Cultures that support productinnovation processes

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Executive Summary

Most managers know that organizational culture influences the firm's economic consequences and recognize its important role in shaping product-innovation processes. Highly innovation-supportive cultures are credited with fostering teamwork and promoting risk-taking and creative actions that seem directly linked to effective newproduct development. Fostering highly innovation-supportive cultures in practice, however, is easier said than done. From the voices of participants in new-product development processes in high-technology organizations, we report what we have learned about the distinctive features of highly innovation-supportive cultures in productinnovation settings and propose how organizations might develop such cultures.

Managers and scholars have largely accepted the notion that organizational culture is linked with positive organizational results.¹ There is growing evidence to suggest that cultures supportive of new-product development processes in high-technology firms (henceforth *innovation-supportive cultures*) can foster creative, innovative, and initiative-taking behaviors among participants—i.e., behaviors that are linked to advantageous new-product results.² The literature is less clear about why, despite the growing awareness of the cultureinnovation linkage, innovation–supportive cultures have failed to proliferate in practice.

This knowing-doing gap persists in part because culture is often used as a catchall phrase to describe the subjective, amorphous side of organizations that managers implicitly know abouteven if many remain mystified about the precise actions that can create the desired patterns of cultural beliefs, values, and behavioral norms in practice.³ Currently, for managers operating in the complex, highly interactive settings in which new products are developed, conceptual and theoretical developments offer little help except the belief that culture and innovation are linked—something which they already seem to know. What can help at this juncture are efforts to present the voices of managers involved in real-life product-development processes and concrete illustrations of existing conceptual developments and research findings about the culture-innovation linkage.

In this article, we provide real-life illustrations of innovation-supportive cultures as they emerge in product-innovation settings and on deriving implications that can speak to the day-to-day realities of managers. The illustrations emerge from an exploratory, qualitative study of new-product development processes we conducted in ten hightechnology industrial manufacturing firms.⁴ In eight of the ten firms we examined, cross-functional teams with representatives from R&D, production, and marketing groups serve as the principal structural mechanisms charged with making new-product decisions and organizing the workflow. By settings, we refer to the task environment created by the web of relationships within and between the core participants in these teams and the important contributors to the process, including the leadership and senior management, multiple departments of the firm, and other key constituencies.

We begin by defining culture and briefly describing how it emerges in the product-innovation settings we studied. Then we discuss how we identified innovation-supportive cultures in new-product settings and briefly highlight their key features. Then we compare and contrast the artifacts of cultures we saw as more or less supportive of new-product development processes. Based on our comparisons, we offer some observations that will interest managers and scholars concerned with fostering innovation-supportive cultures in the settings where multiple technologies, talents, and aspirations are integrated into new products ready for the marketplace.

What We Mean by Culture

Culture in product-innovation settings refers to the social and cognitive environment, the shared view of reality, and the collective belief and value systems reflected in a consistent pattern of behaviors among participants.⁵ While this view of culture and its apparent linkage with the behaviors of people is widely held, several key issues germane to managing culture in product-innovation contexts remain unresolved. For instance, some regard culture as a separate, measurable dimension of the organization; others view it as inseparable from the firm itself.⁶ Similarly, while some suggest that strategies must emerge from a clear understanding of what the existing organizational culture will support, others argue that cultures can and should be changed to implement new strategies and achieve new results.⁷

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In the product-innovation settings we examined, culture emerges as an inevitable, collective creation of participants acting out their urges to commune with others, make sense of their environment, define contingencies, and form a social order. It emerges from the participants' interactions with others directed at, among other things, reducing the anxiety and uncertainty they feel about their involvement in the product-development process. The decisions and actions of the leadership and the senior management, and the topography and physical environment in which participants find themselves, strongly shape the human interactions. From these interactions emerge, among other things, a shared view of reality and a shared value system, i.e., an implicitly or explicitly agreed-upon set of objectives, states of affairs, behaviors, and outcomes that are deemed more important, worthy, and preferred than others.

Illustrating the Culture-Innovation Linkage

We derived practical illustrations of the cultureinnovation linkage by following a three-step pro-

cess. First, we identified product-innovation settings that reported efficient and effective new product-development processes, i.e., settings that had met or improved upon their budgeted time to market and had met or exceeded their sales and marketing goals.8 Second, we examined several elements prevalent in their psycho-social environment including values, beliefs, assumptions, and outcomes to determine the presence of an innovation-supportive culture (see Figure 1). In two settings that reported highly efficient and effective new-product development processes, we found beliefs and values favoring collaboration, creativity, and risk-taking deeply ingrained and readily apparent in the behaviors of participants.⁹ These settings seemed populated with voting citizens enthusiastic about and capable of articulating the clear

Guiding values, beliefs, and assumptions of participants in innovation-supportive cultures:

- A. Taking initiative and exhibiting creativity and risk-taking are important and expected.
- B. All participants are capable of being trusted in a co-creative endeavor and are important, equal stakeholders.
- C. All participants (including leading customers, key suppliers, and members of other functional groups) are *insiders* and should be involved early in the product-development process.
- D. Organizational change is energizing and refreshing. Change should be embraced rather than resisted.

Behaviors:

- A. Participants voice the clear sense of control that they feel about their involvement in the new-product development process.
- B. Participants exhibit high levels of cocreative, collaborative behaviors.
- C. Participants show willingness to make themselves vulnerable to feedback from others.

Related new-product outcomes:

New products from new technologies are developed within time and cost budgets and achieve market success.

FIGURE 1 Distinctive Elements of Highly Innovation-Supportive Cultures in Product-Innovation Settings

sense of control they felt about their involvement in the new-product development process. We labeled the culture of these two settings as "highly innovation-supportive." These cultures contrasted sharply with those we found in two settings that reported not just significantly slower development times but also a failure to meet sales expectations. Despite senior management mandates and the rhetoric of change, these settings promoted thinking and behaviors that favored the status quo. Dissatisfaction with poor information exchange, uncoordinated activities, and unequal distribution of power figured strongly in the responses of participants. We labeled the culture of these settings as "low innovation-supportive."

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Third, we identified and examined in depth the cultural artifacts of these contrasting product-innovation settings. We did so because the study of artifacts is central to scholarly writings on organizational and other cultures.¹⁰ This interest stems from the notion that cultural artifacts are observable signs that can be used to decipher the unseen, complex, and often interactive elements of cultures such as beliefs, values, and assumptions. In turn, cultural artifacts including vocabularies, stories, rituals, and physical symbols are expected to exert powerful influences on shaping values, beliefs, and desirable behaviors among participants. Scholars have taken a variety of approaches to the study of cultural artifacts. For instance, some have examined cultural artifacts without any specific interest in their linkage to product-development processes.¹¹ Others have specifically addressed the culture-innovation linkage by examining artifacts of cultures associated with effective innovation.¹²

What we learned from the comparison of cultural artifacts and discuss in the rest of this article can be useful for two reasons. First, artifacts shed light on the social environment in which these innovation-supportive values, norms, and behaviors emerge. They tell us about the cognitive and social environment in which participants (a) think about and make sense of the settings in which they find themselves and (b) draw meanings, develop belief and value systems, and use these meanings, beAugust

liefs, and values to define their behaviors.¹³ In so doing, they provide illustrations in support of ideas about the culture-innovation linkage and offer a possible explanation for the pervasive and enduring trends in the creative, risk-taking, and innovative behaviors of participants in these product-innovation settings. Second, because these artifacts can be managed, i.e., new stories, rituals, and physical symbols can be shaped and adopted and old ones discarded, what we learned should stimulate thinking among those concerned with shaping and managing culture and influencing the creative behaviors of people in enduring ways.

Contrasting Highly Innovation-Supportive and Low Innovation-Supportive Cultures

Stories

Narratives of critical incidents and corporate mythologies are important because they hold meaning both at the literal and metaphorical levels. They provide important clues about the firm's core beliefs and values which, in turn, set behavioral expectations for people.14 Stories told and retold (i.e., new iterations in which meanings often change) in highly innovation-supportive cultures in our study became part of the corporate mythology. They are essentially about change and uniformly highlight the failure of the old and the success of the new. In particular, the stories allude to the terrible old days of a functionally divided organization and "over-the-wall" workflows in which each functional group finished its part of the newproduct process and flung their output to the next department. Stories highlight near-death experiences, impending bankruptcies, loss of major customers, and dramatic revivals. Two companies we studied with cultures high on innovation, High-Auto Inc. and High-Jet Inc. (fictitious names), are described in Figure 2. A manager representing the production function from High-Auto Inc., and closely involved in new-product development for 25 years, explains:

Oh... the old way... we almost went bankrupt here. Back in the middle '80s... we had a product that we tried to launch... that almost busted us. Because there was no team, it was throwing it [all decision-making and work flows] over the wall. It was late, everybody had their own agenda, everybody had their own little domain. Everything was fragmented and nothing was coming together. And the customer was about ready to say, "Hey, we'll go someplace else." **High-Auto Inc.** produces automobile transmissions and components (sales over \$1 billion and over 3400 employees). New product-related cross-functional teams were formed at the urging of a customer (one of the big three U.S. auto makers). The team leader was carefully selected by senior management to lead the new-product development process.

High-Jet Inc., a division of a larger industrial organization, manufactures jet engine components (divisional sales over \$51 million and 470 divisional employees). High-Jet is in the process of shifting its focus from the defense to the commercial aviation industry. The division is further split into two product groups, and interviews were conducted in one of the two product groups. The managing director of this product group was carefully, deliberately building a team-oriented organization.

FIGURE 2 Two Innovation-Supportive Cultures

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Stories recount personal initiative directed at taking risks, breaking old rules, spanning functional boundaries, building shared responsibilities, and eventually developing a shared understanding. They recount the datedness of old views and the problems associated with functional-hierarchical organizations that inevitably cause participants to focus on their narrowly defined functional areas. They outline the processes by which participants learn new ways of thinking and adopt new ways of taking actions. Participants narrate stories about the promises (or performance guarantees) they make to external constituencies (e.g., marketing manager making promises to customers) based on their in-depth understanding of other participants' concerns and capabilities.

These stories show how the original emphasis on selecting and preparing participants with technical skills has changed to a new emphasis on preparing participants with interpersonal and team skills as well. The managing director of the High-Jet product group that we studied describes his efforts to flatten the organization's hierarchical structure and carefully select department heads and leaders who possess both technical and interpersonal skills in the following way:

I really flattened the organization and have put new people in most of the positions to get people more involved in being team players. The technical skills of how to do your job are important, but so is how to work as a team.

He also recounts stories about actions he took to overcome resistance to change and sell the concept of teamwork among diversely qualified participants. The implied moral of these corporate stories highlights the importance of openness and trust, early involvement of all participants in newproduct decision-making, and the emphasis on intense information sharing.

Highly successful implementation of non-traditional ideas against great odds and amidst skeptics—which eventually create true believers and adherents—is the stuff of corporate mythologies in highly innovation-supportive cultures. The leader from High-Auto Inc. tells the story of how a new idea that initially met with skepticism was eventually accepted across the organization:

When it came time to implement the product out on the floor, to actually put it into place, I got radios for everybody. All the major functions had radios, 2-way radios. And that was something that was never done here before. And [people said]...it will not work, it can't work, we've never done that. Well, I went ahead and did it. Now, they won't give up the radios.... We were asked to do the job one month early by our customer. We did.

In contrast, stories told by managers of firms we studied with low innovation-supportive cultures are about individualistic, competitive people engaged in accusations and finger-pointing. Two companies with cultures low on innovation, Low-Mech Inc. and Low-Electric Inc. (fictitious names), are described in Figure 3. Stories from these firms are about participants in new-product processes acting out scripts on self-promotion and self-protection in hierarchical, status-conscious organizations. Narrators attribute successes to themselves, failures to others. Stories make the tellers appear virtuous and others silly and ineffective. Stories are spun around inter-departmental competitiveness, negative stereotyping, and actions designed to gain senior management's favor. In **Low-Mech Inc.** is a manufacturer of industrial machines (sales over \$300 million and over 1400 employees). The organization's structure is functional-hierarchical and vertical. Most department heads are promoted from within the organization. New employees with fresh perspectives are largely absent in the upper echelons, and the status quo is rarely questioned. Every new-product team leader is an R&D appointee.

Low-Electric Inc. produces electrical construction materials (sales over \$250 million, employees over 1500). R&D and engineering, without much interface with production or marketing groups, traditionally managed new-product development. Because senior management was aware of declining customer focus in the firm, recent changes include institution of project management tools and marketing-led newproduct initiative (via teamwork).

FIGURE 3

Two Low Innovation-Supportive Cultures

general, the stories revolve around the theme: I am right, they are wrong. The product manager from Low-Mech Inc., who serves as the marketing representative in the new-product team (over thirteen years in the firm and over three years in current position), describes R&D's failure to listen to customers in the following way:

I think R&D can be so driven from a non-customer satisfaction standpoint that they lose sight of what their job is all about and that's satisfying customers.... Give engineers a set of problems and they'll work their way through it, and as soon as they come out with the very first fix, they'll stop and say, "Okay! [rubbing his hands together] Design's done. It is going to work everywhere." And you might say, "Well, the problem came from Brazil and you fixed it, but I have another problem here on the same part, and this one came from Korea, and I can tell you that your fix for Brazil won't work from Korea." And they look at me and say, "But it's the same part. It's got to work."

Stories that managers from low innovation-supportive cultures narrate are about individualistic, competitive people engaged in accusations and finger-pointing. Stories reflect the resentment participants feel toward the dominant functional groups' control over new-product decisions despite the formation of teams and toward senior management's actions that highlight the unequal stature of participants. In Low-Mech Inc., for instance, stories tell the various ways in which R&D fails to initiate teamwork or to involve representatives from production or other groups in their decision-making. The manufacturing department head from Low-Mech Inc., representing the only newly hired person with experience in other firms, complains:

Because I'm trying to drive some fundamental changes and because I am critical of the way some things are being done, there is a clash and resistance. There's certainly not a good or real solid team relationship there. I think that R&D wants very strongly to maintain the status quo. They want to be controlling. Some of them are ... not necessarily resentful [about having to share power] but are resistant to other parties doing some project management roles.

Stories are also rich with evidence of mindlessness in the social environment, i.e., senior management's and team-leaders' failure to harness the unique talents and insights of participants and their demonstrable insensitivity toward the breadth of concerns represented in the setting. For instance, the design engineering department head from Low-Electric Inc., expressing the resentment he feels about the mindlessness displayed by the team leader, notes:

[New product-development processes would be] smoother if they [i.e., the team leader and the functional group he represents] knew the processes better and the limitations of the processes; and if they knew the effect on other departments of changes in certain demands and certain [customer] requirements. Sometimes we have to spend quite a lot of time working on something and get something that will work ... and sometimes it [the leader's ideal just doesn't pan out. Sometimes...up front you know it's impossible and it's going to be very very costly and time-consuming to pursue, and yet you have to pursue it and find out down the road that it really isn't that important.... It would have been nice if they had known what it would cost and compare that to the importance of the feature. We could have saved a lot of time.

Social Rituals

Social rituals are formally or semi-formally organized, regularly scheduled activities that engage people in specific information sharing and more so in specific actions. We examined cultural rituals because they channel people's focus and energies toward social, interactive tasks and goals—and are often the venues in which stories are told and values are influenced.¹⁵

An intensive schedule of formal meetings for sharing information, exchanging and developing ideas, expressing disagreement, and managing conflict are the most common rituals in highly innovation-supportive cultures. The meetings help ensure that diverse voices are heard and discussed in open forums and that a shared understanding emerges among participants. Frequent meetings engender a culture of inclusion and help participants overcome us-versus-them thinking.

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In High-Jet Inc., formal staff meetings are held twice a month—one to discuss the financial aspects of ongoing projects and the other to discuss new business and new product opportunities. These meetings are called by the managing director and include all department heads. They symbolize the importance that senior management places on cross-functional discussions and interactions at every stage—from the birth of a new idea to market introduction. These meetings create a sense of shared purpose and emphasize the need to draw input from all interested parties before moving forward.

Rituals in highly innovation-supportive cultures often include customers, suppliers, re-sellers, and internal stakeholders (such as union representatives and machine operators) who are defined as *partners*. Observing a diverse body of people within the organization involved with key suppliers, customers, and resellers in highly focused problem-solving modes sends powerful messages about organizational priorities to participants as well as peripheral observers. The manufacturing manager from High-Auto Inc., describing the culture of inclusion and the emphasis on seeking input from stakeholders and building consensus in the frequent meetings, notes: The difference [here as compared to previous new-product projects] is it's a multi-functional team and we have equal say in what happens. Because everything's by consensus. You've got people off the shop floor that are helping to design and determine what kind of machines we buy. It's incredible. I mean, those are the people who have to use 'em, for God's sakes. Their involvement is critical. We've learned that.

Regularly scheduled training programs, and particularly those held under the auspices of Total Quality Management (TQM) initiatives that engage all organizational members, emerge as powerful rituals for building cohesion, focus, and a collective commitment to new-product quality. In both high innovation-supportive firms (High-Jet Inc. and High-Auto Inc.), special workshops are held to improve the human-interactions skills of participants. In High-Auto Inc., the leader personally sought and was provided with leadership training. In Mid-Tech Inc., a company with a midto-high innovation-supportive culture, a training session called Managing Change conveys senior management's commitment to innovation over the long term and reduces the resistance that can emerge during the implementation of new ideas (see Figure 4 for a brief description of Mid-Tech Inc.). In each of these three firms, senior-management- sponsored rituals including formal meetings, training workshops, and off-site team-building retreats send clear messages to participants that (a) teamwork is important, and (b) intensive investment of time and energy, and acquisition of new ideas and skills that support teamwork, are expected. The marketing manager from High-Jet Inc. (over twenty years of previous experience in engineering) notes:

What helped us a lot was TQM. We followed all the recommendations, and probably the

Mid-Tech Inc. is a division of a larger hightechnology organization and manufactures radar systems (about 1000 divisional employees, over \$250 million in sales). Their core technology was initially directed toward products for the defense industry. Currently, the organization is attempting to develop applications for civilian markets.

FIGURE 4 A Mid-to-High Innovation-Supportive Culture

best one was to train the executive management of the organization...formally train them all in TQM principles and team building. And those people [senior managers] conducted the training seminars for the rest of the organization. And that tells everyone that management takes this seriously. You better learn this stuff; we're not just going through the motions.

In low innovation-supportive cultures, in contrast, the new-product process is highly ritualistic in form but not in substance. Even though people go through the motions and participate in seniormanagement-sponsored rituals, few sustaining improvements in thinking, learning, or doing occur. For instance, the new-product process in Low-Mech Inc. is rich with senior management rhetoric, mandates, and prescriptions for behaviors. Meetings are inordinately dominated by R&D and are heavy with distrust, paranoia, and lack of confidence in others. Participants cheer aloud but whisper, "That can never happen" under their collective breaths. The project director's words suggest that meetings are held less for synergistic cross-fertilization of ideas and more for creating opportunities for senior management to monitor progress and provide what they see as necessary advice:

There might be some times where quality [department] doesn't feel like they're being heard, or manufacturing doesn't feel like they're being heard. They [manufacturing] have been cut short on time to procure parts for manufacturing and they made an issue of it [at the meeting] so that other managers would also be made aware of it. Typically...[it is for] information gathering and also to let our management know where we are, what kinds of problems we're incurring, and maybe also so they can give some direction and make suggestions on how we might handle certain things.

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In Low-Electric Inc., the rituals of meetings and workshops are imposed by the dominant functional group and resisted by other participants. The design engineering department head notes: Those kinds of education [from workshops] don't sink in when they're such a small part of your job. [The dominant department's head] has often mentioned that he wants [his people] to get more involved with what we do and learn more about what we do ... But to learn anything significant in the other field is going to cost time, and nobody's got the time for that kind of education. [I've had] ... some very, very frustrated engineers come to me just overwhelmed. So [the workshops and meetings are] a nice ideal, and it's one that's talked about and promoted verbally here, but there isn't any way of doing it. Unless we work two shifts, one for education and one to get the job done.

Hence, despite the seemingly common structure of rituals, i.e., meetings, training programs, and formal sessions for information exchange, they serve contrasting functions in high and low innovationsupportive cultures. In the former, rituals serve to galvanize opinions from open discussions, slaughter sacred cows, test previously untested conjectures, and air differences. Rituals allow members to span conceptual boundaries, create a team identity, and define their behaviors in informationrich, high-trust environments. In the latter, rituals tend to emphasize the pecking order and clear differences that exist in the stature of participants and, worse yet, reinforce existing micro-cultures and breed resentment.

Physical Symbols

Physical and material symbols include layout and design of the work environment, the displayed documentation, and other concrete objects that signify the organization's priorities and desired behaviors of its members.¹⁶ The topography and layout, coupled with the artifacts of highly innovationsupportive cultures, symbolize free choice, equality, and entrepreneurial energy. For instance, participants from High-Auto Inc. carry walletsized, laminated mission statements that they developed during the initiating stages of team development. The leader explains:

Each team has a mission statement. We [the team] came up with our mission statement. Everybody's got a copy of that. We got it reduced and laminated so people can carry 'em around in their planners. And I pull these out in meetings. And it got so that people would pull them out. If there was some conflict or something, people would go, "Hey, our mission statement says this and this and this."

The mission-statements-in-wallets serve as powerful symbols of collective ownership, commitment, and focus. They reflect the sense of involvement and belongingness that participants feel toward new-product initiatives. In addition to developing their mission statement, the cross-functional team from High-Auto Inc. has drawn and conspicuously displayed its product-development process chart. Drawn in the shape of a wheel, it shows the linkages among participants—signifying the high level of information exchange that occurs, the nearly flat structure, and the absence of a pecking order.

Similarly, the layout of the organization holds much symbolism in highly innovation-supportive cultures. Co-location, to the extent that people in each department exist in close human contact with people from other departments, is common. In High-Jet Inc., the functional department heads share adjacent offices in ways that maximize their interactions. In Mid-Tech Inc., the leader insists on co-locating team members for the duration of the new product project. In High-Auto Inc., the leader organizes off-site retreats to ensure that participants located in different facilities have the opportunity to know each other. The distinctive synergy we find in highly innovation-supportive cultures appears to result largely from the conscious reduction of distance, both spatial and perceptual, among participants.

The layout of the organization holds much symbolism in highly innovationsupportive cultures.

The two-way radios used by the new product team from High-Auto Inc. to ensure real-time contact between members at all times have become a powerful symbol of collaborative teamwork. The electronic umbilical cord they have developed over radio frequencies, to ensure that high levels of information and idea sharing occur, sends powerful messages about the connectedness among participants and the priority attached to rapid, seamless information exchange. Additionally, during the final phase of the new-product process, the leader has set up a trailer on the production floor, conspicuously titled Launch Control Center, which functions as the nerve center for the new-product team. In addition to housing new-product-related documentation and serving as a meeting place exclusively devoted to participants, it symbolizes

the high priority that senior management places on product innovation. The team leader notes:

Another thing we did was we brought a house trailer in, we put it right in the middle of the factory floor, and it was our launch center. Launch control. Anything to do with the launch of this product was centered out of that trailer. We had our daily meetings there, we had our problem meetings, we had scheduling updates... everything was done out of that trailer. And the trailer stayed for four months out on the floor. If anybody wanted to communicate with anyone about the project, they went to that trailer.

In low innovation-supportive cultures, the topography and layout symbolize division, distrust, and the lack of interest in cooperation. For instance, in Low-Mech Inc., R&D is housed in a separate building over a mile away from the one shared by the marketing and production departments. All meetings are held in the spanking new R&D facility, symbolizing their dominance in the new-product process. The conversations that occur during the "meeting after the meeting," i.e., the grousing among manufacturing and marketing representatives during the drive back to their offices, undoes most of the dispassionate meeting of minds that occurs during the formal meeting. The spatial distance also contributes to the negative stereotypes that each function develops about the other. The marketing manager from Low-Mech Inc. explains:

Right now we're separated by a mile, which could be the other end of the earth for all that matters.... You can't just go into an engineer's office... and say, "Look at this problem." So the only time that we really go over to see them is when we have a *real* problem. The only time engineering sees Joe is, "Okay, Joe's got a problem." So, now when you put Joe into the meetings, it's like, "Oh, it's that complainer."

In sum, it is hard to make a case that productinnovation settings with highly innovationsupportive cultures produce different results because of readily apparent differences in the talents and aspirations of their participants. The distinctive artifacts of highly innovation-supportive cultures provide, on the other hand, one explanation for the somewhat dramatic differences that exist in participants' belief and value systems and behavioral patterns, and for the differences in the newproduct outcomes they produce.

Learning about Highly Innovation-Supportive Cultures

In this discussion, we highlight practical insights about cultures drawn from the collective voices of managers as they speak to the issues of leadership in the turbulent, highly interactive context in which they function. We aim to stimulate thinking about fostering innovation-supportive cultures in practice and provide additional illustrations of existing ideas in the culture, leadership, and organizational-change literature.¹⁷

Culture and Leadership

Cultures in product-innovation settings are the collective creation of all participants. Cultures emerge as much from the bottom-up choices made by participants as they do from top-down decisions of leaders. As scholars have noted in other contexts, cultural transformation relies on leadership as well as the willingness and the capacity of participants to manage their anxiety about change, trust others, discard old and adopt new value and belief systems, and learn new behaviors.¹⁸ The importance of technically trained and interpersonally skilled leaders, who possess the autonomy to shape the culture of product-innovation settings and the product-innovation process, however, is hard to overemphasize.¹⁹ In our sample of firms, leaders play a critical role because they (a) carefully select participants—based on their beliefs that not all organizational members will function effectively in product-innovation settings; and (b) overcome the often choking influence of existing norms and focus and channel resources to new-product processes, even when existing power coalitions within the firm tend to regard new activities as quasi-legitimate, threatening, and/or undeserving of resources. While grass roots-level transformation in values and behaviors seems possible without leader encouragement, we find participants less likely to gain legitimacy for their new-product activities or to access resources without strong leadership.²⁰

The Interactive Context of Culture Change

Highly innovation-supportive cultures emerge in product-innovation settings not as much from the sustaining power of one or a few actions of leaders as they do from the intense, formative, and error-prone interactions that leaders are called on to manage on a day-to-day basis. Highly innovation-supportive cultures elude all but a select few organizations largely because these interactions are complex, occur simultaneously, and at multiple levels.²¹ We identify three types of interactions and day-to-day interventions, and expect that more will emerge as the issue of building innovation-supportive cultures attracts more discussion. These three are the interactions between (a) multiple subcultures and new values, (b) participants' implicit and explicit knowledge, and (c) the emerging culture, the setting, and the new-product strategy.

First, for instance, leaders are called on to manage the intense interaction among subcultures and their own values.²² Participants bring a smorgasbord of talents, orientations, values, allegiances, and aspirations to the product-innovation setting. They are required, however, to discard old and learn new ways of making sense of their environment, develop shared values, and adopt new behaviors as a result of interacting with others. Success in creating highly innovation-supportive cultures may be attributed in large part to the leaders' ability to (a) understand the contextspecific nature of subcultures and the sensemaking process of participants even as they foster high levels of information sharing and interactions, (b) understand how subcultures interact and evolve into new social environments, and (c) infuse their own vision and values into their interactions with participants so that new meanings are drawn, new values are internalized, and new behaviors are learned.23

Interactions between multiple subcultures can be managed in several ways. For instance, the leader from Mid-Tech Inc. places all participants in the same office and requires them to follow a seating chart that forces design engineers from R&D to sit next to production engineers. He says:

The first thing you gotta do is physically colocate these guys away from the functional groups and managers. Our functional managers and functional folks are located on the second floor of this building. This team is locked away in a room on the first floor, all co-located, and the more you can do that, the better off you are. Because that gets them away from mother telling them what to do and gets them out on their own where they have to think about what to do for themselves.

Explaining how he created a venue for cross-fertilization of subcultural norms to occur, he further notes:

We're making sure that as much of this prototype is built on the manufacturing floor as possible. In the past, there would be a large tendency to build this prototype in the engineering lab. We're saying we're not going to do that here. We must build it on the manufacturing floor with manufacturing people involved and get their input. We have invited some of those assemblers to our design reviews [in the team meetings]. We've tried to invite people off the factory floor, who will be assembling things, to come and critique our design. And the closer we get to this stage, the more and more we're going to do that so we gradually get them to take ownership for this design and product.

Second, we find leaders called to manage the intense interactions between participants' tacit and explicit knowledge (see Figure 5 for definitions). By interaction, we refer to the process by which participants in product-innovation settings (a) articulate and make explicit to others their deeply held, tacit knowledge about their areas of expertise and discuss their core values and aspirations, (b) intensely exchange explicit information in ways that expand their way of thinking, informed by the diverse talents, knowledge bases, and aspirations that exist in their settings, and (c) integrate the new, emerging, explicit knowledge into their tacit understanding of the new-product task.²⁴ For high levels of tacit⇔explicit interaction to occur, effective leaders foster a social environment of integrity and trust in which participants feel comfortable seeking clarifications, testing their understanding, proposing risky ideas, offering dissenting opinions, and making themselves vulnerable to feedback from others. The tacit⇔explicit interactions largely determine the extent to which participants make use of others' knowledge, build on others' creative insights, and harness the synergistic potential of product-innovation settings. Explaining how he uses an intensive schedule of formal meeting rituals to ensure high levels of tacit explicit interaction, the leader from High-Auto Inc. notes:

[In the current NPD process] there's constant meetings with the team, there's constant meetings with the current functions out there on the [manufacturing] floor, there's constant meetings with the union to make sure they're aware of what's going on. There's constant meetings with the [senior management] explaining to them what is happening with the program. As we get closer to launch this product, there are more and more frequent meetings. Tacit Knowledge. Refers to the deeply held knowledge developed from a lifetime of experience and learning that is often difficult to articulate and transmit entirely in clear, understandable language. For instance, it relates to what a marketing manager *just knows* about the multifaceted complexities of building relationships with customers, that others without similar experiences are unlikely to know or readily understand when articulated in simple language.

Explicit Knowledge. Refers to that fraction of deeply held knowledge which managers can translate into clear words and transmit to others. It is a fraction because managers clearly know more about their areas of expertise than they can articulate to others.

FIGURE 5 Tacit and Explicit Knowledge

Third, once senior management sets new technological directions for product innovations and commits to organizational change, leaders are called on to manage the intense, day-to-day interactions between the culture (i.e., the cognitive and social environment and its belief and value systems), the emerging new product strategy (i.e., technologyand product-related objectives and resourcedeployment choices), and the setting (i.e., participants, structure of decision-making, and workflow). The culture, strategy, and setting emerge together from an interactive, mutually adaptive context (see Figure 6). Effective management of the three-way interaction ensures that (a) change in one is matched by congruent changes in the others, and (b) each factor remains flexible enough to accommodate change, concrete enough to attract continual resource commitment from senior management, and stable enough for participants to develop a sense of continuity, belongingness, and emotional commitment to the product-innovation process.

Clear practical lessons emerge from these insights. First, senior-management efforts to impose the new-product strategy or the working of the product-innovation setting may get in the way of the co-evolution and effective new-product development. We saw clear evidence of such impositions in the low innovation-supportive cultures in our study. Second, academic attempts to isolate structure and strategy from their cultural context, and assess their independent, unique impact on

August

CULTURE

(Beliefs, value systems, assumptions dominant in the social and cognitive environment reflected in a consistent pattern of behaviors)



FIGURE 6

Co-evolution of Culture, Strategy, and the Product-Innovation Setting

new-product development outcomes (such as the effect of structure on development speed or costs, and/or on profit from sales), may well overlook the central impact of the interactions and the resulting synergies that we observed.

The complexity of interactions occurring at multiple levels suggests that highly innovationsupportive cultures are more likely to emerge when leaders focus on simultaneous rather than serial change and regard it as part of what they do on a day-to-day basis. The context of three-way adaptations appears essentially kaleidoscopic, with potential for a large number of permutations. Changes in any one, i.e., in the new-product strategy, the underlying values, the behaviors, the infrastructure, or cultural artifacts, triggers changes in others, often in unpredictable ways. Unless carefully managed, they can spiral out of control, leaving leaders powerless to effect meaningful, sustained change. Among other things, the anxiety caused by the prospects of dealing with unintended consequences of these kaleidoscopic changes seems to paralyze the leadership in low innovation-supportive cultures and increase their reliance on controls and directives.²⁵

Highly innovation-supportive cultures are more likely to emerge when leaders focus on simultaneous rather than serial change and regard it as part of what they do on a day-to-day basis.

Education and training programs are widely used and recommended by leaders from our highly innovation-supportive cultures. However, the ability of these leaders to harness the power of cultural artifacts has much to do with the internalization of new values among participants. The importance of understanding the multiple subcultures—and the impact of stories, rituals, and physical symbols in shaping the links between multiple subcultures, explicit and tacit knowledge, and new-product strategy and culture—is hard to overemphasize.

Culture as a Frame of Reference

Our findings reinforce the notion that in times of uncertainty and ambiguity engendered by changes in new-product processes, organizational culture can serve as a powerful frame of reference for thinking and actions. Even if senior management favors innovation, implementation of new-product processes is frequently impaired by their inability to alter core cultural values and beliefs. The culture shock that participants experience—as they struggle to eliminate the influence of old stories, rituals, and artifacts, even as they develop new ways of thinking about managing new-product-related decision-making and work flows, and new ways of thinking about interdependent, collaborative relationships with others-stands out in sharp relief in the firms we observed.

A careful analysis of an organization's culture the deeply held, tacit beliefs and value systems that lie at the core of organizational thinking and action—and an intimate understanding of its socially constructed fabric rich with stories, rituals, and artifacts can be helpful in developing meaningful ways to understand why participants in new-product processes behave the way they do. We believe that such analysis must occur. After achieving acceptable levels of product-development effectiveness, the challenge of developing significantly higher levels of collaboration, creativity, and innovation appears to relate to the way in which the fuzzy, amorphous nature of culture is integrated with the hard, cold analysis of technology, customers, markets, and competitors. In this fuzzy realm of interpretations, beliefs, and value systems lie the clues for differentiating wildly innovative participants that take quantum leaps in creativity and innovation from those that are just plain adequate.

Endnotes

¹ Pettigrew, A. M. 1979. On studying organizational cultures. Administrative Science Quarterly, 24 (4): 570–576; and Goffee, R., & Jones, G. 1998. The character of a corporation: How your company's culture can make or break your business. New York: Harper Business.

²Zien, K. A., & Buckler, S. A. 1997. From experience. Dreams to market: Crafting a culture of innovation. Journal of Product Innovation Management, 14(4): 274–287; and Frohman, A. L. 1998. Building a culture of innovation. Research Technology Management, 41(2): 9–12. Also see Kitchell, S. 1995. Corporate culture, environmental adaptation and innovation adoption: A qualitative and quantitative approach. Journal of the Academy of Marketing Science, 23(3): 195–205; and Tushman, M. L., & O'Reilly, C. A. 1997. Winning through innovation: A practical guide to leading organizational change and renewal. Boston: Harvard Business School Press. The term innovation-supportive with similar connotations was used earlier by Gaylen, N. C., Keller, C., & Lyons, D. W. 2000. Unraveling the determinants and consequences of an innovation-supportive organizational culture. Entrepreneurship Theory and Practice, 25 (1): 59–76.

³ For discussion of culture as a catchall term, see Denison, D. R. 1996. What is the difference between organizational culture and organizational climate? A native's point of view on a decade of paradigm wars. Academy of Management Review, 21(3): 619–634.

⁴ We term our sample high-technology firms because they rely overwhelmingly on new products from new technologies to remain competitive, employ a disproportionately larger number of scientists, engineers, and technically qualified people when compared to other firms, and face higher levels of product obsolescence. See Von Glinow, M. A., & Mohrman, S. A. 1990. Managing complexity in high technology organizations. New York: Oxford University Press.

Our exploratory study of new-product development was conducted in two stages. We aimed to explore, identify, and develop meaningful ways of thinking about the important and understudied human-interaction, team, and organizational issues of new-product development based on the voices of managers directly involved in the process. We initially conducted a literature review and a pilot study in which we depth-interviewed six managers responsible for developing new products from four high-technology firms. We asked them to discuss their product-innovation-related thinking, actions, and interactions with others, and issues that they viewed as focal and problematic. We content-analyzed their responses, revisited the literature, and derived a set of research questions that were both managerially relevant and understudied.

Based on the research questions, we developed an interview protocol to guide and structure the depth-interviews we conducted in the second phase of our study. We interviewed forty managers involved in new-product development from ten midto large-sized high-technology firms (at least one from R&D, marketing, and manufacturing from each firm). We also interviewed individuals identified by participants as important contributors, such as project-team leaders and division heads. To encourage candid answers, we guaranteed confidentiality. All participants were asked all of the questions in our interview protocol, and mostly in the same order to enable comparison across responses. The depth-interviews were formative to the extent that we asked probing questions and sought clarifications and examples from each participant.

The interviews, lasting between 90 and 120 minutes, were tape-recorded and transcribed. For content analysis, we followed the guidelines offered by Blumer, H. 1969. Symbolic interactionism: Perspective and method. Englewood Cliffs: Prentice Hall; Bogdan, C. R., & Biklen, S. K. 1982. Qualitative research for education: An introduction to theory and methods. Boston: Allyn & Bacon; Burrell, G., & Morgan, G. 1979. Sociological paradigms and organisational analysis. London: Heinemann; Glaser, B., & Strauss, A. 1967. The discovery of grounded theory. Chicago: Aldine; Miles, M. B., and Huberman, A. M. 1984. Qualitative data analysis. Newbury Park, CA: Sage; Miles, M. B., and Huberman, A. M. 1994. Qualitative data analysis. Newbury Park, CA: Sage; Patton, M. Q. 1990. Qualitative evaluation and research methods. 2nd ed. Newbury Park, CA: Sage; and Taylor, S. J., & Bogdan, R. C. 1984. Introduction to qualitative research methods: The search for meanings. 2nd ed. New York: John Wiley & Sons.

⁵ For additional definitions of culture, see Detert, J. R., Schroeder, R. G., & Mauriel, J. J. 2000. A framework for linking culture and improvement initiatives in organizations. *Academy of Management Review*, 25(4): 850–863; and Schein, E. H. 1992. Organizational culture and leadership. 2nd ed. San Francisco: Jossey Bass.

⁶ For the epistemology of culture, see Denison, op. cit. For quantitatively assessed dimensions of culture, see Hofstede, G., Neuijen, B., Ohayv, D., & Sanders, G. 1990. Measuring organizational cultures: A qualitative and quantitative study across twenty cases. Administrative Science Quarterly, 35(2): 286–316. For culture as inseparable from organizations, see Smircich, L. 1983. Concepts of culture and organizational analysis. Administrative Science Quarterly, 28(3): 339–358.

⁷ See Schein, E. H. 1990. Organizational culture. *American Psychologist*, 45(2): 109–119; and Kanter, R. M. 2000. A culture of innovation. *Executive Excellence*, 17(8): 10–11.

⁸ For accelerated development time as an indicator of new product development efficiency, see Vesey, J. T. 1991. The new competitors: They think in terms of speed to market. *The Academy of Management Executive*, 5(2): 23–33; and Kessler, E. H., & Chakrabarti, A. K. 1996. Innovation speed. A conceptual model of context, antecedents, and outcomes. *Academy of Management Review*, 21(4): 1143–1164. For commercial success as an indicator of new-product-development effectiveness, see Dougherty, D., & Hardy, C. 1996. Sustained product innovation at large, mature organizations: Overcoming innovation-to-organization problems. *Academy of Management Journal*, 39(5): 1120– 1153.

⁹ See Frohman, op. cit.

¹⁰ See Detert, et al., op. cit., for discussion about the prevalence of culture studies devoted to artifacts.

¹¹ For cultural artifacts without specific reference to product innovation, see Hofstede, G. 1991. *Culture and organizations: Software of the mind*. London: McGraw-Hill; Martin, J. 1992. *Cultures in organizations: Three perspectives*. New York: Oxford University Press; and Wuthnow, R., & Witten, M. 1988. New directions in the study of culture. *Annual Review of Sociology*, 14: 49–67. ¹² For cultural artifacts of product-innovation settings, see Buckler, S. A., & Zien, K. A. 1996. From experience. The spirituality of innovation: Learning from stories. *Journal of Product Innovation Management*, 13 (5): 391–405. Zien & Buckler, op. cit; and Tushman & O'Reilly, op. cit.

¹³ Weick, K., & Roberts, K. 1993. Collective mind in organizations: Heedful interrelating on flight decks. *Administrative Science Quarterly*, 38 (3): 357–381; and Detert, et al., op. cit.

¹⁴ Boje, D. M. 1991. The storytelling organization: A study of story performance in an office-supply firm. *Administrative Sci*ence *Quarterly*, 36 (1): 106–126; and Martin, J., Feldman, M., & Sitkin, S. 1983. The uniqueness paradox of organizational stories. *Administrative Science Quarterly*, 28: 438–453; and see Buckler & Zien, op. cit.

¹⁵ Pettigrew, op. cit; and Trice, H., & Beyer, J. 1992. *The culture of work organizations*. Englewood Cliffs, NJ: Simon & Schuster.

¹⁶ Schein, E. H. 1986. Are you corporate cultured? *Personnel Journal*, 65: 82–97.

¹⁷ Since our learning originates from our exploratory study, it should not be construed as a how-to primer on cultural change, or as easily replicable conclusions that guarantee results in all product-innovation settings. Similarly, since our findings emerge from high-technology manufacturing firms, our learning speaks mostly to managers involved in developing high-tech product-service bundles, rather than to those involved in developing new services.

¹⁸ Floyd, S. W., & Lane, P. J. 2000. Strategizing throughout the organization: Managing role conflict in strategic renewal. Academy of Management Review, 25 (1): 154–177. ¹⁹ Frohman, op. cit.

²⁰ Dougherty, D., & Heller, T. 1994. The illegitimacy of successful product innovation in established firms. *Organization* Science, 5 (2): 200–218. Also see Henderson, R., & Clark, K. 1990. Architectural innovation: The reconfiguration of existing product technologies and the failure of established firms. *Administrative Science Quarterly*, 35: 9–31.

²¹ For simultaneously occurring organizational changes, see Brown, S. L., & Eisenhardt, K. E. 1997. The art of continuous change: Linking complexity theory of time-paced evolution in relentlessly shifting organizations. *Administrative Science Quarterly*, 42 (1): 1–34.

²² Schein, E. H. 1996. Three cultures of management: The key to organizational learning. *Sloan Management Review*, Fall: 9–20; and Goffee & Jones, op. cit.

²³ Saffold, G. S. 1988. Culture traits, strength and organizational performance: Moving beyond "strong" culture. Academy of Management Review, 13 (4): 546–558. Also see De Long & Fahey, op. cit.

²⁴ Nonaka, I. 1991. The knowledge creating company. *Harvard Business Review*, 69(6): 96–105. Also see Mascitelli, R. 2000. From experience. Harnessing tacit knowledge to achieve break-through innovation. *Journal of Product Innovation Management*, 17 (3): 179–193.

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