

# Reimagining the Differentiation and Integration of Work for Sustained Product Innovation

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## Abstract

This study describes the image of organizing that underlies a complex organization's ability to incorporate streams of innovation with continuing operations. I argue that a mechanistic organization archetype prevents people from seeing in their minds' eyes—from imagining—how to do the work of innovation organizationwide, but that theorists have failed to articulate an alternative to this archetype in its own terms. The study focuses on two elements of organizing: the differentiation and the integration of work. I build grounded theory for an alternate, innovative archetype of organizing by exploring the shared image of work differentiation and integration in twelve firms that vary in innovative ability. I find a fundamentally different image in innovative organizations that is centered on hands-on practice: People understand value creation as a long-term working relationship with customers, in which they apply the firm's skills to anticipate and solve customer problems. This practice is differentiated into distinct problems in value creation, each of which embodies the integral flow of work like a lateral slice, but which situates those problems in their own contexts. People understand themselves to be organized in an autonomous community of practice that takes charge of one of the problems. The communities of practice are integrated by standards for action: vivid, simple representations of value that frame work and that are reenacted in practice.

The analysis details this different image of organizing by describing four autonomous communities of practice and contrasting them with the image of organizing found in noninnovative firms. The paper illustrates how this new image straightforwardly organizes and controls innovative work, and how the noninnovative image of differentiation and integration makes this work unimaginable. I conclude that innovation can be incorporated with continuing operations, provided that managers and theorists reimagine the differentiation and integration of work. I offer preliminary ideas for doing so, and suggest some next steps in this research stream.

*(Sensemaking; Knowledge Management; Innovation)*

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The purpose of this research is to describe the image of organizing that underlies the work of innovation. We

know a great deal about the specific activities of sustained product innovation and how they should be carried out. For example, how to explore and understand customer needs, solve technology problems, build manufacturing and market-focused capabilities, and generate the requisite knowledge for innovation have all been detailed (Day 1990, Griffin and Hauser 1993, Iansiti 1993, Leonard 1996). We also know a great deal about how managers should organize for innovation. For example, Jelinek and Schoonhoven (1990) have described the “quasi-formal structures” or sanctioned problem-solving groups that readily emerge around problems in innovative organizations. Clark and Fujimoto (1991) have developed the idea of “heavy weight project structures” to capture project-focused teams with strong leadership and broad skills. And Brown and Eisenhardt (1997) have summarized the “semi-structured” organizing that delineates responsibilities but does not dictate how work is to proceed. However, we know less about the underlying image of organizing (Morgan 1986), which enables people to see how to do all this work in these ways.

The frustrations of a manager at a telephone company, struggling to make her firm more innovative, exemplify the need to develop an innovative image of organizing:

We are trying to move from a pure organization focus to a process focus. We just completed a major process re-engineering . . . We identified all of the processes for innovation, front to back, all the deficiencies, and we created a new process. The challenge is to make it happen. We need to integrate technology research with market research, but to tell the chief scientist who owns the technology research budget that this has to get reviewed and approved by these two marketing guys, No way Jose. We are so focused on organization control. I don't know if that will ever change.

This manager knows what the best practices for innovation work are, but she and her colleagues do not know how to incorporate them into their organization of work. Their current image of organizing seems based on a rigid

separation of responsibility that provides no shared image of the concerted action necessary for innovation. Simply reassigning these people to a team will not solve their problem, because sustained innovation is an organizationwide activity: The phone company is managing not one but 152 new products, while at the same time implementing a new billion-dollar billing system and absorbing several billion dollars worth of new technology into its network. The chief scientist worries about relinquishing control of the technology budget to “two marketing guys,” and the image of being a team player perhaps does little to assuage his worries. He needs a rich, trustworthy image of how all 152 new services will be integrated with the evolving network technology that he oversees, and how the disparate actions of so many people will be coordinated and controlled before he can change.

This study seeks to *reimagine* organization design to incorporate streams of innovation with continued operations for large complex organizations. The fact that this manager and many others (cf. Dougherty and Bowman 1995) cannot imagine how to incorporate innovation in their organizations, even though they must innovate to survive, should be a central concern for organization theory. It suggests that organization theory fails to capture the organizing challenges faced by many large established firms well enough to help people envisage how innovation fits in with their work. What people can imagine is determined in part by the existing organizational “archetype,” defined by Greenwood and Hinings (1988) as the set of structures and processes that reflect a single interpretive scheme. An archetype’s underpinning interpretive scheme, comprised of understandings and linked assumptions, orders everyday practices and gives “. . . meaning to experience, and guide[s] inference and imagination” (Carroll 1998; see Bartunek 1984). Established organizations with histories of stable operations often have a mechanistic or bureaucratic archetype that has become both deeply entrenched and taken for granted (Dougherty and Heller 1994). They need to *reimagine* the organization of work if they are to see, in their minds’ eyes, how to include the work of innovation in their organizations.

Years ago, Burns and Stalker (1994, p. xxiii) found that people in mechanistic organizations could not reorganize, despite pressures of unstable environments, because “the orthodox bureaucratic system . . . was seen as the only possible mode of organization . . .” I suggest that managers and organization theory still cannot imagine how else to organize, despite the numerous models such as self-organizing teams, team organizations, or chaotic systems that have been proposed. While ideas like these capture important elements of organizing for innovation, we need to flesh out the innovative organizational archetype

that underpins them, and explore in depth the very different mode of organizing this image of organizing makes possible.

This study focuses on only on two elements of organizing, work differentiation and integration, so how other elements such as control, authority, leadership, or learning might be reimaged is not addressed here. However, differentiation and integration are central to organizing. Any complex work must be bounded or “departmentalized” so people know what to do (Galbraith 1995)—without differentiation people would be expected to do anything at any time—but these various partitions must also be woven together repeatedly over time, or integrated. I extend Lawrence and Lorsch’s (1967, p. 11) early conceptualizations of differentiation and integration significantly. Like this study, they focused on underlying interpretive schemes, defining differentiation as “*the difference in cognitive and emotional understandings among managers in different functional departments,*” and integration as “*the quality of the state of collaboration that exists among departments that are required to achieve unity of effort by the demands of the environment*” (emphases mine). However, they considered only the differentiation of “functional departments.” Innovation work in complex organizations also involves differentiation by business unit, product platform, managerial level, organizational process, and international market, to mention a few more dimensions. It is necessary to reimagine differentiation qualitatively, to incorporate all these dimensions but still organize work. Lawrence and Lorsch also defined integration in limited terms, as mechanisms and liaison roles. Innovation involves many more complex kinds of unified efforts, and perhaps thousands of people, so “integration” must be reimaged as well.

In the next section, I draw on the extensive literature on product innovation to identify three properties of innovation work that must be part of an image for differentiation and integration, and to explain why the mechanistic or bureaucratic archetype cannot organize work with these properties. Then I summarize suggestions of new images that have already been developed, to lay the groundwork for this analysis.

## Conceptual Background

### An Understanding of the Work to Be Done

Before we can explore the differentiation and integration of work, it is vital to understand the realities of the work of innovation themselves (Barley 1996). Many studies identify, and describe how to carry out, these realities, including how to: understand user needs, manage technology to solve problems, organize new product

development efforts singly and by product and technology platforms, build and enable multifunctional teams, develop innovation-supporting manufacturing capabilities and technology “absorptive capacity,” devise innovative strategies, create streams of knowledge, and rethink necessary competencies (e.g., Allen 1977, Cooper 1994, Souder 1987, Nord and Tucker 1987, Jelinek and Schoonhoven 1990, Prahalad 1993, Clark and Fujimoto 1991, Dougherty 1992, Wheelwright and Clark 1992, Griffin and Hauser 1993, Bacon et al. 1994, Henderson and Clark 1990, Leonard 1996, Iansiti 1998, Tushman and O’Reilly 1996, Brown and Eisenhardt 1997). While the ideas need to be developed to fit more situations, our knowledge of the work of innovation is impressive. Indeed, the field is advanced enough to have its own “complete idiot’s guide” (Bobrow 1997).

*The Integral Nature of Innovation Work.* One central property of the work of innovation is that all these activities flow together into an organizationwide process of value creation (Day 1990). Both the differentiation and the integration of this work must respect its inherently integral nature. “Product integrity,” as Clark and Fujimoto (1991) put it, occurs on several levels. The various elements of a product must fit with each other and with customer needs. Because of its integral nature, development tasks such as design, manufacturing, and marketing must be executed in parallel, so people must jointly solve problems. Joint problem solving requires that people understand constraints in other departments, anticipate others’ problems (Clark and Fujimoto 1991), and have “T-shaped” skill sets, or both a deep understanding of their specific area and an intimate understanding of the potential systemic impacts of their particular tasks” (Iansiti 1993, p. 139). Because most specialties participate in most phases, people must shape their specialized knowledge to fit the problem at hand, rather than insist that the problem appear in a certain way (Leonard 1996).

Even microscopic technology choices for a specific project may define the costs of whole new generations of technology, according to Iansiti (1998), who argues that this high degree of simultaneous activity requires an underlying pattern of consistency in processes, strategies, abilities and skills across the firm. Leonard (1996) adds that people working on a specific project can get lost in the many problems, and need a “project guiding vision” that clarifies what the project is adding to the knowledge base of the firm. Organization design for innovation must capture the integrity of work. Theory should depict organizing so people can see their own work in terms of the whole value-creation process, or “. . . in the light of the implications of [their] decisions for the rest of the firm’s activities” (Burns and Stalker 1994, p. 93)

*The Situated Nature of Innovative Problem Setting and Solving.* Despite its integral nature, innovation work involves problems that can only be diagnosed and solved in the physical context of use, application, or operation. People with diverse expertise must be integrated in particular problem situations. Innovative work does not comprise simple, clear solutions in the sense of a “formula,” but instead requires the “emergent connection of principles to the details of a particular context” (Carroll 1998, p. 20). Tyre and von Hippel (1997) explain that innovative problem solving is a social process that depends on the physical setting in which actors find themselves. The physical setting provides clues to the nature of the problems and solutions and resources to aid in problem solving, and reveals possible solution paths. Innovation work is like professional practice (Schon 1983), where practitioners “set” the problem, defining the decisions to be made, the ends to be achieved, and the means which may be chosen. People understand how new components work in a system, such as jet engines in aircraft, by “learning by doing:” building and trying prototypes, and working out problems as they arise (Rosenberg 1982, Tushman and Murmann 1998). People also understand the potential of new markets or technologies by putting out successive versions of a product to “probe and learn” (Lynn et al. 1996). An adequate conception of organization for innovation must also incorporate the various situations of work and help people depict how to come together with multiple specialties.

*The Emergent Nature of Standards that Guide the Work.* All these situated problem setting and solving activities must fit together since they do interact. The manner of work differentiation and integration must combine these situations, yet also provide for ongoing recombinations as the overall value creation itself evolves. First, despite whimsical notions of innovation being free of rules or restrictions, empirical study always finds that successful innovations have clear visions, strategies, charters, and guidelines (Nord and Tucker 1987, Cooper 1994, Clark and Fujimoto 1991, Bacon et al 1994, Tushman and O’Reilly 1996, Brown and Eisenhardt 1997). But these standards cannot dictate the particulars of the work because innovation requires experimentation (Leonard 1996) and improvisation (Moorman and Miner 1998). The standards must allow those particulars to be enacted by mutual adjustment as the work proceeds (Thompson 1967, Mintzberg 1991), in which processes of work are defined collectively as the work unfolds. The standards must also evolve through mutual adaptation, in which one practice is reinvented (e.g., manufacturing) to accommodate simultaneous change in another (Leonard 1996). An adequate conception of organization design

must connect unique situations with the overall flow of value creation, but also allow both to emerge and change.

The mechanistic archetype cannot organize work that is integral, situated, and emergent, and fails to organize the work of innovation. Rather than maintain the integrity of the work overall, the mechanistic organization dismembers that integrity to reduce complexity of work. Value creation overall is envisaged only by very top managers, and then is differentiated into independent steps that are assigned to separate departments or “offices.” Each department executes its own tasks in accordance with its own preestablished standards (Weber 1946, Blau and Meyer 1987, Thompson 1967). With this archetype, people imagine their role and their unit’s obligations *apart from* those of others in the organization, and *apart from* the situated complexities of a particular task. They base their performance on general technical or operational standards, not on solving situated problems. Indeed, the particularities of situations are obliterated, because they are imagined to be “noise” that distracts from optimum performance. Work is integrated by the abstracted standards that represent optimal operation. Integration occurs primarily through hierarchy, with each level charged to monitor subordinates’ compliance with standards and to handle any exceptions that arise. The work of innovation is not unorganizable. Rather, the mechanistic organization design does not work.

### **Toward a New Image of Differentiation and Integration**

Some theorists have developed partial images that capture some of the properties of innovation work. One partial image is “multifunctional team,” which depicts work like sports such as soccer, baseball, or basketball, where people integrate interactively as they collaborate in the situation to move the ball or execute a play. Teamwork is integrated by frequent personal interactions, overlapping division of tasks, free flow of information, and coordination mechanisms that are diffused among team members (Souder 1987). But the team image does not fit the organizationwide nature of sustained product innovation for two reasons. First, even if work could be differentiated into face-to-face teams, large organizations would have thousands of teams that also must be integrated. Second, many innovation tasks do not fit into a face-to-face group. For example, new platform teams in the automotive industry may include hundreds of people, and running the network at the telephone company involves thousands of people. A useful image must invoke larger collectives that do not presume face-to-face interaction.

Clark’s and Fujimoto’s (1991) image of a “heavyweight project structure” connects project teams to the

organization through position power and clout. But to the extent that this image simply adds a 500-pound gorilla to a mechanistic archetype, it may be misleading. Moreover, Clark and Wheelwright (1997) suggest that “fundamental change” in the rest of the organization is necessary for heavyweight project structures to work. Ideas such as “self-organizing” teams, participatory management, and “thriving on chaos” indicate what some of these fundamental changes are like and invoke images of people actively choosing and defining their own work. But it is difficult to imagine how these processes can order work well enough to, for example, keep the network up and running. Jelinek and Schoonhoven’s (1990) “quasi-formal structures” and Brown and Eisenhardt’s (1997) “semi-structures” describe how multiple teams interweave over time, and capture how work can be both well organized yet apparently self-organizing. However, their terms do not really depict an organizing scheme. They draw to some extent on a mechanistic image—innovation is partially bureaucratic—and so may be misleading as well.

One image that does convey a sense of how to differentiate and integrate work that is integral, situated, and emergent but is not rooted in bureaucracy is “community of practice.” A community of practice “can be defined as a group of people who have dealt with a set of problem and learned together long enough to constitute, as a social entity, part of the competency of the organization” (Wenger 1998). “Community” is an image of a collective that is larger than a team and can generate diverse quasi-structures for specific problems. In professional or practice communities like medicine, equipment repair, and technicians (Brown and Duguid 1991, Barley 1996), people understand themselves to be responsible for the practice and for contributing their own expertise effectively to it, which helps them understand their particular work in terms of its contribution to the larger whole. As well, the term “practice” connotes “profession” or “occupation” that occurs in a situation. According to Brown and Duguid (1991), service technicians develop their understanding of the work in the authentic activity of doing work. The image of a shared practice can help people imagine how to solve problems in the situation, even with multiple specialties. Finally, a community generates work standards by holding knowledge of the practice in common. As Cook and Brown (1998) explain, only individuals can carry out particular tasks, but knowledge of acceptable practice is possessed by the group.

The empirical challenge is to connect this image of community of practice with the actual work of sustained product innovation in established organizations, to develop it conceptually to invoke a rich yet realistic image

of work differentiation and integration. Questions that will be explored: (1) Is there a way to understand the work of sustained product innovation that captures its integral nature? How can people imagine their own work in the light of this overall process? (2) How can people effectively differentiate this complex work into coherent yet situated units of work? In particular, do people differentiate practices of innovation into working communities, and if so, how? (3) How can people generate emerging standards for this work to connect it over time to both the particular situations and the overall process?

## Methods

To *reimagine* the differentiation and integration innovative work, I address these three questions by comparing people's shared images of work in organizations that do not innovate easily and in those that do. I interviewed 119 people who were working on new products, managing functional and business units, or managing the corporate level in 12 organizations in total. The organizations are relatively established firms in North America with mostly mature technologies, and include service and manufacturing. This is a theoretical sample: Organizations were included if they: (1) were more mature, (2) added variation on capacity for sustained product innovation, (3) were attempting to improve product innovation abilities (to leave out those content to not innovate), and (4) were profitable (to leave out those under stress).

A common interview protocol was used for all people, with specific questions for different groups. Everyone was asked to describe actual processes and specific examples, to keep them grounded in their firm's way of working. People working on specific innovations were asked to describe whether and how they linked user needs with technology in the product's design, how they organized their work and coordinated with other departments, and processes that helped or hindered them. Functional and business managers were asked to describe how they allocated resources, evaluated projects, and developed capabilities for innovation. Senior managers were asked to describe strategies for innovation, how they developed resources, and programs to improve innovation. People come from all functions and specialties.

These data are limited in four ways. First, the organizations are in more stable industries, where discontinuities have been less abrupt and changes less rapid than one might find in other industries. The shared images for creating value and for differentiating and integrating that process that are found here may fit organizations with similar experiences only. Second, these data are cross-sectional, so inferences regarding change are extremely

tenuous. Third, I try to hold characteristics of technology and markets roughly constant, but these may vary. The most innovative firms here are industrial, and customers are a fairly small group of other firms. The consumer products firms are less innovative, so market complexity may affect the organization's interpretive schemes. Fourth, breadth is chosen over depth: Issues are examined across a variety of organizations rather than in depth in a few firms, so the theory developed here addresses new ways of differentiating and integrating work in broad terms only.

The organizations' innovative capability was established independently of the analysis, based on managers' assessments of their organization. Because no common, objectively measured cross-industry comparison of innovative capability was available, I relied on managers' opinions. For example, in several firms a senior manager characterized the firm as innovative, but noted that most of their new products either copied competitive innovations or comprised simple changes in appearance. Others in these organizations said they could not create new products readily, and detailed many problems, so these firms were categorized as noninnovative. Several firms were skilled in innovating only within a product category, while several others generated new products readily for both established and new markets. The first column in the appendix details the evidence used to determine the innovative capability of the 12 firms in the study. The firms were divided into three categories of innovative capability to facilitate exposition: noninnovative, incrementally innovative, and more fully innovative. Table 1 summarizes the organizations and the number of people interviewed in each.

To identify shared images for creating value and for differentiating and integrating the work of innovation, I worked with several groups of research assistants to look for themes in the data. We first analyzed interviews from one innovative firm, examining people's descriptions of their work of new product development, and how they coordinated this work with others. These descriptions were compared to equivalent ones in interviews from people in noninnovative organizations, and initial themes that characterized the differences were articulated (methods detailed by Bailyn 1977, Strauss 1987). We continued this comparative assessment by weaving in interviews from various firms, in about 20 sessions of two or three hours each. The result of this phase of the analysis was the identification of the underlying images for work overall and for its differentiation and integration in innovative versus noninnovative organizations. Drafts of these findings were written, evaluated, and clarified to integrate

**Table 1** Organizations, Number of People Interviewed, Innovation Category

Organizations	Number of People Interviewed	Category of Innovation Capability
Chemco: 110 year old specialty chemicals	4	more fully innovative
Texco: textiles, 130 years old	6	more fully innovative
Infoco: systems services, 20 years old	7	incrementally to more fully innovative
Comco: office and electronic equip, 50 years old	3	in transition to more fully innovative
Mealco: processed foods, 30 years old	11	incrementally innovative
Engrco: engineering services, 50 years old	5	incrementally innovative
Humresco: professional services in human resources; 55 years old	21	noninnovative
Machco: industrial machinery; 120 years old	30	noninnovative
Transco: transportation, shipping; 100 years old	9	noninnovative
Prodcoc: consumer durables; 130 years old	6	noninnovative
Phoneco: operating communications co in US, approx 90 years old	8	noninnovative
Shoeco: producer of women's shoes; 30 years old	9	non to incrementally innovative

comments from readers, research assistants, and some of the people interviewed.

## Findings

### Summary Statistics

It is first necessary to ask if the approach to organizing in the innovative firms incorporates the three properties of process integrity, situated problem solving, and emergent standards that the literature suggests should be part of innovative organizing. Answering this question serves three purposes: (1) to assure that the data contain theoretically significant differences and are adequate for theory building; (2) to provide some evidence that the different images of organizing found here exist across the data; and (3) to provide some independent corroboration for the noninnovative versus innovative classification of firms.

Working independently of the author, three doctoral assistants developed indicators for these properties of organizing (see Table 2 for descriptions), and measured a subset of interviews against these indicators. The primary measurement tasks were locating the relevant passages that reflected each indicator and identifying their boundaries. The research assistants separately identified all passages that reflected each item, and then met to clarify any differences. The unit of analysis for each item was a complete thought on the topic in the person's story, and included all words until the subject of the interview changed. The measures are the percent of words in the interview devoted to that topic. Only a subset of the 119 interviews was measured due to enormous time demands for this kind of analysis. We excluded the two most non-

innovative organizations, assuming that including them would only heighten the differences, and then sampled within the organizations included to roughly match the variance in departmental affiliation and level of management across the organizations.

Table 2 compares the average percent of the interviews in noninnovative, incrementally innovative, and innovative organizations devoted to each of the topics measured. *Integral nature of work*: People in innovative organizations described far fewer organizational constraints than those in noninnovative organizations, suggesting that they could maintain the integrity of the work more easily. *Situated nature of work*: People in innovative organizations involved external and internal users in their design work more often, which suggests that they situated their innovation work in the context of use or application more often. *Emergent nature of work*: People in innovative organizations described more reciprocal than linear interactions, but the reverse is true in noninnovative organizations, which suggests more mutual adjustment in innovative organizations, where the standards of work are generated as the work unfolds (Mintzberg 1991). As well, people in innovative organizations described more organizational changes made to accommodate innovation, which suggests more mutual adaptation, where work in one area is reinvented to accommodate work in another (Leonard 1996).

The figures in Table 2 indicate that innovative organizations do incorporate the properties of innovative work in their organization, so the next step is to determine the image of organizing that underpins their ability to organize work in this way. Table 3 summarizes the images of organizing found by this qualitative analysis in terms of

**Table 2** Comparing the Characteristics of Differentiation and Integration in Noninnovative, Incrementally Innovative, and More Fully Innovative Organizations

	Non-Innovative Organizations	Incrementally Innovative Organizations	More Fully Innovative Organizations
Integral Nature of Innovation Work (organizational barriers, constraints to innovation work)	18.7%	5.5%	3.6%
Situated Nature Of Innovation Work: (including external and internal users in doing work)	0.74%	2.267%	4.19%
Emergent Nature of Innovation Work: <i>mutual adjustment</i> (linear, sequential, vs. interactive interactions)	5.7% vs. 1.2%	3.5% vs. 3.2%	1.9% vs. 3.1%
<i>mutual adaptation</i> (changing systems to accommodate innovation practice)	2.5%	5.7%	6.7%

Figures represent average percent of interviews in category devoted to the topic. A subset of interviews are included: 11 interviews in total from Chemco, Texco, and Infoco (more fully innovative); 18 in total from Comco, Mealco, Engrco (incrementally innovative); and 18 in total from Shoeco, Transco, Prodco, Phoneco (noninnovative)

the three research questions: (1) How work is understood so people envisage its integral nature, and see their own work in the light of this overall process; (2) how people differentiate this work into coherent parts that situate the work; and (3) how people generate emerging standards that connect work over time to both particular situations and the overall process. The next three sections address each question in turn by contrasting the images of work overall, differentiation, and integration in innovative versus noninnovative organizations.

**Reimagining Value Creation as a Situated Practice of Problem Solving with Customers**

First, the image of how value is created in innovative organizations invokes work that is at once integral and situated because it is based on *practice*, in the sense of an artfully competent exercise of an occupation or profession. People understand their practice to be grounded in active, hands-on work: They create value by developing and maintaining working relationships with customers that focus on using the firm’s capabilities to solve customer problems. This hands-on, practice-centered image of creating value is part of people’s organizational identity in innovative organizations. Identity refers to people’s perceptions of the features of the organization that are central, enduring, and distinctive (Albert and Whetten 1985, Fiol 1991, Kogut and Zander 1996). According to Ring and Van de Ven (1994), identity allows members of the organization to project themselves onto the environment and gain a self-referential appreciation of themselves, which permits them to act in relationship to that environment. The innovative identity concerns what they *can do* for customers, and embodies both the integral nature of organizationwide innovation and the

situated nature of its problem solving. The shared image of value creation in noninnovative organizations is to keep the system going, to maintain its ongoing functioning. The organizational identity in noninnovative firms is based on a passive, internal sense of status, not practice: “who we are,” not “what we can do.”

The practice-centered (cf. Dougherty 1992) image of value creation plays a crucial role in organizing, because it gives people a clear, sharp view of their common enterprise and common objectives. Everyone knows what they are all working toward and why. Two comments illustrate the fundamental differences in the innovative versus noninnovative image of value creation. The first is by the technology director at Texco, an innovative textiles firm:

You have to be careful about one thing. We are a manufacturing company, we really are, and our focus is on what assets do we need to do business and what we need in the plants. That shades our thinking and we do worry about that. We are as innovative as anyone in the world on thinking about new and less costly ways of doing things, plus the research guys are always building new machines . . . Most of the long range thinking is in manufacturing capability, what will it be. We are selling a product component to a manufacturing company, and there are multiple layers of technology involved,: the kinds of machines we use and the kinds of machines customer use . . .

Texco identifies itself as a manufacturing company, but its identity is rooted in manufacturing *capability*. Its strategic thinking is driven by what that capability *will be* and what the company *can do*; it is inherently forward looking. Senior managers articulate these aspects of their identity by focusing on “what assets we need to do business and what we need in the plants.” This image captures

**Table 3** Contrasting Images of Differentiating and Integrating the Work of Sustained Product Innovation

Innovative Capability	Shared Image of How Value Is Created by Organization as a Whole	Shared Image of How Value Creation Is Differentiated	Shared Image of How Value Creation Is Integrated
<p><b>More Fully Innovative Organizations</b>                      innovation is part of strategy as well as of daily operations; self reports, published corroboration</p>	<p><i>value is created through practice: active working relations with customers over long term; using firm's unique skills to anticipate and solve customer' problems</i></p> <p><i>Nature of Organizational Identity: A Practice; what we can do</i></p>	<p><i>value creation differentiated into four distinct problem areas, organized as communities of practice, lateral slices of whole practice, highlights importance of all four problems; autonomous communities of practice take charge of each problem area, sets and solves problems in context</i></p>	<p><i>value creation is integrated by acting out standards, working toward standards: continually enact standards of practice across, within communities as practices evolve; visible standards for action articulated by senior managers and enacted, reenacted in practice; plus extensive mapping, remapping of connecting processes</i></p>
<p><b>Partially, or Incrementally Innovative Organizations</b>                      vastly improved NPD processes, reaching for more systematic innovation strategy; self reports, corroborated by other mgrs, experts</p>	<p><i>Value is created by managing a specific product category or kind of business: focus shifts from internal functioning to specific customers</i></p> <p><i>Nature of Organizational Identity: A Status in a product category; active, concrete; based on what we do</i></p>	<p><i>Value creation differentiated into product development problems, vs. all else; PD organized as a community of practice; firms are recognizing that other problems are also unique, beginning to organize them explicitly; business and strategic work still focused on optimizing outputs in abstract</i></p>	<p><i>Value creation integrated by enacting, re-enacting specific market and product category; product standards are somewhat rigid; common standards for action developing</i></p>
<p><b>Noninnovative Organizations</b>                      firms do not innovate readily or easily, according to self-reports, corroborated by other experts</p>	<p><i>value is created by maintaining status of current system; keeping it functioning at optimum: system is like a machine, job is to keep machine running;</i></p> <p><i>Nature of Organizational Identity: A Status; passive, static; based on what we are</i></p>	<p><i>Value creation differentiated into separate steps, in effect into solutions that already exist; organized as separate units; each applies own specialty solution to given problem; problem setting separated from problem solving; no distinction of different kinds of problems in innovation management</i></p>	<p><i>Value creation integrated by standardizing action; by matching activities to system; problem translated by top mgt into rules for optimizing current system;</i></p> <p><i>all innovation decisions made by top mgt to assure that they fit with current system; cannot make sense of new activities</i></p>

**Examples from Each Company**

<p><b>More Fully Innovative Organizations:</b>                      innovation part of strategy as well as daily operations                      KEY THEMES:                      EXAMPLES</p>	<p><i>value is created through practice: active working relations with customers over long term; using firm's unique skills to anticipate and solve customer' problems</i></p> <p><i>Nature of Organizational Identity: A Practice; what we can do:</i></p>	<p><i>value creation differentiated into four distinct problem areas, organized as communities of practice, lateral slices of whole practice, highlights importance of all four problems, autonomous communities of practice take charge of each problem are</i></p>	<p><i>value creation is integrated continually into practice by enacting standards across, within communities of practice as practices evolve; common standards for action articulated by senior managers and enacted, reenacted in practice; plus extensive mapping, remapping of connecting processes</i></p>
<p><b>Chemco:</b>                      often cited in popular and academic studies as exemplar of innovative firm; measure all businesses on % of revenues from new products</p>	<p><i>developing more systematic customer focus from attention to specific customer problems; (mkt mgr): "Now we have changed the job of the lower-level managers. We have people focused on integrated solutions now, to bring the capabilities around the company together into one face to the customer."</i></p>	<p><i>logic of differentiating into four distinct communities of practice is well developed, but as a technology-driven firm, are behind on market capability community of practice (marketing treated more as a separate function). Also evolving sharper, fuller business focus. Major concern is developing formal structures and processes to frame and connect all the product/technology parts.</i></p>	<p><i>Senior managers use "pacing" projects to encourage breakthroughs "that will change the nature of the competition," and overcome tendency to be incremental; easy integration across business units to create "integrative solutions" for bigger marketplaces. Struggling to create integration between functions and operations teams so that the right specialty decisions are made yet collective decisions are strategic.</i></p>

Innovative Capability	Shared Image of How Value Is Created by Organization as a Whole	Shared Image of How Value Creation Is Differentiated	Shared Image of How Value Creation Is Integrated
<p><b>Texco:</b> all interviewed described changes to be more innovative; measure all businesses on % of revenues from new products; won major award in part for innovative abilities</p>	<p><i>see text: strong focus on developing long-term working relationships with customers; worry about improving this ability:</i> (tech mgr): "I am not satisfied we are doing everything we can for innovation. We are constantly being engineered out, obsoleted by our customers . . . We focus on what it takes to get these customers and make them happy."</p>	<p><i>developing mkt community of practice; have business communities:</i> (tech mgr): This group handles all of the xxy fabric, but that industry is cutting back so we may shift them . . . This business is one of our new innovations, and it could double in two years, so we ask how can we service it? We are not automotive and not apparel, so we do whatever we want as long as we don't interfere with other businesses at Texco . . . When the growth of a business gets too big.. they spin it off. The specialty wovens over there used to be part of us but they are separate now . . ."</p>	<p><i>Senior mgrs responsible for corp. wide task forces to improve processes (e.g., innovation, quality, employee satisfaction);</i> (tech mgr on how integrate) "A development engineer will continue to support it, and his counterpart in manufacturing will have the same burden of responsibility. . . . their two lines will cross, and . . . down the line the colleague on the team in manufacturing has more customer contact. It all fits into the question of what expectation we put on the eventual capability of the product. We do not manage this up front because our people have lots of experience."</p>
<p><b>Infoco:</b> transforming to full solution service from IS "body shop;" numerous new services but all interviewed said lack organization</p>	<p><i>identity shifting from project-by-project service to provider of end-to-end business solution:</i> (mgr of new unit): "This is a business solution for that type of industry. The starting point is to understand the client's business very well. This is not a system and we are not selling to the IS guy. We talk to the plant manager."</p>	<p><i>Changing from very disconnected local units and customer teams;</i> trying to re-cluster work to form business and capability communities of practice; have instituted strategic group; are still underorganized</p>	<p><i>building in firm-wide integrating processes (ISO9001) and strategic decision-making; know what not to do:</i> (Senior mgr, strategy): "The AST project started as a good relationship with a client. It was a risky venture and the client needed a partner. There was no clear plan. As the project unfolded, at each point we were faced with a new set of possibilities . . . There was no strategy for this . . ."</p>
<p><b>Partially, or Incrementally Innovative Organizations:</b> vastly improved NPD processes, reaching for more systematic innov. strategy: <i>KEY THEMES: EXAMPLES</i></p>	<p><i>Value is created by managing a specific product category or kind of business:</i> focus shifts from internal functioning to specific customers</p> <p><i>Nature of Organizational Identity:</i> A Status in a product category; what we now do; active, concrete</p>	<p><i>Value creation differentiated into product development problems, vs. all else;</i> PD organized as a community of practice; firms are recognizing that other problems are also unique, beginning to organize them explicitly; business and strategic work still focused on optimizing outputs in abstract</p>	<p><i>Value creation integrated by focusing on external market and product category;</i> product standards are somewhat rigid; common standards for action developing</p>
<p><b>Comco:</b> still in transition, all interviewed described major restructure to focus on innovation; corroborated by numerous newspaper accounts, mgt articles</p>	<p><i>value created by focusing on industry, not internal ops:</i> still developing and diffusing more action-oriented identity based on long term working relationships with customers</p>	<p><i>have PD and business communities of practice corp. but still developing them:</i> (enrg mgr): "Now within the business teams there is a concerted effort to think things through—who are the customers, what are all the requirements, and what do we need to do with the engine." Technology, manuf capability communities developing as well, via tech platforms and modularity focus</p>	<p>published accounts say strategy is handled via community of practice, but integrating effects of strategic identity not yet in force: (enrg mgr) "My sense is that the strategic planning horizon is shorter than product development."</p>

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<p><b>Mealco:</b> this bus unit transformed but middle managers said are stuck in product category, innovation limited; mgr of other Mealco unit said this is firm's most innovative in NA.</p>	<p><i>Identity is concrete focus on current customers: (food tech mgr): "We know what Big Brand users want, that they like this kind of side dish or that sauce.. they are more contemporary. And here in the department we do restaurant reviews . . ." Good sense of current customers.</i></p>	<p><i>operational level work differentiated by NP problems; rest by functional steps; are developing technology capability, but production works like a function, (tech mgr) "We work very closely with marketing and we are involved in product design panels and in research, and we are often there with focus groups. When the results come back we sit down with marketing and talk it out and analyze the data. It is a collaborative thing. To some extent we involve the factory but not enough—if they wanted more involvement we would give them more."</i></p>	<p><i>reaching for richer identity based on value creation: (mgr of tech): "We do understand the end goal. Management is very active in communicating that." Md mgr of tech): "Within Mealco there are phenomenal resources and knowledge and money. But we do not know how to put them together . . ."</i></p>
<p><b>Engrco:</b> similar to Infoco, transforming way they do service business and trying to develop more systematic, strategic thrusts</p>	<p><i>working on more systematic approach to value creation (from one at a time client service); (proj mgr): "Now, our projects are more and more in the design, build, operate mode. We used to be great at design but not operations . . ."</i></p>	<p><i>adding communities of practice in business, competencies, have NPD communities: (VP): "We recognized that we were not doing a good job in environmental service. Everyone was doing it their own way and there was no synergy. We have a group now and it has shown dramatic results as far as identifying opportunities and putting in proposals that reflect the best resources."</i></p>	<p><i>re-imagining identity to incorporate history with new systematic approach to service, (also know more of what not to do): (VP) "Before we would just do a parochial approach, based on the regional office. Five years ago we were at the point of confrontation over who proposes and who supplies the project manager. I did a lot of lecturing on what is important to the Engrco bottom line and the business plan."</i></p>
<p><b>Noninnovative:</b> firms that do not innovate readily or easily, according to self-reports corroborated by published accts: <i>KEY THEMES;</i> <i>EXAMPLES</i></p>	<p><i>value is created by maintaining status of current system; keeping it functioning at optimum: system is like a machine, job is to keep machine running:</i> <i>Nature of Organizational Identity:</i> <i>A Status; passive, static; based on who we are</i></p>	<p><i>Value creation differentiated into separate steps, organized as separate units; each unit applies own specialty solution to given problem, problem setting separated from problem solving;</i> <i>no distinction of different kinds of problems in innovation management</i></p>	<p><i>Value creation integrated by matching activities into system; problem translated by top mgt into rules for optimizing current system;</i> <i>all innovation decisions made by top mgt to assure that they fit with current system; cannot make sense of new activities</i></p>
<p><b>Humresco:</b> head of corp. wide task force on new product development reported that all projects in past 3 years had lost money; corroborated by others</p>	<p><i>self-defined, operations-focused definition of value (senior scientist): "We have an obsession with quality. An implicit goal is zero defects. One bad [service item] which makes the front page of a newspaper will kill us we think, so we have put in lots of steps to make sure there are no bad [items]. But the client thinks in terms of is this service valid and fair. To a large extent, it is us who set the standards for us to meet, and we are surprised when the rest of the world says that is not what we want."</i></p>	<p><i>rigid separation by specialty, NP problems cannot be set collectively:</i> <i>(project leader): "We are notoriously bad at development. We have lots of departments with their own specialty. Each is responsible for some aspect . . . so if you do something new you have to have lots of meetings."</i> <i>(head of NPD task force): "Each department has responsibility for a certain area. So if you need them, you do the specifications for them and hand the job off to them, and they go do it."</i></p>	<p><i>cannot mutually construct shared goals as work evolves; cannot see a future path;</i> <i>(director of new technology): "This is the first lance in the significant change in Humresco's sense of what it is and where it is going. There is a lot of ongoing confusion and soul-searching from the officers about the direction . . . There is an extreme lack of definition of the future path and what markets we will get in to versus which ones we will drop."</i></p>

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<p><b>Machco:</b> unit slow to react to market changes; in recent effort to improve NPD, all new products were very late, over budget (corroborated by archival study, 2 other researchers at site)</p>	<p><i>value is created by optimizing measures, not actual products:</i> (purchasing mgr): "At our annual meeting, corporate management talks about cost management, profit, and share price . . . I remember when a corporate VP came here. He was very honest about the fact that when he looked at [our products] he has no idea what they were. But he knows our contribution to the corporation's bottom line down to the last five digits . . ."</p>	<p><i>strong separation between functions:</i> (engineer on a new product team): "It was not real tough to get manufacturing's attention, but it was tough to keep it after we got it. We made them aware of all our new parts but that fell through the cracks . . . They should have started thinking about how they would make the part at that time, but they came back and said 'we don't have any drawings so we can't.'"</p>	<p><i>existing rules do not allow recombination, inhibit emergence of new sense of whole:</i> (asst plant manager): "I don't see a universal strategy for new products. Everything is on a micro basis . . . Things get too segmented on a day to day basis . . . Every five minutes you put a new hat on and take the old one off. The only time we can work on something for more than five minutes is when management is coming to town to look at our costs, and we have to come up with another program to reduce people . . ."</p>
<p><b>Transco:</b> senior mgrs said firm is good at NPD; all product mgrs said otherwise; all new products except one were duplicates of competition's</p>	<p><i>focus on internal functioning blocks view of actual customer needs:</i> (head of mktng): "Speed to market is a real pain. Part of the problem is our desire to be real accurate [in evaluating profit potential], and the other part is that we can't mess around . . . We have thousands of customers and we are finding it very hard to get our arms around them. We are doing it via old fashioned segmentation, and now we use research as a proxy to customers."</p>	<p><i>units cannot imagine their part in whole well enough to solve own problems for whole; solutions recreated for each NP:</i> (product mgr): "Our shipping schedule is not conducive to [this kind of delivery] so we had to do a relaunch of it. The current shipping system is not flexible. Also customer service had to understand the product, and the sales people too. We had to break the mold [of our usual shipping]."</p>	<p><i>integrating according to current functioning slows innovation:</i> (speaking of myriad decisions for new product described just left): "The management committee had to bless all of this . . ." note: all new products, all operational decisions for each new product are made by CEO and his direct reports at Transco.</p>
<p><b>Prodco:</b> one major new product 5 years prior; only incremental fixes to products' appearance since, according to strategist, engineer on prior new product</p>	<p><i>focus on ongoing functioning of firm as production machine:</i> From text: (mkt mgr): "We have a long history of production. . . [T]he stark reality is that we are definitely a production company. I hear top managers say: "If you don't feed the big dog, the dog will get you." The dog is the plant. The thinking is that what really makes this company successful is keeping the plants running at full tilt . . ."</p>	<p><i>eliminating step-by-step boundaries within function, still cannot organize for long term capability development:</i> (tech mgr): "We have silos in technology, but we have made big strides in breaking them down . . . We used to have a materials group, a technical group, all with their own functional directors, [but now] they are all under one functional head . . . There is still a way to go . . . We are too short term in technology development."</p>	<p><i>top down planning does not embody emerging practice, provides no sense of long term development needs:</i> (strat mgr): "The businesses go through a rigorous planning process, a twelve step process to put together a three year business plan . . . and all that ultimately leads to broad administrative programs, some centered on new products. It ends up with a budgeting exercise. The place we are struggling in terms of breakdown is the ability of businesses to get capital for products that are 3 to 5 years out."</p>

the ongoing flow of innovative work and its activities, such as figuring out customer needs and building solutions to keep the firm tracking in the same way. Noninnovative Prodco's (consumer durables) image of value creation is very different, as a manager describes:

We have a long history of production. We are attempting to become a more market-driven company, but if you cut out all the window dressing, the stark reality is that we are definitely a production company. I hear the top managers say: "If you don't feed the big dog, the dog will get you." The dog is the plant.

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<p><b>Phonoco:</b> moving to incremental; benchmarking study done by corp. group shows that firm is too slow on NPD, lacks proper processes</p>	<p><i>value creation seen as annual revenue generation; makes NPD just another ST enhancement to ongoing functioning:</i> (bus mgr): "There may be 100 million dollars in the revenue forecast for new products, but these are all [small]. I have one NP for 63 million, but it is just a re-pricing . . . When you are under so much pressure to produce new products you don't do complete analyses to come up with them . . ."</p>	<p><i>differences between product vs. business development problems not recognized:</i> value creation partitioned into revenue generation (in "business" units), and cost management (in "supplier groups", which are operations); are creating "interface" teams to cross numerous boundaries; close to a NPD community of practice firm wide; no others</p>	<p><i>in transition: know they need to change, are ready to do so, but do not have new image of how:</i> (strategy mgr): "The competitive dynamics coupled with our own benchmarking has led senior officers to recognize that change is important . . . We recognize the need and we are at the decision point . . . but we have a billion viewpoints on how to get there."</p>
<p><b>Shoeco:</b> all interviewed report problems with NPD, changes underway; in private conv., consultant said company is bad at NPD</p>	<p><i>product development process becoming central definition of value creation:</i> (product mgr): "Senior managers are pushing innovation much more today. Three years ago the committed resources were not in place, but now we have designers on each product team, we do not have to share . . ."</p>	<p><i>technology capability problems are not separated from ongoing NPD:</i> (tech mgr): "There is no long term technology plan . . . We are a marketing driven company . . . We are working in secret [on new technologies]. If we show it to marketing ahead of time, they say we have already seen it, or it is an old idea, or it costs too much . . ."</p>	<p><i>lack common referents for value that can be mutually re-enacted; integration by abstract but short term criteria;</i> (VP manu): "The challenge affecting innovation is that we are very unfocused and the criteria change, criteria become more price driven than product driven. I say innovate to take costs out, but various price points become more of a focal point . . ."</p>

The thinking is that what really makes this company successful is keeping the plants running at full tilt . . .

Prodco also identifies itself as a manufacturing company, but its identity is rooted in the status of manufacturing *functioning*, and its strategic thinking is driven by current output. Senior managers at Prodco invoke an unreal image for strategic management: feeding a "big dog." They define value creation as "keeping the plants running at full tilt," an image that is stuck in the present and that does not invoke actual activities of innovative work.

The innovative image of value creation as an active working relationship with customers frames and focuses the everyday work of innovation very effectively, as illustrated by this comment from a director of technology at a business unit in Texco:

(Who works with customers?) Everyone works with customers. Our work is divided into technical areas like weaving versus knitting . . . The team would be marketing, development, manufacturing . . . If the team finds a new customer or an existing customer or a new need, they are experienced enough to know whether this is the right technology or not for that need. There are five or six ways to make fabric, ten to fifteen raw materials and technologies in manufacturing fabric, and eight or ten fin-

ishing processes—that is the gunk you put on the fabric. If you iterate it all out there is a huge number of different technologies. (He drew circles on the board to represent the different teams in his unit). These guys give a requirement the eyeball, and say we choose #3 from the first technology list, #2 from the second, #7 from the third, or they say no, we can't do it . . . We have in the engineers and sales and marketing group a large number of good, experienced people. They pair up a technician with a customer to make sure the customers are getting the right stuff . . . And the manufacturing facility—in more than 90% of the cases there is a face to face with manufacturing and the customer . . .

He explains that everyone works on the same activity: to make sure customers "get the right stuff." His description suggests that everyone is actively engaged in problem solving and actively anticipating both customers' emerging needs and what they at Texco can do to meet those needs. This image makes their obviously complex work fairly simple and straightforward, by helping people from a variety of specialist thought worlds to see a common problem, and shape their knowledge to fit the problem at hand (cf. Barton 1996).

The analysis suggests that organizations cannot become more innovative unless they develop a practice-

centered image of how value is created. For example, a marketing person at Comco (incrementally innovative office equipment) explains that an industry-focused image of value creation was essential to their efforts to improve their innovative abilities:

Before, everything was organized in towers. We had worldwide marketing, worldwide development, sales, manufacturing. Then four years ago we formed business teams, and that drives an industry focus. There are business groups with a broad product responsibility, and they have a market responsibility . . . The rate of change continues to change, so you focus people on what is happening in the market place. The more you take engineers to customers, the more sensitive they are. Comco is doing a lot to embrace change. It fosters the idea that change is the way we do business, it is not a transition.

Comco's new "industry focus" image of creating value is an anchor in the sea of change, enabling them to organize around change rather than be disrupted by it. Everyone is focused "on what is happening in the marketplace," a realistic focus that allows them to see their own work in the light of the work of others. This comment also describes their transformation in work differentiation, from functional "towers" to "business teams" with a "broad responsibility"—more on this below.

People in noninnovative firms define both value creation and customers' problems in terms of their own internal status and operational concerns (see examples in the appendix; e.g., at Humresco, they map their own concern with quality onto customers and discover it does not fit; at Machco senior managers talk about operations, not products). This operations-focused image of value creation provides no clear view of collective work other than to keep the machine going, which does not relate to the work of innovation. They also have no view of where they are going. So as the examples illustrate, they cannot pull together or see opportunities as they really are, which makes doing the work of innovation very challenging indeed.

### **Reimagining Differentiation as the Distinction of Problems to Be Solved, Which Are Organized into Communities of Practice**

The integral practice of working closely with customers in innovative organizations is differentiated into specific problem areas, each of which encompasses all innovation work. That is, each problem area is a "lateral slice" of value creation that reflects a different kind of situation and set of problems in working with customers. Innovative work incorporates all the specialties by function and product, but these specialties are in the background of organizing rather than in the foreground. The situated

problems of creating value are in the organizing foreground.

I find four categories of problems that are organized separately in different "practices," although the broad rather than deep cut of data may have prevented me from seeing additional kinds of practices or more distinctions within a practice. The four practices of innovation are: (1) *the strategic practice*: forming and reaffirming the corporate identity for value creation; converting that identity into standards for action that make sense in the other practices; making long-term investments in competencies; and creating decision-making systems to move resources to the right place and connect the various practices over time; (2) *the new product development practice*: defining product concepts; determining customer needs for a product in priority order; assessing and solving technical problems in a product's design; and working in parallel with people from all functions and managing joint problem solving in the design, manufacture, and delivery of the product; (3) *the business management practice*: making a profit by bundling firm resources to fit with market, technology, and competitive trends; overseeing product portfolios and platforms to maintain the right mix; tracking dimensions of value for the particular business; and overseeing the ongoing assignment and movement among personnel; and (4) *the competency management practice*: identifying and developing deep expertise in the technological, operational, and marketing knowledge bases necessary for long-term value creation; keeping competencies connected with the businesses and product efforts to disseminate new capabilities and to learn about new ways of defining value; and encouraging creativity and ongoing development of skills.

These are familiar sets of problems in innovation management, thoroughly described in the literature. The key insight of this study is that people in innovative organizations differentiate their practice overall into autonomous communities of practice, each of which organizes around doing a category of problems in innovation. This image of differentiation maintains the integrity of the work as well, and deliberately includes the situations of work in the organizing. Moreover, everyone is a practitioner. Everyone, including senior managers, actively does the hands-on work of creating value, but focused on different problem areas. The four communities of practice complement each other, and frame each other's work. For example, both the product development and the technology competency community use technology, but in different ways. Product developers work on identifying specific technical solutions for a given need, while technology practitioners work on mastering basic technological

capabilities to match emerging industry needs. Both practices are part of the work of innovation, but occur at different levels around different activities, so they work separately.

It is perhaps easiest to understand how product development work evolves into a community of practice, because this work cannot be done except by a multi-functional team centered on the development activity (Souder 1987). A marketing manager at Texco describes the transformation of product development differentiation by functional steps that occur in sequence to differentiation into an organizationwide community of practitioners:

I came to this business seven years ago. It had a traditional organization with director of development [technology] and a bunch of engineers, and a marketing manager and salesmen. The salesmen would go and find customers and get a quote on a product, and bring it back and drop it in a box, and the engineers would pick them up and do them. The salesman would go back to the customer and show it to them and say "is this OK?" We were doing hundreds of these costings, and very few of them would get to the sample stage, and of those, very few succeeded. Our hit rate was very low . . . Everything the engineers worked on was screened through the sales people, and they never heard the voice of the customer . . .

Texco used to differentiate work by function, which chopped up the development process into separate steps, each handled by a unit that worked independently toward its own goals. Sales people abstracted customer needs into "quotes," and engineers abstracted these further into "costings." Their image of differentiating work made the work of innovation very difficult, because no one had a clear view of what they were doing or how to do it. Because they changed that image to differentiate by the product development process, the work can be accomplished, because now people can see what they are working on together, as the manager explains:

Now the new ventures team develops new markets and innovations, and pulls in people from across the organization. To see if they will work with us, we say this is a wonderful opportunity . . . For example, the XYZ project—we did a screen [using stage-gate]and it looked like a very good idea. The whole team helped to call [firms in the industry] to help explore the idea. We looked inside to see what resources we had. We selected a yarn plant and got them involved. We sit down with a plant manager and ask who can I work with. The same things at the weaving, dyeing and finishing plants. We help them understand the needs and the wants, do the QFDs, have the manufacturing people help with the QFDs, and the development engineers take the process engineers to several customers.

Their innovative image of differentiating product development work centers on the whole process rather than

on steps. The new image reverses figure and ground. Putting the process of work as figure encourages people to see their work in terms of its contribution to that process, not on its own. The different specialists are "pulled in" from around the company to work on a project. At Texco, the process engineers at the yarn, weaving, and dyeing plants mentioned above all report to those plant managers and the ventures team reports to a business manager, but their jobs are to develop new products. Texco and Comco both have thousands of people like these in manufacturing, engineering, product management, and marketing who are part of the product development community of practice, and who see their jobs to be getting products designed and developed properly and quickly. They cannot all work face to face on the same "team." But because they are part of a community of practice, and because the process itself is extensively mapped out across the organization, with clear demarcations of what needs to get done and who is accountable for what when, people know what to do when they get together, even though they do not know each other. All members of this community are also trained in this practice as processes are updated, even though they report to different bosses in different units.

Managing the organization's technology, manufacturing, and marketing capabilities to sustain value creation comprises another category of problems that come to be organized as communities of practice. The need to transform technology from a separate function into a capability is evident at Comco (office equipment), which was struggling to do so at the time of the interviews. An engineer product team manager explains some problems with technology:

The key is strategic product planning. You can't decide in 1990 that in 1992 you will need this product, because the technology development cycles are longer than that. Someone needs to be thinking in 1985 that in 1995 here's what the world will look like and here are the products that we will need, and the technology organization needs to say what are the physics that we haven't mastered to make the technology, to do the print quality or the paper handling that is necessary. There has to be enough time to do this, so when you bring in the mechanical and the electronic design people they focus on how to do the parts and how to build it so it can be serviced, and how we can do it for a lower cost. They should not worry about how to make it work.

He highlights the different technical problems that should be worked on by different communities of practice: mastering the physics versus building the product so it can be serviced. An important part of becoming more innovative is recognizing that these different problems need to be distinguished so they can be handled in their own terms.

The following two examples illustrate the fundamental difference between technology differentiated into a community of practice and technology differentiated into a separate function. First, a description of how technology is developed at the innovative Texco:

R in Texco is corporate, D is SBU specific, and E is SBU and manufacturing specific. The R guys are hired as inventors. I have had one or two of my guys go over there and I was very happy to see that. (On moving technology into the businesses): The guys call all the time, plus every thirty days I walk around the lab just to see that if they have something I don't miss it. In lots of companies if something is really hard, they say let R do it, but here I have to talk R into it because they do not have to do what I ask. They do new textile process technology, new chemicals, machines . . . We do have people in research who have developed specific expertise in a process, and they function like internal consultants.

Texco corporate researchers, as practitioners, work on their own projects and take charge of creating underlying textile capabilities. The technology community of practice is a source of value for customers in its own right, and its practitioners contribute directly to that value creation. They do not "do" technology in the abstract, but rather are richly networked into the business and product communities of practice, and the latter work directly with them to see if they have something. Indeed, technology practitioners flow from one community to another.

Contrast this with a description by the head of technology at noninnovative Humresco:

We have a platform selection committee made up of all the vice presidents and general managers, and they look at new technology and decide when it is appropriate for Humresco to start to use it. We are very conservative, and we decide based on cost, feasibility, and whether it is stable and robust . . . Object-oriented programming is a good example. We have no data bases that can run on it, so systems held off bringing it in. We keep conservative and try to be economical. The functions sometimes march off on their own, but 99% of the time they come back.

Technology practitioners at Humresco do not take charge of developing the organization's technology to support value creation, as they do at Texco. Technology problems are not solved in application, and technology is not differentiated as a special source of value. Instead, it is bracketed out of the flow of value creation and managed by abstract, generic standards for optimizing its functioning and for fitting its operations into the existing system. Standard such as "cost," "feasibility," and "stability" only weakly (if at all) reflect customer needs or market trends. As well, senior managers make technology decisions, not the technologists.

The analysis suggests that all categories of innovation problems need to be differentiated and organized as autonomously operating communities of practice before the organization can do all the work of innovation. Both of the more fully innovative organizations in this study organized all four kinds of problems in what I term communities of practice, although as illustrated in the appendix, each specific community was not fully developed. Firms in transition like Comco were developing all four communities. Incrementally innovative firms had at least one community of practice and were starting others. All organized product development was in an autonomous community of practice, in which practitioners took charge of all product decisions (working within strategic mandates). Just this change significantly enhances new product development ability. However, the products that could now be developed much more quickly and successfully were still confined to a given product category in these firms because manufacturing was organized as a function that optimized abstracted standards like cost or volume, rather than as a capability whose practitioners updated manufacturing techniques for various products.

The noninnovative organizations differentiate by steps in development, which prevents people from collectively seeing actual problems of development, the difference in the kinds of problems, and the situations which are so crucial to effective problem setting and solving. The result is that the development of particular products is delayed, and often severely disrupted. Everyone at all levels gets involved in any particular new product, since their work is not differentiated by activity, just by function. However, everyone makes decisions based on different problems: Senior managers try to use a particular product to determine strategy; technology managers try to use it to explore a technology; business managers try to use it to generate immediate revenue. The appendix has some examples of these problems. In addition to not being able to generate a clear image of a common objective, people operating with a mechanistic image of work differentiation also cannot generate a clear image of the work itself.

### **Reimagining Integration as the Ongoing Enactment of Common Standards of Action**

Differentiating work into its distinct problems, organizing that work as autonomous communities of practice that take charge of these problems in their situations, and connecting all the work with a practice-centered shared identity of working with customers enhances the propensity for coordination almost automatically. An example illustrates the integrative nature of the innovative shared image of practice and how it differs from the mechanistic integration by abstract standard. A food science manager

at Mealco contrasts their current way of integrating work with their former, mechanistic way:

(Drawing a point with a circle around it): This point is perfection, but the circle is the circle of acceptability. You spend 20% of your time getting into the circle, and 80% getting to the center. We had the goal of highest quality but we also had the highest price . . . But the competition reduced the quality gap and still had a large price gap, so we were on a path to self destruction . . . Now we say to [manufacturing], you do what ever you need to do to keep in the circle. It used to be, you give them this much leeway, they would take a bit more and everything would get out of control. But as long as everybody believes and accepts and understands what we are trying to produce, we have a high probability that they can do it.

In their former way, they tried to dictate the specific actions of units by asking them to hit the point of perfection. He notes that they in product development could not trust manufacturing to work on their own because manufacturing took advantage of any leeway to optimize their functional goals. Now both groups work toward the same understanding of value creation—"what we are trying to produce." They work toward a "space" of jointly understood practice, not an abstract point. The change is not a loosening of standards so much as a deepening of the shared appreciation of the joint practice they are engaged in. With that joint image in mind, each specialty can determine its own way of contributing.

There is another challenge of integrating innovative work. Solving situated problems creates new insights that must be continually integrated into the collective practice, but the collective practice must be standardized enough to assure a common strategic focus. The analysis suggests that people in innovative organizations have an image of integration that is based on enacting standards in action. They work toward specific, vivid, clear standards for practice and then rethink those standards in the work. Senior managers, working in a strategic community of practice, articulate a small set of standards that represent their strategic view of the firm's working relationship with customers and the direction of that relationship. The strategic community then interacts with people in the other communities of practice to frame the enactment of these standards by the different communities to fit the various situations of work they each encounter. This description of the connection between business managers and strategic managers illustrates the use of standards of action at Texco:

We are target price and target cost driven. The marketing manager is responsible to set the price, there is no standard and it depends on the market. In Market A the leader makes 5% profit (a mature market), versus in a technology-driven market we will

only play if the margin is at least 15%. (I asked how do you decide?) We make the determination based on experience, but we also map it out, do the market share and competition analysis, share trends, and customers—it is a very formal process and standard charts exist. The Bob Browns (his general manager) of the world stand up twice a year to George Black [CEO] and report on what is going on in the business and what will go on in the next three years. Bob uses the exact same charts at this big meeting that we use [in the unit] to evaluate a business. Sometimes he gets the middle managers to do the presentation—that gives ownership. Using these analyses are ingrained throughout the company, even though we are in all these different businesses . . .

Target price and target cost are routine standards, but they are not abstract numbers that are imposed on the businesses. Rather, each business enacts the standards ("there is no standard") based on the actual working relationships with customers experienced in each business. These common standards represent the value-creation process in simple terms that people across the organization can enact in their own situations. These standards are not "owned by" senior managers and sensible only to them; they make sense to every community. However, by enacting these standards in a particular situation, the standards absorb new meaning about the working relationship with customers, and this new meaning becomes part of the next interaction between groups that the standards help mediate.

Note that senior managers ask business managers to imagine themselves three years into their futures, to reenact the standards to fit emerging situations, or to imagine working toward new situations and new standards. Every six months all 47 business managers at Texco reenact these standards of action, so every six months senior managers reenvision the firm's standards overall and the joint value-creation process they represent. Everyone, including senior managers, actively participates in "strategic conversations" (Westley 1990), in which the directions, plans, and very the practice of value creation they all are engaged in is continually enacted.

These standards are enacted again within the business and product communities of practice in smaller cycles of adaptation (cf. Leonard 1996), as the technology director explains:

We organize our people around products and we simply redefine them if we find a new business. Every thirty days we sit down and review what we have been doing with delivery, quality, new product cost issues—we ask the micro details plus we also deal with questions at 50,000 feet.

They coordinate their work by focusing on "*what we have been doing*"—a common experience—and on standards

that represent this experience: delivery, quality, product cost to customers. Each standard connotes action for specialists and product teams. The relationship between marketing and manufacturing communities of practice is ordered by the same standards.

Senior managers also articulate processes and procedures that map out necessary activities and connections in the innovative firms, and they take charge of constructing and reconstructing these important processes over time. Indeed, this careful attention to organizing is a big part of the practice of the strategic community of practice (see examples in the appendix).

The shared image of how value creation is integrated in non-innovative organizations is one of standardizing action, not acting out standards, they match specific work to the overall system, in effect working back rather than working toward. Because innovation by definition does not match current work, people in these organizations have no systematic way to make collective sense of new products or new technologies, nor to continually integrate new activities into their ongoing practice. All decisions therefore rise to senior managers, who do not see the specific problems in their particular situations. The manager at Phonoco who was quoted in the introduction to this article explains that her senior managers operate like monarchs, from their "own frames of reference:"

We are a monarchy internally. There is a high level of control of what happens at the top (Why, I asked). Personality types. Control types. All are engineers. The chairman is very visionary, but within his own frame of reference. Most decisions go all the way up, more than they should. We can go to the senior managers and say here is the game plan for [major product], and they say no, we'll do it this way. I remember a Dilbert cartoon. They had all the analyses done, but every layer up they had to reduce the information down to fewer and fewer bullets, so by the time it gets to the most senior team it is only six bullets. Behind them are boxes and boxes of data, but the senior manager hears something on TV and makes a decision based on that.

Phonoco's senior managers set and solve all of the problems of value creation themselves. They have enormous control over final decisions, but virtually no control over the actual situations of innovation. The appendix contains a number of additional examples of the failure of the mechanistic image of integration to make the new products, markets, or technologies that are inevitably generated by people in these organizations collectively sensible. It should be noted that in all noninnovative organizations in this study, senior managers decide on all new products. The analysis suggests that they do so because the organizations have no other means for collectively imagining which new activities to pursue nor how to

weave these activities into the ongoing practices of the organization. The outcome is that all the other problems of innovation do not get adequate attention. As the examples in the appendix illustrate, because they cannot collectively imagine how to enact standards in practice or even to solve all the problems that keep coming up, people in innovative organizations cannot collectively imagine where they are going, nor how to go there. They cannot imagine how to do the work of innovation in their organizations.

## Discussion

This analysis of the images of work differentiation and integration in innovative versus noninnovative organizations leads me to four conclusions: that the shared image of work in innovative organizations is indeed fundamentally different from a mechanistic or bureaucratic image; that this new shared image is not unimaginable, weird, chaotic, or out of control, just very different; that organizations and organization theorists need to reimagine organizing to incorporate sustained product innovation in complex organizations; and that a new image is necessary but not sufficient to an organization being capable of innovation. I discuss each conclusion and suggest possible extensions of the findings that each suggests.

First, the innovative image of work and its organization is not just more of some aspects of mechanistic organizing and less of others (e.g., more coordinating devices, fewer levels), but comprises a very different way of imagining work; it is based on a fundamentally different organization archetype. This conclusion is hardly new (cf. Burns and Stalker 1994; Nord and Tucker 1987), but it bears repeating because to truly advance organizing, it is necessary to understand that a fundamentally different image for organizing innovation exists, and what that image is. All the organizations in this study have elements of organization in common; they all have jobs, reporting relationships, bosses, business units, standard operating procedures. It is the underlying image that enables organizations to use these manifest organizing devices effectively for innovation. As Jelinek and Schoonhoven (1990) found in their study, the innovative organizations in this analysis use the manifest elements of organizing as tools, short-term maps, so they could reorganize regularly. My contribution is to begin to articulate the underlying image that orders work, so that the various structures, processes, and procedures that enable innovation can be implemented and shifted as appropriate.

One contribution of this analysis is the beginnings of a vivid, detailed understanding of this new image of differentiating and integrating sustained product innovation.

The analysis finds that a new image begins with a very different image of work itself. The central thread of the new imagery is work as *practice*, the exercise of a profession or occupation in an active, hands-on, problem-solving manner. This image of practice enables people to see the integral process of innovation and their part in that process. People in innovative organizations understand that value is created by developing and maintaining a long-term working relationship with customers, and indeed this image of work as practice is a major part of their identity as an organization. This image of active practice is fundamentally different from the image in non-innovative organizations, based on passive maintenance of the system.

The overall practice is differentiated into autonomous communities of practice, each of which takes charge of a category of problems, setting and solving those problems in their contexts. The communities of practice embody the entire process, but practice different aspects of it. This differentiation is a qualitatively different kind of “break” in the work than those imagined by Lawrence and Lorsch (1967) (and many organization theorists since). The breaks are not based on steps, or job units, or market segment or country—at least not as the primary cut. Rather, work is sorted by kind of problem and situation, which assures that setting and solving the problems of defining the standards to work toward, bundling resources to match markets, building and rebuilding capabilities, and designing and launching products are at the heart of organizing. Of course these other groupings (e.g., specialty, customer channel, geography) add vital situated insights to working through these problems; how to organize all these interconnections among the many perspectives on the underlying working relationships with customers remains a serious management challenge for the innovative organizations. My key point is that the noninnovative organizations could not even begin to address these important challenges because their image of work differentiation obscured them.

The practices are integrated by enacting standards of the practice in the actual practice of work. Senior managers generate specific, vivid standards that sensibly represent the practice overall in all specific communities of practice, and then oversee their ongoing enactment and reenactment. These sensible, “see-able,” achievable standards are there leading the way, so to speak, helping to frame the kinds of actions people might take in their particular situations of practice. This image of integration by standards for action is very different than the image of integration by standardizing action. Enacting standards in practice provides fluidity yet constancy, while matching activities to standards provides only stability, which

makes little sense of the continually emerging customer needs, technologies, and so on.

Second, despite its qualitatively different nature, the new image is not weird somehow, or chaotic or out of control. It is quite sensible, even simple and straightforward, but on its own terms. My findings suggest that people in innovative organizations know what their jobs are, who they report to, and how they should do their work because they can imagine what to do and how to do it, and because they can adequately imagine what others will do. Indeed, it seems to me that the work in noninnovative organizations was chaotic and out of control because many of the people could not see how to get their work done effectively. To continue developing our theories of organization, it is essential to question whether innovative work is itself inherently chaotic (using either the mathematical or dictionary definition of the term), “self-organizing,” or risky, or if the work simply appears to be so when considered from the perspective of a bureaucratic archetype. In other words, is the chaos, the self-organizing, and the risk really in the work or are they in our paradigms of organizing? Another theoretical possibility is that new images of organizing like these are the “deep structures” that underpin more manifest structures, and that the latter are outcomes of the image. It is important to explore whether or not this alternate innovative mode of organizing is as orderly, sensible, and controlled as it seems from this analysis to be. If so, then people like the chief scientist at the phone company can imagine how to organize in this fashion, if theorists can conceptualize it effectively. In any case, this analysis is limited, and it is essential for future work to articulate the fundamentally different images of control, authority, and participation itself that may also be part of innovative organizational archetype. Theory must get beyond the outward manifestations of nonbureaucratic models of organizing, beyond describing them simply as being team oriented, participatory, and risk taking, and articulate the underlying images on which they are based.

Third, people could not organize innovation across the organization until they began to envisage this new way to organize work, however unarticulated their reimagining was. Indeed, the noninnovative image of work actually prevents people from innovating. Thus, it is necessary to explore how organizations can go about reimagining organizing, and how such a transformation might unfold. This study’s cross-sectional nature precludes anything but vague inferences, but several dynamics can be suggested that can be examined in subsequent research.

One is that managers of noninnovative organizations need to reimagine their organizational identity to vividly represent the practice of working with customers. The

findings suggest that communities of practice and enactable standards for practice to integrate those communities cannot emerge until the organization's work is understood as a practice itself. As described in the appendix, incrementally innovative organizations shifted to a concrete, external image focused on a particular product category, which may be a feasible intermediate step in the reimagination of organizational identity. Second, managers must differentiate distinct problem areas to be set and solved by communities of practitioners, and allow communities to take charge of those problems. Developing a product community of practice seems fairly easy and may help people imagine work as practice so they can form other practices. Differentiating the business communities might be encouraged by forming separate businesses with autonomy of action within organization-wide mandates. Differentiating the strategic community of practice means that senior managers take charge of this specific problem area of innovation work, which is fundamentally different than determining problems and solutions for everyone else. Actual steps and variations for transformation need specific consideration.

Finally, a new image of organizing is necessary but not sufficient to becoming innovative. As suggested in the appendix, people in the innovative organizations of this study have shifted to this new underlying image, but are now struggling to craft formal structures and processes that help them articulate and apply the new image. Research needs to connect specific structural arrangements like "quasi-formal structures," "semi-structures," and ambidextrous organizing (Tushman and O'Reilly 1996) with the images of organizing that underpin them, so that we can explore them as they actually operate—together. Future research can test and as necessary correct the image for organizing developed here, and also deepen our understanding of how organizational archetypes or images operate with the various organizational devices to order work in practice. It is also important to explore the limits of this new image of organizing—what properties of work does this image not address? And, given the limits of these data, are there other images for organizing innovation in high technology or small organizations, or various subtypes? What aspects of these images work well with which organizational devices, measures, policies, and procedures?

In conclusion, this study has developed some insight into the different image of organizing that underlies an organization's capability to implement all the practices, processes, techniques, approaches, and structures research shows to be important for sustained product innovation. Much more development is necessary. However, by elaborating these and other conceptual building

blocks of organizing to fit the work of innovation, researchers can synthesize the many excellent ideas on the management of innovation that already exist into sensible, workable images for building innovative capability into complex organizations.

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