan, 1997, p. 58). The analysis provides insights into the "what and how" of making organizations more innovative. Morgan's subsystems are outlined briefly below, beginning with strategy.

Strategy.

In a complex organization there should be a systematic analysis of new threats and opportunities. In an innovative organization it is assumed that the organization's strategy will include a "proactive stance" and a constant search for new opportunities, while evaluating existing activities. In this paper, strategy will be understood as the calculated relationship of ends, ways, and means by which an organization pursues its vision, mission, purpose and objectives in seeking advantages, and defending against threats, in an environment that is both competitive and cooperative. Morgan's second subsystem is technology.

Technology.

Morgan notes that technology has both mechanical and non-mechanical components. Technology will be understood primarily as an organization's work processes; including both standard/routine/incremental and new/creative/discontinuous methods for transforming inputs into outputs. In terms of innovation it is assumed that there will be future technological (socio-technical) choices and that the organization must develop the capability to be flexible and replace, or adapt, its existing work processes. The third subsystem involves the people and culture, or the social aspects of organizations.

Human/Cultural.

This dimension refers to the kind of people, culture and ethos that exists within the organization. Morgan proposes that individuals in innovative organizations search for challenge and involvement. In an innovative organization it is assumed that the human and cultural subsystem is also complex. This subsystem includes formal and informal, individual and group, core values and beliefs that shape patterns in the corporate culture and subcultures. As the case studies will illustrate, the human/cultural subsystem is typically described as the most difficult to assess and change within a complex organization. Morgan's fourth subsystem addresses organizational structures.

Structural.

Traditional organizations are mechanistic, vertically integrated and bureaucratic. Morgan describes an organization seeking to become more innovative as organic, or matrix, in form. Given the complexity inherent in large organizations -- and given their wide range of organizational roles and missions -- both mechanistic/bureaucratic and organic forms are expected to coexist over time. Management of these complex structures is the fifth subsystem.

Managerial.

Management in innovative organizations encourages initiative and enterprise. In a complex organization the enterprise is expected to be one of great scope, risk, and complication (Webster's II, 1984, p. 435). Large, complex organizations mix authoritarian and democratic management styles, safety and continuity are stressed alongside creativity, innovation and risk taking. The final, sixth subsystem is the operating environment.

The Environment.

Large, complex organizations include different sub-organizations facing mixtures of stable, moderately changing, and turbulent environments. Environmental turbulence will be the source of continual changes in the information age, or what Friedman calls the age of globalization

In a turbulent environment, the organization faces new opportunities and challenges to improve existing operations in "mixed" forms.³

While Morgan characterizes certain organizations as totally innovative and revolutionary and having innovation as their lifeblood, the problem for large, complex organizations is how to innovate more effectively in a mixed, hybrid form. In other words, the organization must concurrently carry on evolutionary change in performing its core missions, while preparing for an uncertain future and the possibility of revolutionary changes. In addition, there is an overarching question regarding the capability of a large, complex, organization for whole-system transformation. Is it feasible to transform from an organization capable of moderate changes to a completely innovative organization?

A foundation concept for the study of change is Deborah Dougherty's notion of examining the "capacity" for innovation in large, complex organizations. Dougherty's literature review in the Handbook of Organization Studies (1996) outlines her ideas, highlighting four aspects of an organization's capacity for innovation. First, is the capacity to generate and maintain an identity based on the value provided to customers. Second, is to view work as a process, focusing on the relationships among the parts and change. Third, is what is called situated judgment, or the organization's capacity to engage in the details of work and to appreciate the requirements for approaching unstructured problems. Fourth, is collective accountability, or the organization's capacity for the acceptance and sharing of responsibility for legitimate innovation, as well as the inclusion of innovation within the large organization.

Morgan's typology of organizational characteristics, or subsystems, and Dougherty's suggested capacities are formed into a matrix in Table 1 below. Based on Morgan and Dougherty's analytical framework, this suggests a series of propositions regarding developing capacities for becoming more effectively innovative.

Table 1: Framework for Analyzing the Capacity(s) for Innovative Organization Design

Capacity(s) ® Subsystem(s) ↓	1. Value-Based Identity	2. Work Processes	3. Situated Judgment	4. Collective Accountability
A. Strategic				
B. Technological				
C. Human/Cultural				
D. Structural				
E. Managerial				
F. Environmental				

The usefulness of combining Morgan and Dougherty's frameworks can be demonstrated by briefly examining the major themes developed as a result of a recent innovation case study. Roth and Kleiner focus on process innovation in the context of a large organization in their book, *Car Launch* (2000). Using a learning history method, they chronicle the development of a new car line by a team (called the Epsilon Team) using learning organization theory, as developed by Senge of the Massachusetts Institute of Technology (MIT)

Several themes emerged from the study of Epsilon Team that illustrate the relationship between and the interconnections among the various "cells" as described in the matrix above (Roth and Kleiner, 2000, pp. 3-4). For instance, in examining the strategic subsystem and the capacity for a value-based identity, the case illustrates problems when the subsystem values the principles of "learning organization" while the larger organization (AutoCo.) fails to include learning organization values in its strategy.⁴

In the technology subsystem, especially with respect to the capacity for collective accountability, Roth and Kleiner write about Epsilon team's use of learning laboratories; such as computer simulations, as well as developing ways for encouraging risk-free conversations. Another process innovation was the team's approach to engineering and human relations, which enhanced the relationships among the engineers and designers – and linking the technological and human/cultural subsystems. One innovation included the use of a "harmony buck," a common design prototype of the new automobile. The prototype model was used for design experimentation and engineering team interactions. The use of the physical prototype -- and the resulting interactions among the team -- improved the information flow across the previous, traditional boundaries that separated engineers from other sub-organizations within the company.

Within the structural subsystem, the team's sense of collective accountability was furthered by additional boundary spanning activities, such as forming partnerships and devoting resources to collaborative learning. Finally, the structure and work processes of Epsilon Team were initiated and nurtured to promote innovation. Within the constraints of the traditional, hierarchical, automobile industry, the project managers stressed non-authoritarian leadership techniques - which led to problems in the managerial subsystem that will be addressed later. Let's now examine each of the Morgan subsystems in more detail. Looking at other significant books and case studies will serve to broaden and deepen our analysis of innovation in large, complex organizations.

A The Strategy Subsystem

Prather and Gundry write that designing organizations for what they call "Bottom-Line" innovation must begin with strategy (Prather/Gundry, 1995, p. 81). For them, strategy is the organization's statement of its purpose and mission. The Prather and Gundry organizational strategy would include emphasis on three areas. They form a "Three Arenas Model" for innovation. The arenas include: (1) education for generating ideas; (2) application for problem solving; and (3) culture for setting an innovative climate. Each of these are interrelated, but are treated as part of other capacities, as discussed later in this paper. Prather and Gundry stress that the organization must have a strategy that includes activities in all 3 arenas; including education and learning, creative problem solving, and cultural and climate changes.

Prather and Gundry cite values as the basis for determining needs, which they place as the first step in what they call the innovation journey. Needs are further defined as the market's demands for products, processes and services. There are three parts to a needs assessment. First is identifying the value added. Second is verifying the value added by developing a shared understanding with customers. Third is to continually validate the relative strategic value of the innovation.

Roth and Kleiner address strategy in terms of goal-directed behavior. The Epsilon Team project manager developed clear goals for the team. First was to build a good car. Second was to run an orderly program. Third was to use a team approach to manage people better than previously experienced in the larger organization (called AutoCo.). The project manager stressed these throughout the project and it seems they were well understood within Epsilon Team. Continuity and stability at the strategic level were stressed and the project manager noted that throughout the project, "I never changed those goals." (Roth and Kleiner, 2000, p. 93) From the case study history these goals set a foundation for the team's ability to develop open work processes and pursue creative thinking. The Team's strategy included developing team-based, situated judgment and a shared sense of collective accountability for the Epsilon's performance.

Car Launch also addresses strategy in terms of the team's approach to the larger organization. The project manager decided to use a "strategy of isolation" with regard to the upper management echelons. He and the team assumed that their techniques would produce hard, quantitative results that would legitimize their learning organization approach and expand their influence throughout AutoCo. As it turns out this strategy was flawed. The innovative work processes challenged the "rules of the game" as they had developed over time and experience. In retrospect it was discovered that the Team would have benefited from early assistance from upper management levels to overcome roadblocks and help anticipate barriers. Problems with organizational culture turned out to be extremely critical to the Epsilon Team's strategy and will be addressed later in the paper.

For the strategic dimension, Tushman and O'Reilly in *Winning Through Innovation* also stress the importance of a value-based identity. For these authors, the corporation's "vision, strategy and objectives are the bedrock for managing innovation and change." (Tushman and O'Reilly, 1997, p. 219) Vision is essential for capturing the energies of people and should answer the question of "Why are we doing this?" The authors strongly prescribe that these values for innovation must be linked to concrete business unit strategies and objectives.

B The Technological Subsystem

The technological subsystem involves first and foremost designing and developing effective work processes within organizations. Prather and Gundry stress the importance of work processes, especially assembling powerful and creative teams. Their guidelines for innovative work processes include moving employees to improve boundary spanning; designing project-oriented tasks; and organizing teams in horizontal, dynamic and work-driven forms.

In *Car Launch*, the Epsilon Team practices these kinds of innovative work processes. Their strategy of isolation worked against their ability to maintain open communication throughout

AutoCo. This key decision hurt their ability to enlist the support of higher management when certain work processes faced roadblocks or failed to avoid dead ends.

Technology plays a fundamental role in Tushman and O'Reilly's book. They differentiate between mature and new technology, and incremental and discontinuous change. They propose that organizations must be "ambidextrous" to manage both mature and new technologies simultaneously. They define ambidextrous organizations as those with "internally inconsistent competencies, structures, and cultures, yet with a single vision" providing "the range of capabilities for excelling both today and tomorrow." (Tushman and O'Reilly, 1997, p. 35) For mature products they suggest incremental product and process improvements. Mature technologies should be defended and given the capacity to grow incrementally. Funds generated from the mature technologies should finance breakthrough innovations - to take advantage of discontinuous product and process improvements.

Tushman and O'Reilly emphasize what they term "technology cycles" as drivers of innovative streams (Tushman and O'Reilly, 1997, p. 26) Cycles are defined as periodic variations in the development of technology when an industry selects a dominant, new design. The new technology then goes through a period of incremental change until technological change is punctuated with a breakthrough. Successful innovation is possible by influencing these cycles to shape dominant designs and trigger the new technological cycle. Innovative organizations are proactive in initiating breakthrough product or process innovation.

Watts Humphrey stresses the importance of an organization's ability to foster situated judgement within the technology subsystem. He notes that a few, key technical decisions can result in major innovations. At the same time, he cautions the reader about the high risk of failure when an organization's strategy includes innovation as a goal and an integral part of the work process. For support, he cites studies reporting that 40-80% of new product innovations result in failure. (Humphrey, 1997, p. 139) He notes that the innovation process includes both the high risk of technological failure as well as the general uncertainty of the marketplace. Humphrey sees the #1 problem as caused by a failure to understand the users needs. Therefore, for effective organizational design, he stresses that the success of innovation improves when market and technological developments are coupled tightly.

Humphrey notes another aspect of situated judgment within the technology subsystem in his discussion of the decisions regarding reverse engineering. One of the key decisions organizations face is whether to be the first or second entrant in developing new products or services. He notes that some attention has been placed on the benefits of reverse engineering, or waiting for a leading innovator to develop a new technology before deciding to develop it. He calls this second entry. Today, especially in the field of high technology, such as computer software engineering, the danger is that given the fact pace of change there is no time to catch up. Therefore, Humphrey recommends that innovative organizations must continually build their knowledge and maintain mastery by controlling key technological developments, while linking team innovations with market needs. Organizations require situated judgement to devote time and effort to build their knowledge base and maintain a lead in core areas of technology.

C. The Human/Cultural Subsystem

Prather and Gundry include culture as one of the major areas in their Three Arena's Model. They define culture in terms of setting an environmental climate, expressed as "what it is like for workers." (Prather and Gundry, 1995, p. 13) They draw on work by Isaksen⁵ who suggests nine dimensions for an innovative organizational climate. These dimensions include: challenging and involving work; freedom; idea time; idea support; conflict resolution; debates; play and humor; trust and openness; and risk taking.

Roth and Kleiner note that the value-based identity in the case of Epsilon Team's subculture as a unique, special, learning organization caused problems within AutoCo. The strategy of isolation raised a "curtain of silence" that was perceived as either threatening or misguided by the traditional upper echelon managers, including those who directly and indirectly affected the innovation process. Noted organization theorist Chris Argyris had advised the team to include senior AutoCo. managers in the innovation process. In retrospect, this seems particularly important given the existing, traditional, hierarchical, automobile industry culture within the larger organization.

The AutoCo. culture had evolved into what Roth and Kleiner dramatically term a "climate of fear." (Roth & Kleiner, 2000, p. 93) Product driven goals had produced a strong desire for hard data. Hard data and results mattered most. Spending the time and effort required for developing a learning organization for soft results was not perceived, or rewarded, as real work. Engineering occurred in a high-stress environment where it was considered risky to be open about problems that the individual could not present a solution for overcoming. Conflicts between the old and new values in the cultural subsystem resulted in a new role for the Epsilon production manager. This role, as a team buffer, will be discussed later under the managerial subsystem.

Tushman and O'Reilly's congruence model also includes organizational culture as a major subsystem. Like other authors, they note that organizational culture is the most difficult subsystem to diagnose and change. As discussed above under the strategy subsystem, they propose that a single, clear vision and a limited set of core values are critical while, at the same time, organizations must be capable of hosting diverse, internal, subcultures. Tushman and O'Reilly also note the importance of developing a sense of collective accountability in the cultural subsystem. They write that for an organization committed to major product and process innovation, it must have a culture that supports change and is shared throughout the organization.

Tushman and O'Reilly note that problems occur within organizations because of the inertia that occurs in mature organizations due to age and previous success. They suggest that success leads to ingrained learning in the organization's norms, values, social networks, myths and heroes. When discontinuous change occurs, then culture can become a barrier to change. They cite Gerstner's experience, as CEO of IBM: "Fixing the culture is the most critical - and the most difficult - part of the corporate transformation." (Tushman & O'Reilly, 1997, p. 29)

Prather and Gundry do not attempt to explain theoretically how a climate of innovation produces a capacity for developing situated judgment and collective accountability. They assume that positive outcomes will result from an environment that promotes and supports innovation and

that creativity in all activities will lead to the generation of new ideas -- which will in turn contribute to innovation.

Prather and Gundry cite five factors that contribute to developing creativity within an organization. Creativity factors include individual and group attributes, conceptual skills, behaviors and processes. Attributes include individual characteristics, such as independence, risk taking and intuitiveness. Conceptual skills include organizing and interpreting information in "pattern breaking" ways. Behaviors include those actions that lead to inventions, innovation, and unexpected outcomes. Processes combine both individuals and groups. Creative individuals are essential for their talents, skills, and activity. In sum, creative organizations must have innovative supporting cultures.

D. The Structural Subsystem

Organizational structure is the way an organization groups people, jobs and responsibilities. Prather and Gundry stress that five factors account for the uniqueness of all organizational structures - there being no one best way to organize for innovation. The five structural factors include first, the external environment, including the nature of the industry and competition. The second factor is the market(s), which vary according to what they call the volatility and the frequency of cycle changes. Third is the organization's mixture of products, services and processes, which will also be dynamic. Technology and technological change is an important fourth factor. Fifth, they note that the manager's preferences will also account for the uniqueness of organizational structures.

As a model for structures that provide a foundation for innovative organizations, Prather and Gundry present the circular or pizza form as used by the Eastman Chemical Company. Picture a drawing of a circular organization, with communication centers scattered throughout, organized along functional and regional lines. The circular design is proposed as a structure that enables innovation in two particular ways. First, it encourages interunit communications. Second, it allows for the interaction of small, multifunctional teams. Circular structures also imply improved access to and the involvement of managers and top teams within and between business areas.

Humphrey also notes the importance of an organizational structure that allows for more open communication. He reports that the #1 complaint in organizations is the lack of communication. Humphrey provides an illustration of both the importance of open communication and the use of creative techniques to promote openness. He provides an example of a design team set up in a contracted facility - formerly a dance hall. Desks were arranged along the outside wall. A chalkboard with some tables and chairs were set up to provide a common area in the middle of the dance floor. As problems were identified they were written on the board. Impromptu meetings were called for individuals who had something to contribute. Rather than being disruptive of the individual work, this open and voluntary communication structure served to improve group relations and led to effective problem solving.

The Epsilon Team's "harmony buck" prototype also served as a way to improve team communications. By having a physical prototype to work with, engineers and others involved in the car launch, including outside subcontractors, had a

laboratory for experimentation. This joining of engineering and human relations improved the Epsilon Team's capability to discuss and develop group solutions to common problems. Early successes also produced incentives for those using the prototype to partner with other team members in improving the new car design.

Tushman and O'Reilly also stress a team approach in innovative structural designs. They strongly recommend structures that include autonomous, cross-functional, co-located teams under the direction of "strong" project leaders. They propose that a team's work process be conducted independently of the larger organization to encourage the exploration of several solutions and increase the chances for technological breakthroughs. The structure would thus be capable of combining shifts in innovation streams and proactively pursuing discontinuous organizational change. They note that the key barrier to change is not the development of new ideas -- the key is escaping old ideas.

Tushman and O'Reilly again note the importance of developing an ambidextrous organization with dual capabilities. Structures and work processes must provide a foundation for giving the organization the capability of getting today's work done effectively while anticipating tomorrow's discontinuities. They write, "Innovation is a team sport." (Tushman and O'Reilly, 1997, p.222) The role of senior management then is that of a "signal generator" to promote, protect, and provide structure and processes for innovation, while maintaining the effectiveness of existing, mature, technologies.

E. The Managerial Subsystem

In their discussion of barriers to innovation, Prather and Gundry note the obstacles caused by a lack of top management's commitment to developing innovative values within an organization's overall strategy, composed of its purpose, mission, and vision statements. Leadership, or top management, is expected to play a major role in an innovative organization. In addition to developing a management approach to enable innovation, leaders are charged with identifying and overcoming the other major barriers to innovation. Like Tushman and O'Reilly, Prather and Gundry also stress the importance of the manager's role in establishing company norms and expectations that foster creativity and innovation.

As mentioned earlier in this paper, the values of the learning organization adopted by the Epsilon Team created a new role for their project manager. Without a mentor to act as an advocate from above, the Epsilon manager had to act as a buffer. According to Roth and Kleiner, the team's perception was that the AutoCo. Vice President was not really interested in the learning organization experiment. The failure to communicate the innovation in a nonthreatening manner resulted in problems in the capacity of the managerial subsystem to engage directly in the innovation process. Epsilon Team was labeled as a cult, victims of groupthink, and Senge disciples. A lesson learned from *Car Launch* is that the entire managerial subsystem, from top to bottom, must be, involved in the change process.

Alongside the other author's reviewed, Humphrey also places major emphasis on the managerial subsystem and the manager's critical role in the organization. He proposes that managers in fact have the key role in determining a team's attitude. The manager's role includes assigning work, evaluating performance, and setting the pace of work. Humphrey also puts forward the idea that creativity improves when organizations allow for a loose and informal management style. At the

same time, he stresses that the key for managing innovative teams is to mix management styles effectively. The manager must know how and when to choose the management and team styles to fit the required tasks and environment. He provides a typology of team styles to characterize different approaches to group work.

The typology identifies four team management styles. The types are a product of two measures, the degree of direction and the degree of interaction. A closed style is both more directive and less interactive. This style is also called *top-down management*. Humphrey suggests using this approach for situations he characterizes as involving a "last-minute crunch." Open management styles are more interactive and less directive. The *open style* may be appropriate in many situations where a team is fully trained and integrated. Team members can easily switch positions and the team can continue to function. A *random style* is for situations that are less directive and more interactive. This situation is typical for brainstorming where independence and creativity are encouraged. Finally, there is a *synchronous style* involving individual and independent work. For synchronous, or independent work, the manager should be more directive and the team will be less interactive. The situation is one where the manager insures procedures are in place for sequentially planned work processes.

Humphrey illustrates this approach to team management in a case involving forming a study team to develop recommendations to solve a particular, technical problem. For the initial fact-finding phase, the manager used a synchronous style by scheduling individual briefings to provide information. Strong direction and minimal interaction were chosen in the initial phase. The second phase was free form: a random style was used to improve creativity and brainstorming. There were no agendas or planned activities, the team was left to its own devices to define the nature of the problem and explore possible solutions. For the final phase the manager reverted to a traditional or closed style. This top-down approach was effective for ensuring final presentations and reports were prepared on time.

In addition to focusing on management alone, Prather and Gundry stress the relationship of management and structure. Structure has a purpose and that is to direct and coordinate the organization's actions. The managerial actions include determining work cycles, communication patterns, and decision-making processes. Their management design guidelines include maintaining flexible structures that are project oriented and counter the rigidity of vertical, stovepipe configurations. A key management role is to design structures that foster horizontal work processes that are dynamic and work driven.

Tushman and O'Reilly prescribe three complex roles for managers in ambidextrous organizations. Managers must be architects, "building fit, consistency and congruence of structures, human resources, and cultures to execute critical tasks in service of strategy, objectives, and vision." They must also be network builders, "managing strategic change by shaping networks and coalitions down, across, up, and outside the manger's unit." Third, managers must be jugglers, "hosting contradictory strategies, structures, competencies, and cultures in service of incremental, architectural, and discontinuous innovation, as well as integrating these contradictions with a clear vision."

Managers, in Tushman and O'Reilly's view, need a keen sense of situated judgment. They must manage for today and tomorrow and align the four subsystems (people, structure, culture, and process) that are the key for long term success. "Excellent managers encourage both incremental and discontinuous innovation and focus on both the short term and the long term." In a fast-paced, turbulent environment, Tushman and O'Reilly note that managers must build the capacity to accomplish their strategic objectives faster than their competitors. To accomplish this, the crucial job for the manager is to clarify the most important organizational problems. These problems are defined as real or perceived gaps between strategic requirements and organizational performance. The authors view management as the critical determinant in successful innovation - as masters of the "fundamental dynamics of integrated change management." This includes "shaping the politics of change, dealing with individual anxiety and resistance, and maintaining control during transition periods." (Tushman and O'Reilly, 1997, p. 222)

The manager's judgment or skill in managing innovation requires a keen sense of understanding the patterns of organizational change. They must figure out ways of observing and assessing cycles that include long periods of incremental change punctuated by discontinuous change. Managers must also maintain control during periods of discontinuity, such as performance crises and technology, competition, and regulatory shifts. A "success syndrome" during periods of environmental stability can lead to a failure to change when environmental shifts occur. Therefore, the importance of congruence, or fitting strategy, structure, people, and culture over time and during periods of stability and change.

Leadership's role in conflict management is also important, especially when changing organizations in turbulent environments. Humphrey stresses leadership's role in developing situated judgment for managing organizational conflict. Humphrey provides guidelines for managing conflict in innovative teams that is drawn from work by Harvard's Fisher and Ury. This "getting to yes" approach involves using several techniques. First is avoiding early polarization due to the fact that win/lose situations are hardest to resolve. Next is to focus on issues, not personalities, motives or blame. To avoid these pitfalls the recommended conflict management technique encourages focusing on verifying data and turning energies towards obtaining additional information. Parties must be equally involved. Each meeting should end with some form of agreement, if only to agree to meet again. Humphrey's advice is that highly creative individuals and teams will often experience conflict. To manage effectively leaders must anticipate that conflict will occur and they should equip themselves with tools for conflict management.

One approach to developing collective accountability is provided by Humphrey. He provides the history of the development of Capability Maturity Models (hereafter CMM) at Carnegie Mellon University. The notion of organizational maturity was developed to help complex organizations establish orderly and effective ways to manage work. CMM are presented as a way to stress the importance of organizational process improvement. CMM uses an engineering approach of breaking a project into tasks, assigning responsibility, establishing completion goals, and tracking tasks to completion. According to Humphrey, CMM provides a framework for the organization to chart its process improvement path.

The CMM includes 5 levels for addressing an organization's level of activities, processes and goals. Level 1 organizations are characterized as operating in unstable environments, are routinely over-committed, and typically rely on heroic efforts to compete projects. Level 2 organizations meet schedules, however, they usually cannot control their costs. For a Level 3 organization, work processes are stable and repeatable; and costs, schedules and quality standards are rated as satisfactory. At Level 4 the organization operates according to predictable patterns, with results that are measurable quantitatively. A Level 4 organization performs to high quality standards. World-class, or Level 5, organizations are true innovative leaders and maintain the highest productivity and quality standards through advanced process and technology change management and defect prevention.

The CMM framework is intended to serve as a mechanism to evaluate and improve collective accountability. It does this by providing a common framework and language to improve an organization's communication and visioning. CMM also serves as a tool for organizational measurement and evaluation. This method, according to Humphrey, assists in setting measurable improvement goals and guidelines, while maintaining flexibility in determining goals.

Collective accountability was also an important issue in Car Launch. This was discussed in terms of the problems encountered when high numbers of change requests were reported during product design and development. The communication of change requests had a special meaning within the AutoCo. culture. High numbers of engineering change requests were normally perceived as a problem. Traditionally, engineers were driven underground in waiting to report needed changes only after they had developed a solution. The traditional approach worked to slow down the design process and contributed to the last minute crunch in the months prior to a new car launch.

Under the new Epsilon Team approach, using the learning organization philosophy, the project manager encouraged raising problems early for the team to work on jointly. Under this open communication system the Epsilon project manager viewed the early identification of change requests as an opportunity for creative, group problem solving. For managers accustomed to traditional procedures the Epsilon project seemed "out of control." The new, open system of reporting key metrics encouraged innovation, by providing learning opportunities for early fixes made possible through team solutions.

At times AutoCo.'s senior management constructed barriers to innovation and discouraged collective accountability. This was especially true in the powerful symbolism of the forced early retirement of the first Epsilon project manager. While the Vice President portrayed this as an inadvertent consequence of company reorganization, the project manager understandably took the news as a "slap in the face." Surely the team's perception of the value higher management placed on innovation was called into question in light of the treatment of the key manager involved in the innovation process.

F. The Environment

The environment for an organization, as described by Prather and Gundry, centers directly on its relationship with the "market." A market-orientation is the foundation for their four stages of the innovation journey or process. They view the market as the heart of their concept for the innovation journey. Value identification, verification and validation are the first stage and require

a close and continuous market orientation. Stage two is the idea phase, where creativity is most important. Stage 3 is project management, where the innovation process must scale up to prepare for new products. As is true for all stages, this requires maintaining direct links to the market. Prather and Gundry strongly recommend continuing market sampling throughout the innovation journey. They also suggest forming an innovation committee to monitor project development especially in connecting the project development phase to *the fourth, or launch, stage*. Similarly they note the importance of linking the launch stage with the market and with a cycle of continuous innovation.

Humphrey also notes the importance of environmental factors in guiding innovation. While Prather and Gundry emphasize the market, Humphrey underscores the importance of customers or users of technology. In cases where users are technically competent, studies find that users will be the originators of innovation. Conversely, when users are not technically competent, then manufacturers are more likely to originate innovation. Significantly, one study points out that 75% of innovation developed from a recognized need that stemmed from users or customers. Thus, in the studies cited by Humphrey's, in the majority of cases the market demand generated a need for new product innovations.

Humphrey uses these studies as illustrations to support his contention that the key for successful innovation is the pilot test. Pilot tests are an important part of organizational learning. Humphrey encourages starting with a small system, based on an integrating concept. Through pilot tests innovators learn from experience and test their technology, product or service on the market. From the testing process technical enhancements are encouraged thereby accelerating the acceptance of the innovation both within the organization as well as within the market or customer base.

Tushman and O'Reilly also stress the importance of maintaining the close relationship between the organization and its environment. They focus primarily on the role of management in developing the corporation's collective accountability for connecting the organization and the market. Managers are expected to link diverse competencies across multiple boundaries. This includes the work of executive teams in managing "organizational processes down within their units, across with their peers, up with more senior managers, and outside the firm with important suppliers, vendors, alliance partners, and customers." Operating externally, without formal power or control, requires managers who have the skills of "politicians, negotiators, and network builders."

Conclusion:

Assessments and Propositions

"This is the discipline of innovation," he lectured a convocation of his followers. "It means having a clear mission. It means defining what you mean by results. It means the ability and willingness to abandon where you don't get results. And then when you find the real opportunity, the unique opportunity where you can make the greatest difference, zone in on it" and "reassess and reassess and reassess."

Peter Drucker⁶

Tushman and O'Reilly agree with Ducker's stress on the importance of achieving results. They write, "Innovation is about execution, about getting it done." (Tushman and O'Reilly, p. 219) Most writers agree -- innovation is about creative ideas that are successfully implemented. The subject of assessments in organizational design, and especially for organizations seeking to be more effectively innovative, requires further study. Prather and Gundry list assessment as Stage I in developing an innovative approach. Assessments involve examining several questions, most basically about organizational strategy. According to Prather and Gundry these strategic issues include: Determining where the organization is now and what can it do better? What is being done right, but can be improved? What specific processes are required to make improvements? Who should be involved, including former competitors? What individuals and groups can help, and how do you encourage voluntary cooperation? Can a core group be assembled and quickly demonstrate success? Which one problem should be worked first to demonstrate purposeful action and overcome initial barriers?

Difficulties in assessing innovation are apparent in Car Launch. In one instance a senior AutoCo. manager responded that there are "forty different ways" to achieve the ends, that is, producing a car. As described in the Epsilon Team case study, the metrics used for measuring performance had important organizational consequences regarding what was perceived as "real" and rewarded or punished. Identifying and measuring key variables over time is difficult in studying innovation and change dynamics. Approaches for making assessments and measuring innovation will be problematic, but should be the subject of further research. For continuing the study of how large, complex organizations can become more effectively innovative, assessment methods should be developed to identify key variables involved in measuring organizational and cultural change, and evaluating outcomes in pursuing performance goals.

A starting point would be the refinement of the general and specific propositions listed below. These propositions reflect the previous analysis, based on the general systems model developed for this paper. These propositions should be refined further and operationalized for future research. For a quantitative study, the scope of future research would have to be narrowed to permit the development of a small number of key variables and testable hypotheses. Another possibility would be to use a qualitative approach by conducting a learning history, or in-depth case study of large, complex organizations that are considered innovative. The propositions below would provide a useful beginning for future research -- for evaluating the extent to which the organization involved had understood or discovered the significance of developing organizational capacities to innovate effectively.

General Proposition:

Large, complex organizations can be more effectively innovative by developing capacities for innovation.

Propositions, by Capacity:

Proposition 1:

Large, complex organizations can be more effectively innovative by developing a capacity to promote a values-based, environment-oriented identity.

- 1A. The capacity to promote a values-based, environment-oriented identity requires a strategy that includes innovation in the vision, mission, values and purpose statements.
- 1B. The capacity to promote a values-based, environment-oriented identity requires core values that encourage innovation and can be embodied in achievable and measurable goals.
- 1C. The capacity to promote a values-based, environment-oriented identity requires constant environmental scanning (for current and future competitive threats and cooperative opportunities) and the capability to change values to support both incremental and discontinuous change.

Proposition 2:

Large, complex organizations can be more effectively innovative by developing a capacity for flexible work processes.

- 2A. The capacity to develop flexible work processes requires the capability to assemble powerful, flexible, creative, multifunctional, and boundary-spanning teams.
- 2B. The capacity to develop flexible work processes requires a culture and climate that supports innovation and change.
- 2C. The capacity to develop flexible work processes requires ambidextrous approaches for managing existing technology while simultaneously developing new technologies (this includes the capability to align all organizational subsystems to support both incremental and discontinuous change).

Proposition 3:

Large, complex organizations can be more effectively innovative by developing a capacity for individual and collective situated judgment.

- 3A. The capacity for individual and collective situated judgment can be developed by promoting creativity in individual and group attributes, conceptual skills, behavior, and processes.
- 3B. The capacity for individual and collective situated judgment can be developed by improving the organization's decision making, knowledge-base and technological mastery (including the capacity to experiment, conduct pilot tests, and manage technology cycles).
- 3C. The capacity for individual and collective situated judgment can be developed through environmentally-oriented, flexible and adaptable team and management styles, and project-oriented, horizontal work processes.
- 3D. The capacity for individual and collective situated judgment can be developed by improving the ability of top management to identify and overcome barriers to innovation and change.

Proposition 4:

Large, complex organizations can be more effectively innovative by developing a capacity for individual and collective accountability.

- 4A. The capacity for individual and collective accountability can be developed through structures and management that encourage horizontal, boundary-spanning, open

communications and the interaction (and conflict management) of independent, small, multifunctional teams.

- 4B. The capacity for individual and collective accountability can be developed by a top management that performs the roles of architects, network builders, jugglers and buffers.
- 4C. The capacity for individual and collective accountability can be developed by improving the metrics used to measure continuous improvements (through methods, such as CMM).
- 4D. The capacity for individual and collective accountability can be developed by a top management that can identify the most important problems and performance gaps, then align organizational subsystems to enable rapid organizational change and develop new technologies faster than environmental competitors.

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Footnotes:

1. The views expressed in this article are those of the author and do not necessarily reflect the official policy or position of the U.S. Army, Department of Defense, or the U.S. Government.
2. Niccolo Machiavelli 1985. *The Prince*, translated by L.P.S. de Alvarez, Dallas: University of Dallas Press, p. 44.
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5. S.G. Isaksen, K.B. Dorval, and D.J. Treffinger 1994. *Creative Approaches to Problem Solving*, Duguque, Iowa: Kendall/Hunt Publishing Company.
6. Fred Andrews November 17, 1999. "Management: The Sage of Value and Service: At 90, Drucker Still Preaches Customers Over Profits," *The New York Times*, p. 14.