Improving the way organizations run through participative planning and management.
Achieving coherence out of chaos is about building organizations that respond to change, crises, and challenges with poise and balance. It’s about organizations of people who know how to manage themselves mentally and emotionally, who care about the organizations they work in, and are motivated to manifest their best qualities.

Our view is that a new level of organizational efficiency, synchronization, and effectiveness is possible by studying and applying new information about the intelligence of the human system. Organizations will make only incremental improvements in effectiveness and sustainability until a more thorough and sensitive understanding of human processes resides at the core of how organizations function. We propose new ways to achieve such organizations, grounded in science, practicality, and the intelligence of the human heart and intellect. It is designed to educate, inspire, and stretch you into new understandings that can affect how you live, and how you lead or influence your organization.

It helps to start by facing up to what is really going on in the workplace for most people. It would startle most managers to know how much time each week people spend thinking and emoting over their problems. If a computer readout showed the kinds and amounts of hormones released into the body as a result of those thinking habits, and the negative health consequences, you might insist that your people make some mental and emotional adjustments. Then, if you could trace a path of poor decisions and lost opportunities arising from the emotional inefficiencies of your people, you would take action. However, there is currently no easy way to see these patterns, yet we are still faced with incoherence in our organizations.

When we founded the Institute of HeartMath in 1991, we knew that individuals’ levels of stress would increase dramatically in the future. Globalization in communication technology, and markets, along with increasing cultural diversity on all continents were examples of how the rules of the game were changing faster than people could keep track. One of the most profound ironies is that, in the late 1990s, many of the world’s technology-driven economies are enjoying unprecedented growth and expansion yet, in our experience, personal fulfillment plummets and fear...
soars. The Y2K computer problem exemplifies the type of chaos facing us today. The resulting uncertainty and anxiety has compelled people to ask new questions of themselves and their organizations.

Conveniently, new answers have arrived on the scene. Research studies during the last decade profoundly affected our knowledge of human intelligence, opening up surprising new possibilities. The knowledge that intelligence is distributed throughout the human system, and that the heart is an intelligent system profoundly affecting brain processing, represents an exciting new model for helping organizational systems become more intelligent, more adaptive, and more humane.

Our team set out to build a coherent organization that would put both care and efficiency at the heart of all our activities: care for our clients and ourselves, efficient service for our customers, and internal efficiency for ourselves. Many of the 20 or so who formed the original core team had worked in companies or public agencies mired in incoherence and ineffectiveness. Human values often were absent, and so was business efficiency. Early on, we recognized a link between the heart of a person and the heart of an organization. We knew organizations reflect the collective mind-sets and attitudes of the people who inhabit them. We also knew that the next step was a new, more coherent system that addressed how people feel and how they perform.

Before continuing, it would be useful to define chaos and coherence. Coherence means a logical connectedness, internal order, or harmony among the components of a system. The term can also refer to the tendency toward increased order in the informational content of a system or in the information flow between systems. When a system is coherent, virtually no energy is wasted because of the internal synchronization among the parts. In organizations, increased coherence enables the emergence of new levels of creativity, cooperation, productivity, and quality on all levels. Chaos is great disorder or confusion, incoherence.

The work that we and other researchers have done has yielded important insights into human physiology and the consequences of stress, with organizational effectiveness. We've learned much through extensive research, direct work with dozens of public and private sector organizations, and experience growing our three organizations. Through this process we developed Inner Quality Management® (IQM), a set of scientifically-based tools for bringing people and organizations into coherence (see appendix). There are four dynamics of Inner Quality Management that, in healthy organizations, are integrated. They involve a thorough, research-based set of tools for: 1) Internal self-management. 2) Coherent communication. 3) Boosting the organizational climate. 4) Strategic processes and renewal. For the purposes of introducing you to what we have learned in our work in a brief article,
Achieving Coherence Out of Chaos: The Inner Quality Management® Model

Developing Inner Quality Management, continued

we will focus on the emotional virus. A more complete discussion is found in our book, From Chaos To Coherence: Advancing Emotional and Organizational Intelligence Through Inner Quality Management, published by Butterworth-Heinemann.

The Emotional Virus

Most of us intuitively understand that the climate of one’s workplace has an impact on how people feel and perform. In using the term climate, we refer to the collective atmosphere of a workplace: the attitudes, perceptions, and dynamics that affect how people perform on a daily basis. Climate, like the weather, is not static and unchanging. Nevertheless, as with any locale, certain climate patterns are unique to each organization. More importantly, we all are involved in creating our organizational climate on a daily basis.

A healthy organizational climate is proven to boost productivity

The elements of a healthy organizational climate include supportive management, contribution, self-expression, recognition, clarity, and challenge. For almost a century, researchers have explored the causes of work-related injuries, a major cost to any organization and one of the earliest and roughest measures of organizational incoherence. At first, it was believed certain employees were more “accident prone” than others, but studies failed to support this contention as a definitive personality trait. Research then shifted to uncovering the personality traits that differentiated workers who were hurt from those who avoided injury. Looking into the psychology of safety became essential as organizations such as OSHA and the National Safety Board in the United States determined that 90% of all accidents are caused by an individual performing an unsafe act, while only 10% are caused by unsafe working conditions.

The vast majority of workers today are employed in nonmanufacturing jobs, where workplace safety concerns focus more around issues such as ergonomics, workload, and mental and emotional processes. Yet workers’ compensation claims are soaring in many non-manufacturing sectors of the economy. Health, safety, and environmental issues are growing in importance, especially in high technology, petroleum and aviation, where disregard for these issues can be catastrophic. Dr. Phil Smith, an organizational psychologist working in the United Kingdom and Hong Kong, reviewed 61 studies of job burnout in 1997:

Of the three facets of burnout—emotional exhaustion, depersonalization and diminished personal accomplishment—emotional exhaustion is most sensitive to factors which negatively influence workplace climate, and is the strongest predictor of attachment to the organization. Interestingly, job stressors such as role stress, workload and role conflict have a disproportionate impact on emotional exhaustion, not equaled by the relief provided by resources such as social support, job enhancement and reward structure. This implies that attempts to compensate for the effects of stressful work environments by the provision of additional resources may not be successful.

Dr. Smith goes on to suggest that, “While a good emotional climate is not by itself sufficient to ensure success, a bad climate is certain to prevent it.”
The Brown & Leigh study

Underlying the Inner Quality Management model is the understanding that your effectiveness in anything—career, marriage, relationships, recreation—is based on activating the most intelligent perceptions of yourself, your environment, and those with whom you interact. Most of us would agree with this principle. However, there is little research showing a direct, measurable link between one's perception of the workplace climate and one's own performance. A groundbreaking study by Steven P. Brown and Thomas V. Leigh, published in 1996 in the Journal of Applied Psychology, sought to investigate the process by which workplace climate is related to employee involvement, effort, and performance. The researchers chose 178 salespeople in three different companies as the test subjects. Sales results were monitored and correlated with the study's predictions, providing a bottom-line context for the study outcomes. Based on numerous previous studies, Brown and Leigh designed their study to examine six dimensions of a workplace's psychological climate (See Figure 1.):

- Supportive management—The extent to which people feel supported by their immediate manager.
- Clarity—The degree of clarity about what is expected of an individual.
- Contribution—The feeling that one's contribution is worthwhile.
- Recognition—The feeling that one's contribution is recognized and appreciated.
- Self-expression—Feeling free to question the way things are done.
- Challenge—The feeling that one's work is challenging.

The 178 salespeople were surveyed on these six aspects of their managers' attitudes and the workplace climate. The salespeople in turn were measured by their managers on three dimensions of work performance: achieving sales objectives, extent of technical knowledge, and administrative performance. The study results were significant and supported the researchers' predictions. The researchers determined that an organizational climate perceived by employees as psychologically safe
The Brown & Leigh study, continued

and meaningful positively affects productivity. This occurs when:

- Management is perceived as supportive
- Work roles are well-defined
- Employees feel free to express and be themselves
- Employees feel that they are making a meaningful contribution
- Employees are appropriately recognized for their contribution
- Employees perceive their work as challenging.

Then, employees are more involved in their job and exert greater effort. This leads to measurable improvement in sales, administrative performance, and product knowledge.

Ignoring the climate

The health consequences of ignoring the workplace climate was researched in a long-term study of British civil servants. The study indicated that employees with little control over their working environment face a significantly higher risk of heart disease than those with authority to influence their job conditions. “Our research suggests that illness in the workplace is to some extent a management issue,” said Michael G. Marmot, director of the International Centre for Health and Society at University College in London and lead author of the report. “The way work is organized appears to make an important contribution” to the link between socio-economic status and heart-attack risk. The study tracked nearly 7,400 men and women in London civil-service jobs for an average of more than five years. It found that those in low-grade positions with little control over their responsibilities were at a 50% higher risk of developing symptoms of coronary heart disease than those in higher level jobs. Since 1992, the United Kingdom has made companies liable for employee stress. Many successful lawsuits have been brought by employees against employers who created stressful environments. Similar legislation has not been passed in the United States. In the highly litigious American culture, one can imagine the economic and social chaos that would be wrought by such legal actions. Liability issues aside, organizations must deal on a daily basis with the consequences of unhealthy climates.

Thinking in terms of an “emotional virus”

An “emotional virus” is thriving in the unhealthy climates that exist in many organizations today. It is the net effect of emotional mismanagement and short-sighted management practices. And its corollary is this: organizational learning thrives when the organizational “immune system” is strong and vibrant.

Some organizational change agents call themselves organizational viruses, hoping to infect the organization with their view of needed transformation. Their intent, like a computer hacker’s, is to get in and out fast, before the organizational immune system kicks in to throw out the invader. This analogy is intriguing and quite appropriate, but our use of the term is an inversion of that. An organization is much like an organism. It requires a wide variety of nutrients and resources to be
Achieving Coherence Out of Chaos: The Inner Quality Management® Model

Emotional virus, continued

healthy; it can get sick in response to external stressors or internal imbalance and, unless it learns to heal itself, eventually becomes sick and dies.

A tendency to misdiagnose the underlying problem

Typically, when an organization recognizes something's not right, the solutions are to focus on cost cutting, process reengineering, product improvements, or improving customer service. While these well-intentioned initiatives are usually necessary, they are not sufficient. They focus on symptoms, not the cause. In many organizations, this classic Band-Aid approach actually creates more frustration, anger, and anxiety, while the organization, or organism, becomes even sicker. Once people are drained emotionally, the creative energy needed to develop new innovations is sapped. Additional energy is then expended in inefficient ways that put added strain on the people, and the downward spiral accelerates. Acrimony, mistrust, antagonism, and blame are just a few of the emotional reactions that take up residence in the workplace. Finger pointing becomes the preferred exercise program, and left unchecked, the very creative source for the organization is drained.

Some data: CSC Index

The 1994 CSC (Computer Sciences Corporation) Index “State of Reengineering Report” revealed these statistics undermining many organizational climates:

- 50% of the companies studied reported that the most difficult part of reengineering is dealing with fear and anxiety in their organizations
- 73% of the companies said that they were using reengineering to eliminate, on average, 21% of the jobs
- Of 99 completed reengineering initiatives, 67% were judged as producing mediocre, marginal, or failed results.\(^9\)

Understanding the emotional virus

Childre first coined the term “emotional virus” while he was consulting with a CEO who had attended an IQM program in California. The executive was concerned about the internal backbiting among several of his management teams, which was clearly affecting not only morale but also productivity in a key division. The emotional virus was described this way: It is the net effect of emotional mismanagement within an organization. As with other viruses, the emotional virus is highly infectious. People think it is okay to complain, whine, and sarcastically laugh—about the imbalanced coworker, the stressed out boss who ignores voice mail or e-mail, the department that just cannot get its act together—not realizing they have caught the emotional virus bug. Each casual complaint and unconscious judgment is like coughing in a coworker’s face, thus spreading the germs of negative emotions and creating a caustic, unfulfilling environment.

Once an outbreak of the emotional virus has been detected, the workplace should be quarantined until proper medicine arrives, but that is not the way business works—yet. In evaluating long-term growth, companies that spend time...
and money on eliminating the emotional virus will see a big return on their investment. Ignoring it and staying on the track of believing “that is just the way it is” is a dangerous move on the chessboard of future business.

People are changing and the worker of tomorrow will have a different set of standards for evaluating job satisfaction. This already is happening. The work-force already is demanding more harmonious working relationships. Salary, although still important, is not as high on the list as it used to be. Workers often are “cashing out,” taking less pay and moving into jobs more in line with their core values. Working in an environment where people do not stab each other in the back, where management and employees can have a more open dialogue, and where the employee feels connected to and proud of the company and its products are among the career core values people are adopting. The emotional virus eats away at these organizational qualities and many people are seeking a place to work where they do not have to witness watercooler and back-room character assassinations. It isn't that people can't take it. Millions do daily. Times are changing, however. As Doc told the CEO, “In the name of smart business, increased productivity, less employee turnover and lower health care cost, the emotional virus eventually will have to be dealt with.”

The workplace is not the only location where an emotional virus is on the attack. Many employees leave home or community environments full of viral activity. Without tools for effective self-management, people become drained emotionally because of the increasing pressures in society, family life, and their workplace. They are unable to recoup the lost energy, and the people around them soon become affected or infected. Like any virus, it spreads quickly if the organizational immune system already is weak.

The only way we have seen to eliminate the emotional virus or stop it before it gets out of control is to educate individuals who make up an organization on how to manage their thoughts and emotions. It has to come from the individual change of perspective within the people who make up an organization. It is usually essential to start right at the top with the senior management but it can start in a team of line workers and be highly effective. Just as the emotional virus spreads from person to person so does the antidote. As people in the organization, especially the most visible and influential ones, begin to actualize change within themselves, others soon will follow suit or move on to another environment that resonates with their attitudes.

Start by fostering an atmosphere of appreciation. Do not allow judgments to go on without pointing them out. Put more care into communication and use heart intelligence to make decisions, big and small, especially when the decision affects others. There is more but these suggestions, if applied with sincerity and consistency, at least will save you from becoming infected and go a long way toward helping your coworkers and your organization.
Who is to blame?

Executives or other highly visible employees often take the blame for being the carriers of the virus that has hit the company. Witness the unpleasant public departures of CEOs at Apple three times within five years, a company once noted for its innovative vision and people-oriented culture. Or the blindness of American automakers to their companies’ sickness while the Japanese gained dominance and market share. Many business magazines write gloating postmortems of once-hot executives, helping their demise become public. No company is immune from the emotional virus or its ravages. Yet, rarely do analysts look at the emotional coherence of the organization, so easy is it to blame missed product deadlines, bad decisions, or other external factors that have a deeper cause. It could be tempting to see the emotional virus as an isolated phenomenon. “It won’t happen here.” Reconsider some of the global statistics cited earlier.

The sudden collapse of several Asian economies in 1997 forced a reexamination of business potentials in that part of the world while affecting global commerce. What role has emotional mismanagement—greed, unhealthy competition, and the like—played in that drama? Similarly, could many of the stress-related health care and productivity-related costs of doing business today in Europe and North America be based, at least in part, on underlying emotional mismanagement and organizational structures that ensure a fertile environment for continued viral growth?

Is the procrastination in many organizations around Y2K issues an outcome of emotional overload on the part of these managers? We anticipate the situation will worsen as increasing globalization creates conditions perfect to mutate new strains of the emotional virus. As with populations that were isolated for centuries then devastated by disease brought by their conquerors, few have built the emotional resilience required to manage unprecedented change and uncertainty. In an age of connectivity, no one is isolated anymore.

How to strengthen the organizational immune system

Recent research in human physiology has revealed key aspects of immune system health with remarkable parallels in organizational behavior—the organization as an organism. In the human body, feelings like anger, frustration, and irritation weaken the immune system and drain vitality, leaving you more susceptible to colds, flu, and more serious illnesses. A recent Institute of HeartMath research study, published in the Journal for Advancement of Medicine, shows that even a five-minute episode of recalling an angry experience can suppress a key component of the immune system for as much as six hours. This research is showing the converse is also true: Attitudes like appreciation, care, and compassion significantly boost the immune system, and give you more resilience and strength to withstand sickness (see Figure 2).

With these positive feelings operating in your system, even if you do get sick, you recover more quickly and recoup lost energy. The more your system is balanced, the more intuitive insight you are capable of—intuition that can anticipate problems before they turn ugly.
How to strengthen the organizational immune system, continued

In this study, IgA (secretory immunoglobulin A), a key immune system antibody, was found to be suppressed for nearly six hours after a five-minute period of recalled anger. On the other hand, a five-minute period of feeling sincere care caused a significant short-term rise in IgA, and a gradual increase over a six-hour period.

Organizations are strikingly similar. Work environments characterized by excess stress, contention, and anxiety breed insecurity, unproductivity, and inhibit creativity. People do not want to come to work in these rigid, inflexible environments. The negative attitudes compound the pressure on an already strained organization. The last place most people look for answers is within; the first thing many will do is find someone or something to blame, reinforcing organizational rigidity.

The same attitudes proven to boost a person’s immune system are known to create a harmonious, productive and creative workplace. Where people are valued, appreciated and cared for, they produce more, have greater loyalty to their employer, and have higher levels of creativity (see Figure 3). Attitudes like appreciation, care, and compassion are not just sweet, they are powerful medicine for the virus.

The challenge in tracking and curing the emotional virus again is one of perception. Like a fish growing up in the Hudson River, assuming the polluted water was “real” water, many of the symptoms of the emotional virus are so prevalent, there seems no alternative, or they seem invisible, so maladapted are we to their effects. Common symptoms include:

- Caustic humor
- Constant stream of complaints
- Defeatism
- Resentment
- Us versus Them mentality
- Suspicion
- Frequent communication breakdowns

Figure 2. Emotions Can Affect the Body’s First Line of Defense Against Bacteria, Viruses, or Pathogens.

IgA concentration (mg/dl)

- Baseline
- Anger
- Care

After five minutes of care
After five minutes of anger

Elapsed time – six hours

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How to spot the emotional virus

The challenge in tracking and curing the emotional virus again is one of perception. Like a fish growing up in the Hudson River, assuming the polluted water was “real” water, many of the symptoms of the emotional virus are so prevalent, there seems no alternative, or they seem invisible, so maladapted are we to their effects. Common symptoms include:

- Caustic humor
- Constant stream of complaints
- Defeatism
- Resentment
- Us versus Them mentality
- Suspicion
- Frequent communication breakdowns
How to strengthen the organizational immune system, continued

• Ongoing fatigue or an overrushed pace of work
• Anxiety, fear, intolerance, resignation, antagonism, despair.

All these symptoms can be seen, heard, and felt in lunchrooms, around the coffee machine, by the copier, in mail rooms and boardrooms, and around the dinner table. Early detection and prevention is the best insurance policy.

Figure 3. Attrition Improvements

A summary of improving employee attitudes in three organizations utilizing the IQM technology. Data reflects responses to questions on feeling conflict between home/work priorities, desire to leave the organization, desire to quit the job, and feeling good about the job. The data collected shows an improvement in most measures. For each category, bars represent predata, and postdata.

Conclusion

There is a momentum of new intelligence that cannot be stopped, even though it may appear embryonic and fragile in the face of so much chaos and pain. Heart-based organizations will encourage and enhance the self-development and self-management of all their members. They will seek to maximize intelligence, not by aggravating people into doing more, but by nurturing, supporting, and stretching them. They will see the mental, emotional, and physical health of people in the organization as essential to productivity and long-term viability. They will see...
Conclusion, continued

communication as the flow of living information, which has the power to vitalize and regenerate. And they will create processes that renew and revitalize both the individuals and the organization, serving the needs of all. For all this intelligent effort, they will be rewarded with unheard of breakthroughs in innovation, customer loyalty, and personal fulfillment. They will have moved from chaos to coherence.

Notes

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6. Ibid., p. 361.

7. Ibid.


Author information

Doc Childre, CEO and President of HeartMath LLC. He is the architect of the HeartMath® System and founded the nonprofit Institute of HeartMath (IHM) in 1991 out of a sincere desire to help people and organizations deal with the ever-increasing stress in their lives. He assembled a talented team of researchers, educators and business people who care about the stresses people face today, and who are committed to providing practical, easy-to-use, scientifically-validated technologies to help people prevent and eliminate stress as it happens.

The HeartMath system has been featured in many major national and international print and electronic media and has case study results from business, public sector, education and health audiences. HeartMath training has been delivered in Fortune 100 companies, medium and small businesses, all branches of the military, state and federal governments, health and education organizations and to thousands of individuals worldwide. Childre has authored nine books on the HeartMath system and as a composer has created two albums which are used to complement HeartMath’s human performance technology. He is coauthor, with Bruce Cryer, of From Chaos to Coherence; Advancing Emotional and Organizational Intelligence through Inner Quality Management.

Bruce Cryer is Vice President, Global Business Development, HeartMath LLC. He has more than twenty years of experience in business management, human performance training and organizational change. Cryer helped launch the Institute of HeartMath and is one of the key architects of the Inner Quality Management® (IQM) training programs. IQM incorporates the Institute's innovative biomedical research into practical tools and strategies to enhance organiza-
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Bruce successfully guided HeartMath programs into the global corporate arena, with significant projects at clients such as Motorola, Hewlett-Packard, CIBC (Canadian Imperial Bank of Commerce), Royal Dutch Shell, LifeScan (a Johnson & Johnson company), and Cathay Pacific Airways. Bruce has also edited more than 25 books on human performance, stress reduction and education. He is on the faculty of the Stanford Executive Program.

Inner Quality Management® (IQM)

IQM is a multi-contact, research-based program that is customized to fit an organization’s business objectives. Introductory IQM workshops are offered regularly at the Institute’s research and conference center, in Boulder Creek, California. HeartMath’s proprietary assessment tools, coaching, and consulting services give ongoing feedback on effectiveness of the program while sustaining integration of the IQM process into the organizational culture.

Dynamic 1—Internal Self-Management

The FREEZE-FRAME® technology is a scientifically-based process for improving decision making and in the moment stress reduction. Participants learn the science of how and why to apply this powerful technique to job stresses, strategic planning, customer service, meeting effectiveness and personal interactions.

Dynamic 2—Coherent Communication

Interpersonal and organizational communication problems dramatically inhibit organizational effectiveness. Our Intuitive Communication process helps individuals and teams improve their ability to listen and to develop new clarity in their communication with co-workers, clients, customers and vendors, all of which translate into savings of time, energy and money.

Dynamic 3—Boosting Organizational Climate

Systems theory has demonstrated that no individual or team in an organization is truly separate from the organization itself. Research has also shown which attitudes prevalent within organizations enhance productivity and which attitudes compromise it. Participants learn how to create a self-sustaining atmosphere of respect, appreciation and care within the organization, increasing cooperation, coherence, commitment, and bottom line results.

Dynamic 4 Strategic Processes & Renewal

In this module participants learn IQM tools for project and strategic planning, and complex decision making. Participants also create an action plan for successful integration and application of IQM tools to ensure ongoing renewal, both personally and organizationally.

HeartMath LLC is an international training, coaching and consulting firm born out of research conducted at the Institute of HeartMath (IHM). It provides research-based programs to Fortune 100 companies, government agencies, military installations, and many other organizations. The term HeartMath was created by founder and CEO Doc Childre to describe a system of practical tools for uniting heart and mind within the organization and within the individual.

Founded in 1991, HeartMath programs have become recognized as leading-edge human performance technology that enhances both individual and organizational effectiveness. Their research shows that individuals and organizations become more coherent and smarter when a synergy of intellectual, intuitive and emotional intelligence occurs. They call this dynamic “heart intelligence.”

HeartMath Organizational Programs are based on a modularized program of scientifically-researched tools and processes to achieve and sustain high performance. These programs provide proven methodologies that bring out the best in people while giving the organization measurable outcomes to track program effectiveness and organizational health. Their website is: www.heartmath.com.
Chaos Theory and Creativity: The Biological Basis of Innovation

Dr. Ary Goldberger, Beth Israel Deaconess Medical Center and Harvard Medical School, Boston, Massachusetts

Introduction

My organization is the Beth Israel Deaconess Medical Center where I’m the Director of the Margret and H.A. Rey Laboratory for Nonlinear Dynamics in Medicine—two names that may be familiar to you. Margret Rey and her husband Hans wrote the Curious George books for children. We try to emulate the spirit of Curious George in our laboratory—we get into places where we don’t really belong. You may think that as a cardiologist I shouldn’t be researching chaos and complexity theory or human creativity. Most people don’t usually think that products of the imagination have much to do with biology. They are usually considered as separate disciplines: the arts and the sciences. They are in fact deeply melded. This article explores how chaos and fractal theory is relevant to health, to disease, to human creativity, and to what I call organizational pathologies.

Healthy individuals and organizations share the same three characteristics

As a physician I spend most of my time exploring the challenge of restoring and maintaining health. There are three defining characteristics of a healthy individual. 1. Productivity—the ability to do useful things. 2. Innovation—the ability to grow and change. 3. Resilience—the ability to bounce back from an injury or a setback; the ability to heal.

What are the defining characteristics of a healthy organization? When I took an unscientific poll at my own organization, I came up with the same list: a healthy organization is productive, innovative, and resilient.

Polyscopic analogy gives us insights to social systems

If we understand complex systems at one level, this may give us insights into systems at either lower (microscopic) levels or larger (macroscopic) levels. I call this the principle of polyscopic analogy. By coming to understand individual health, we may develop some insight into the health of human organizations and social systems. The connection is the new science of nonlinear dynamics, popularly called chaos theory. We can explore these relationships more thoroughly using these concepts and looking at actual data.

Natural systems are nonlinear

Chaos and fractals are interrelated parts of nonlinear dynamics. Almost all of classical mathematical physics and most every scientific field evolved from the assumption that the real world can be modeled using linear equations. But linear equations and models are, at most, a first and very rough approximation of natural systems. Nonlinear systems don’t behave according to the classical rules. They do wild and weird things—they are the real world.
If you measure something that is chaotic in the technical, nonlinear sense of the word, it dances around in a way that looks completely irregular. However, if you re-graph it in what's called a phase plot, you find that a system that first appeared random as a time series may indeed have remarkable, hidden structure. It now appears organized in a complex way (Figure 1).

Nonlinear systems are doubly counterintuitive. Irregular dynamics like those shown in Figure 1 can arise from very simple systems, provided they are nonlinear. You can write a set of rules and the system may still explode in your face. It can behave in a very ill-mannered, unpredictable way, just because it's nonlinear. Chaos is defined as the irregularity that arises in systems that appear relatively simple, but are nonlinear. Equally remarkable is the fact that hidden in this apparent disorder is a type of architecture, a hidden order that relates to fractals. Fractals are the geometry, or the order within chaos.

Fractals are the order within chaos

A fractal is a pattern that repeats itself on various scales. It is composed of sub-units and sub-sub-units that resemble the larger structure. A tree is fractal: it has branches that have smaller branches that have twigs (Figure 2). Another example is the Russian matreshka dolls: hollow wooden dolls nested within dolls, a folk art image thought to symbolize fertility—life within a life. In the US, both federal and state court systems are organized in a fractal-like branching network. The lower courts feed cases to the higher courts, like streams feeding into larger rivers. This sort of property is called self-similarity, or scale-invariance. A fractal then has no charac-

Fractal patterns have scalar variance

Figure 1. Nonlinear chaos; time series and phase space map

Figure 2. Fractal branches
Fractals have scalar variance, continued

Characteristic size. For example, there is no single length of a tree branch. You might say a branch is this big, but that's only one branch. A twig or a limb is smaller or larger. So, branches don't have a single length: they have a wide range of lengths.

Importantly, this concept not only applies to geometric structures, but also to processes. Processes can be fractal when they incorporate different time scales; the fluctuations over different time scales resemble each other. What is the characteristic temporal scale of human life? Some biological processes take microseconds or seconds. There are other processes that take months or years. All of these processes occur simultaneously, in a symphonic way. Fractal processes do not have a characteristic temporal scale. I'll come back to that because that turns out to be the basis of much of healthy physiology.

Fractal designs have many advantages

Fractal designs are very robust and redundant. These are very useful structures to diffuse nutrients throughout a system. Branching systems are very information-friendly: they allow information to percolate throughout the network. This becomes very relevant in physiology and social systems.

Fractal design infuses artistic creation

People like to look at fractals; many quilt patterns are fractal (Figure 3). Another example is the work of the great Japanese artist Katsushika Hokusai. In Figure 4, we see waves with Mount Fuji in the background. There are big waves that have smaller waves, that have smaller waves, that give off smaller wavelets. Mount Fuji in the background is also fractal. The closer one looks at a mountain the more irregularity and structure is revealed. The remarkable thing about this work is that if you were to move the image of Mount Fuji to one of the waves, and put the image of the wave where Mount Fuji was, you couldn't tell the difference. Hokusai somehow recognized the correspondence—the equivalence of the form of the waves and the form of Mount Fuji. Nature seems to favor certain forms in very different settings: we call this correspondence universality.

Tom Stoppard
Fractal design infuses artistic creation, continued

Fractal design is inherently artistic

Fractal lines are irregular and “wrinkly”

wrote a play called Arcadia that is remarkable because it’s a metaphysical exploration of fractals and chaos theory—in fact, Stoppard gives a glossary of terms in the playbill. Stoppard’s play explores explicitly what artists and writers have always used implicitly in their compositions: the harmony and rhythm of fractal design, and the excitement and drama found in the dynamic movement of chaotic, nonlinear systems.

Figure 5 shows a glorious example of fractal patterns in architecture. The Gothic design of the Cathedral of Cologne is made up of structures that have smaller structures that have yet smaller structures—arches upon arches, crenellations upon crenellations, spires upon spires. That’s a very fractal-like form.

Perhaps when we walk into a cathedral, we are literally entering a recreation of nature. It’s a moment of self-discovery because these cathedrals are built using nature’s fractal architecture, reminiscent of the branching patterns of trees in the great forests, the wrinkliness of mountains, and the fractal patterns found in our bodies. We are fractal machines, and by entering a cathedral we are, in a sense, entering ourselves. The great architects who designed these were unconsciously projecting human physiology and natural forms on a macroscopic scale.

Fractal lines are wrinkly like the one shown in Figure 6. They look like coastlines. If you magnify a fractal line, what you see are wrinkles upon wrinkles, and if you magnify those wrinkles, you once again see wrinkles upon wrinkles upon wrinkles. If you look at a coastline from a distance, it looks smooth and regular. The
Fractal lines are irregular and “wrinkly”

Closer one looks the more and more irregular it becomes.

Fractal geometry differs from the mathematics we grew up with, which may be why so many of us hated high school geometry—it seemed so irrelevant to the natural world. As Benoit Mandelbrot, the father of fractal geometry, has described, nature doesn't produce straight lines, rectangles, and cubes. Instead, the real world is filled with irregular and crinkly shapes, and branching structures. That's fractal geometry, and we need a different type of mathematics to describe it.

Fractional dimension

What is the dimension of a line like the one shown in Figure 6 that has wrinkles upon wrinkles? It is not one-dimensional because it has more structure. But it doesn't fill up a plane, so it is not two-dimensional. The dimension of a wrinkly line like this is somehow between one and two. It's an in-between or fractional dimension, which is where the term fractal comes from. It refers to the things that exist in between the dimensions of classical geometry.

Fractals, therefore, have non-integer dimensions. We measure lines using a ruler. But if you try to measure a fractal line, such as the one in Figure 6, the length will depend on the size of the ruler (Figure 7). If you plot the length of a linear line against the size of your ruler, the result will always be the same. You can use a big ruler, or a small ruler, you'll get the same length. But if your line is a fractal, the smaller your ruler, the more the detail you will pick up, and the longer your measurement becomes.

Suppose you measured the coastline of Great Britain using different methods. The first measure was made using a picture from a satellite. Next, if you walked the coastline—you would measure a much longer distance, because you'd be walking along that entire craggy coast. But suppose you put a pedometer on an ant's foot, and had it trace out the coastline. By the time it got back, it would measure a very long line, because the ant is going to pick up even more of the wrinkly detail. Trees don't have a characteristic branch size, coastlines don't have a characteristic length, and fractal processes don't have a characteristic temporal scale.

Normal heartbeat is fractal

The geometry of fractals and the inherent strength and advantages of fractal designs leads us to physiology and to your heartbeat; and on a more macroscopic scale, to health and disease. Pictured in Figure 8 on the following page are records derived from an EKG of a healthy person. Although your pulse normally feels quite regular, if you very precisely measure the interval between heartbeats, a surprising finding appears. The normal heart rate is not metronomically regular, even during sleep. Instead, there is an imperceptible but highly complex variability in the normal
Normal heartbeat is fractal, continued

The time trace of a normal heart rhythm has a fractal, "wrinkly-coastline" irregularity. We can prove this in a more rigorous way, but, put simply, the heartbeat is fractal because, measured over several hours, the heart rate doesn’t settle down. It moves around, jumping up and down. If you look over a smaller scale, let’s say thirty minutes, the heart rate still traces this irregular coastline-like portrait. Even over a three-minute span, it doesn’t smooth out. That’s the nature of a fractal process: its behavior is not regular and smooth, and it shows irregular variations over multiple time scales.

This type of irregular fractal “coastline” plot not only describes your heartbeat, but is also mathematically comparable to the fluctuations of pitch in classical music. By comparing the two mathematically, we found that the frequency spectrum is essentially identical to that of classical music.

In the spirit of Curious George, we thought that we could do a little experiment. We started with the heartbeat intervals and converted them into a sequence of musical notes. But we needed someone to add an accompaniment to these. Fortunately, there was someone around my house who was able to do that at no cost—my son. Zach David Goldberger is a professional musician who performs under the name Zach Davids. He is also a pre-med student, so it was doubly convenient. To his surprise when he started to play these notes generated by heartbeat variations, he
found that the notes actually sounded musical. So without much trouble at all, he was able to compose music around these heartbeat-generated notes, and create what we call “Heartsongs: Musical Mappings of the Heartbeat.”

“Heartsongs” are complex physiologic rhythms transposed onto a musical diatonic scale with some embellishments. If your heartbeat were perfectly regular, smooth, and metronomically pure, it would make for very boring music. If your heartbeat were completely random, it would sound like some kid pounding away at the piano. Was the result of our experiment plausibly musical? Any answer is going to be a subjective one. But most people who listen to the songs agree that they have musicality. Some people find them particularly relaxing. Classical music and healthy heart rate variability share a fractal connection. Both are products of complex nonlinear control mechanisms. [A sound clip of “Heartsongs” appears on our website, www.goalqpc.com.]

Let me pause and give proper credit—we are not the first to observe the connection between music and the heartbeat. More than four centuries ago, William Shakespeare wrote, “Ecstasy! My pulse, as yours, doth temperately keep time and makes as healthful music.” *Hamlet* (Act 3, scene 4)

An article written about our work that appeared in *The New York Times* a while ago described our speculation that creativity in some way represents an externalization of biological dynamics. Artists such as Hokusai, composers like Bach, and the architects of the great cathedrals projected onto a canvas, onto a musical score, and into the design of the buildings, very deep innate biologic rhythms. When we hear, see, or experience these works of art, these are in fact moments of self-discovery. We are seeing and hearing patterns that are already inside of us. And when it is done just right, there’s a magical resonance. Our Heartsong “experiments” may help demonstrate this biological connection to artistic creation.

What is the result if something terrible happens to a biological system that has this fractal “playfulness?” Perhaps the most common thing that happens is that the system loses its variability, and becomes pathologically regular: the time scale repeats itself again and again. When systems become excessively regular, there is an increase in predictability and a loss of resiliency. Figure 9 on the next page contrasts the excessive regularity of a pathological heartbeat with the complex variability of a healthy heartbeat.

**Warning:** excessive periodicity is bad for your health. Seizures can be induced in susceptible individuals by giving them excessive periodic stimulation with light, called stroboscopic stimulation. There was recently an epidemic in Japan after children watched a cartoon character repeatedly flash its sparkling eyes—over 500 children were admitted to emergency rooms, some with apparent seizures. The human brain doesn’t like to be excessively and periodically stimulated.

The second way the system can break down is to become completely random. It traces a stochastic signal, such as white noise or static. An example of this occurs when the heartbeat becomes completely irregular during the arrhythmia called atrial
Excessive periodicity or random behavior, continued

Pathology correlates with a loss of fractal complexity. We have evolved the concept of disease as a decomplexification of a system. Counterintuitively, the output of many biological systems becomes more regular and more predictable with pathologic perturbations. Although we call pathology in systems disorders, many diseases manifest patterns that are highly ordered and periodic: the tremors of Parkinson’s disease, manic depression, autism, obsessive-compulsive disorder, brain waves during epilepsy, and breathing patterns in heart failures. In fact, clinical medicine is not feasible without this paradox; without such stereotypic periodic behaviors, clinicians couldn’t make diagnoses.2

The aging process is also typified by a loss of complexity. A comparison of the cross-section of the brains of elderly persons and young accident victims shows a much richer pattern of neural branching in the latter.

Healthy function is difficult to characterize

Healthy function, on the other hand, with its broadband, fractal-like variability, is much harder to characterize. It’s very hard to use a single word to describe healthy behavior. We end up using words like plasticity, variability, resilience, and productivity. This type of variability enables the organism to adapt.

Human organizations have fractal structure

If, like Curious George, you have followed me this far, let me suggest that fractal theory may be applied in polyscopic analogy, not only to human biology, but also to human organizations. There are three defining features the “3F’s,” which underlie productivity, resilience, and innovation, the hallmarks of healthy functioning individuals and organizations.

- Fractality—branching, treelike complexity.
- Feedback—interdependence dominates interactions; the interactions are nonlinear.
- Ferment—systems don’t sit still, and are most stable when driven far from equi-

Fibrillation. The uncontrolled growth of cancer cells may be another example.

The paradox of clinical diagnosis

Figure 9. Heart rate dynamics in health

<table>
<thead>
<tr>
<th>Healthy</th>
<th>Congestive Heart Failure</th>
</tr>
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<tbody>
<tr>
<td>Heart Rate</td>
<td>Time/minutes</td>
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<tr>
<td>Healthy</td>
<td>Time/minutes</td>
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<td>0</td>
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<td>120</td>
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<td>140</td>
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</tr>
</tbody>
</table>

0 5 10 15

Heart Rate

Time/minutes

Healthy

Congestive Heart Failure

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librium. These systems jump around; they don’t settle down to a constant steady state. The corporate analogs to corporal diseases which degrade these “3 F’s” are—

<table>
<thead>
<tr>
<th>Corporal Diseases</th>
<th>Corporate Diseases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excessively periodic behavior</td>
<td>Excessive rigidity or over-regulation; too much predictability.</td>
</tr>
<tr>
<td>Random behavior</td>
<td>Anarchy, hierarchical dissolution.</td>
</tr>
</tbody>
</table>

Healthy systems, therefore, live in between complete randomness and excessive order—that healthy zone is fractal.

This raises the possibility that we can do new types of diagnoses on organizations because we can potentially test for these features. I can’t give you a specific test yet, but I would suggest the following parameters for measuring corporate health:

1. Draw an organizational chart of your company. Does it have a treelike appearance? Are there nested hierarchies? Fractals disseminate information very quickly. Does information percolate efficiently through your system? Or do you have a bunch of middle managers running around in circles, talking only to each other?

2. Is your organization auto-inventive? Does it readily evolve new structures to adapt to unpredictable challenges on different time scales? Is it playful? Is it creative? Is it innovative? How varied is the repertoire of your organization? How much spectral reserve does it have? Does it resemble a composition by Bach? Or is it a one-note marching band?

How can we cure sick organizations? I suggest to you that rather than thinking of ourselves as managers, we should think of ourselves more as choreographers, composers, and conductors. And by doing so, we can restore the music of the heart not only to ourselves, but also to our organizations.

Note: This article was based upon a presentation Dr. Goldberger made at the 1998 GOAL/QPC Annual Conference.

References


Author information

Dr. Ary Goldberger is a graduate of Harvard College and received his M.D. from Yale Medical School in 1974, where he was an intern and resident. He received his cardiology training at UCSD. He is currently Associate Professor of Medicine at Harvard Medical School where he is the Director of the Electrocardiography and Arrhythmia Monitoring Laboratories at Beth Israel Deaconess Medical Center, as well as the Director of the Margret and H.A. Rey Laboratory for Nonlinear Dynamics in Medicine. Dr. Goldberger’s pioneering work in the application of nonlinear dynamics in medicine is widely cited.
In the spring of 1995, the top 100 managers in Ford’s Powertrain division met to determine their breakthrough initiatives for the year. They wanted to decide on what vital few processes could be worked on, so that if breakthrough was achieved in these processes, Powertrain could obtain a breakthrough in results.

Some of the discussion centered around quality methods. One Chief Engineer remarked that there were too many quality tools, and that the tools were too complex. He said, “Today someone might come and talk to me about implementing Taguchi’s methods of robustness. Tomorrow someone will ask me to better implement reliability methods; the day after: customer focused engineering. There are too many quality methods and they are too complex. We need them simplified and integrated into one common actionable sequence.”

After listening to and thinking about these comments, a breakthrough initiative was forged that is now called the Robust Engineering Process. The Robust Engineering Process is a straightforward, iterative pattern of team-oriented actions to design and manufacture products that consistently satisfy customers, despite changing environmental circumstances and the passage of time.

The Robust Engineering Process was developed by a cross-functional team over an 18 month period of time. A fractal-based approach was used to provide a framework to integrate and simplify the various quality initiatives used in new product development. This is best explained with illustrations. Consider the fern leaf drawing shown in Figure 1. This fern has such an intricate shape; it could take a large number of instructions (detailing the various dimensions) to explain to someone how to reproduce this shape.
The task becomes even greater when we consider that within each element of this drawing, the overall detail is replicated at smaller levels of scale. As illustrated in Figure 2, characteristics that replicate patterns at lower levels of scale are called fractals.

Figure 2. Fractal nature

A repetitive fractal nature becomes evident at every level of examination

Irrespective of the level of examination of the fern leaf, the same pattern, shape, and characteristics apply

Fractals are commonly found in nature and also show up in the product development process! Consider the systems engineering aspect of new product development as shown in Figure 3. George Box, the well-known Quality statistician from the University of Wisconsin, said that, “All models are wrong, but some are useful.” This model is useful to illustrate system engineering principles associated with cascading requirements and integrating system elements in new product development. Although the product development process is also very complex (it takes many instructions just to describe the system architecture part of new product development), let’s use this simplified model to illustrate the fractal nature of new product development.

Figure 3. Complexity in Product Development—A System Engineering “V” Model shows cascading requirements and system integration
A fractal approach provided the overall framework, continued

Typically, systems engineering begins with a definition of system architecture, functions, and requirements for the system (vehicle), the subsystem elements (such as a powertrain), and components (for example, an engine). However, Figure 4 shows that systems engineering activity conducted on the vehicle level can be replicated on the engine. In other words, the engine can be treated as a system in its own right, cascading requirements to subsystem elements (such as a short block) and components (for example, a crank drive). However, the crank drive can be considered a system in its own right, with the conrod assembly as a component. But the conrod assembly is a system ... and so it goes with vehicle level actions replicated at smaller levels of scale for each fractal element.

Let’s explore the fern leaf example a little more. Even though the fern leaf shape is intricate and complex, the shape can be completely reproduced by iterating three simple rules:

1. Begin with a seed shape and select a seed shape size
2. Orient the shape in an upright direction
3. Connect with what is already on the page.

Iteration among these simple rules, and a high level of autonomy, will generate the complex fern leaf, as shown by the drawing in Figure 5, made with a computer programmed with these rules.
A fractal approach provided the overall framework, continued

Figure 5. A Complex Fern Leaf

From a combination of three simple steps, and high levels of autonomy, emerges the beautiful, complex fern leaf.


At Ford, our Robust Engineering Process utilized a similar, fractal based, approach to simplify and integrate quality and reliability methods in new product development. Using the iterative framework shown in Figure 6, the Robust Engineering Process identified fifteen ways of thinking (big ideas that make big differences) that link to common sense engineering:

1. Program team
2. Information center
3. Customer wants/delights
4. Specifications
5. System architecture

Figure 6. An Iterative Framework of Actions and Ways of Thinking

Dotted lines indicate iteration.
6. Select concept
7. Concurrent design
8. Prevent failure
9. Optimize function
10. Tolerance design
11. Finalize process
12. Design verification
13. Manufacturing confirmation
14. Launch confirmation
15. Corporate memory

When engineers think, and then act this way, robust and reliable products with great customer satisfaction will be the result.

Once the overall framework for the Robust Engineering Process was developed, the team treated these fifteen ways of thinking as an iterative strategy, and began to develop suggested actions, or how-to alternatives to assist engineers with implementation. These actions were developed using Knowledge Maps, a combination of Mind Mapping and Moderation Techniques.

Mind Mapping was developed by Tony Buzan [2,3,4]. Tony reasoned that the brain is composed of right and left halves. The left part of the brain tends to be very analytical. Logic, language, and numbers are primarily left brain activity. The right part of the brain is more associated with emotion and creativity. Relationships, shapes, and colors are primarily right brain activity. Tony developed a format, called Mind Maps, which combined logic and language, with colors, shapes and relationships. When this format is used, both halves of the brain are intentionally stimulated. Tests conducted found that brainstorming with this format tended to provide a richer solution set; and learning with this format tended to have a longer retention span.

The facilitator for our team was from Ford of Germany, and was trained in the use of Moderation Techniques. Moderation Techniques utilize portable pinboards with a variety of different sizes, shapes and colors of paper. This paper is used by the facilitator and team members to record notes and thoughts on the pinboards.

Moderated Knowledge Mapping came about as our team began to use Moderation equipment and techniques to create Mind Maps for each of the fifteen strategic steps. An example of what such a map might look like is shown in Figure 7.

Figure 7 represents our team’s emerging thoughts about chocolate chip cookies. If you are going to design a great cookie you should think about shape (alternatives could be round or square), and type. Type could involve the use of a flavor enhancer (such as nuts or raisins) and whether the chocolate is in chips or chunks. By the way, this chocolate could be dark, white, or milk. This represents another idea that should be added to our Knowledge Map — I bet you can think of others. Give it a try!

Knowledge Mapping was used to generate suggested actions within the fractal framework.
Knowledge Mapping was used to generate suggested actions within the fractal framework, continued

Figure 7. A Mind Map Illustrating Ideas about Cookies

Knowledge Maps are Mind Maps that are used to document knowledge and “how to” alternatives. In addition to stimulating both sides of the brain, Knowledge Maps are easy to update when new knowledge becomes available. They are also fun! Our team initially used them for brainstorming (not all team members were in favor of this when we started). As we developed and used the Knowledge Maps, the team liked them so much we kept them in the finished product.

The Robust Engineering Process currently consists of Knowledge Maps and Write-ups. Knowledge Maps exist at a high level for each of the fifteen steps, and then at lower levels to provide additional detail. Write-ups are organized by categories such as: Suggested Readings; Suggested Actions (Inputs/Outputs); Definitions; Overview; and Purpose/Value of Step. The Knowledge Maps and Write-ups work together to provide useful information to engineers (in printed form, each page of Write-up has a facing Knowledge Map).

In the Robust Engineering Process (REP), engineers are responsible and accountable to implement the strategy. How they implement the REP strategy is determined by the engineer. Knowledge Maps document the alternatives. Engineers in teams consider the alternatives and have the opportunity, flexibility, and responsibility to select any approach that makes the most sense for their situation. Consider the following high level Knowledge Map (Figure 8) from Step 8:

Step 8 involves improving a product or process design after it has been engineered, by taking action to reduce failure modes and variability. The key thoughts involved in this are: work in cross-functional teams, thoroughly understand previous product and process work, ask “what can go wrong?”, modify the product and/or process to prevent this from happening, and then ask, “now what can go wrong?” The team continues to iterate until they have improved the product and/or process as much as possible. Suggested actions for this process are provided in lower level Knowledge Maps, such as the one shown in Figure 9.
Knowledge Mapping was used to generate suggested actions within the fractal framework, continued

![Figure 8. Detail of a Knowledge Map](image1)

![Figure 9. Further Detail of a Knowledge Map](image2)

The Knowledge Map in Figure 9 provides additional detail for the higher level Knowledge Map shown in Figure 8, part C. In this portion are suggestions for teams working on “what can go wrong?” Teams may want to consider such actions as: identifying potential failure modes, dimensional variation in manufacturing process and/or assembly, and deterioration over useful life. Tools are then referenced appropriately as possible approaches. In this case, tools used by teams to accomplish this strategic element in the past include: Failure Mode and Effects Analysis, Fault Tree Analysis, Dynamic Control Plans, Process Decision Program Charts, and Ford’s Energy Control and Power Lockout procedure.
Knowledge Mapping provides an ideal medium for internet hypertext linkages

A very powerful benefit of using Knowledge Maps became readily apparent when the Robust Engineering Process was uploaded to the Ford Intranet. Knowledge Maps provided the perfect application for internet hypertext linkages. From the Ford intranet website, an engineer can access the overall strategic model, click on the model to obtain information about one of the fifteen steps, including purpose of the step and value. Lower level detail can then easily be accessed by clicking to detailed Knowledge Maps with associated Write-ups (see Figure 10).

Figure 8. More Detailed Information can be Accessed by Clicking Parts of the Knowledge Maps

Identify Signal Factor:

A Signal Factor is a parameter controlled by the customer or user of the system to express the intended value for the system’s response. Part of the engineer’s role in optimization is to identify the Signal Factor based on engineering knowledge of the system, knowledge about how the system is to be used, and by consideration of physical laws which express and characterize the system’s functional behavior and input energy.
On paper, the Robust Engineering Process is over six hundred pages of material. On the web, the engineers never see the magnitude of the material. They easily browse to select the information that is useful to them at this moment in time, and can print that relevant information at their workstation.

Web based Knowledge Maps can provide linkage in a variety of ways. In REP they are cross-linked to each other, linked to Write-ups with figures, linked to real examples, linked to definitions of tools and terms, and linked to other related web sites. The potential exists to provide further linkage to more specific web-based tool training and tool software. Since Knowledge Maps are relatively easy to update, even when they are on the web, the REP Knowledge Maps can be continually evergreened with new learnings for use in future programs.

References


Author Information

Larry Smith is a Quality Reliability Manager for full-size pickup and utility vehicles in Ford Motor Company’s Truck Vehicle Center. He has extensive experience applying statistical and quality methods for improved customer satisfaction, with an emphasis on Quality Engineering and Product Development. He served as team leader for the development of Ford’s new Robust Engineering Process. He has worked at Ford as a design engineer, statistical specialist, manufacturing quality supervisor, casting operations manager of quality systems and training, powertrain manager of quality strategy and planning, and powertrain reliability new methods manager.

Larry has published several case studies and papers in the area of designed experiments, quality function deployment (QFD), and culture change. He currently teaches courses in statistical methods and designed experiments for Wayne State University and Cast Metals Institute. Larry has master’s degrees in physics and metallurgical engineering from the University of Michigan and in industrial engineering from Wayne State University. He is also a member of GOAL/QPC’s Board of Directors.
Leadership

Norman E. Rickard—At Xerox Corporation, and in particular Xerox Business Services, the leadership is primarily responsible for three things. First, we must set a clear direction for the organization. Second, we have to create an environment where this direction can be carried out. Third, and most importantly, we must act as role models, exemplifying behaviors that will enable people to be empowered and fulfill their own expectations.

I have been in a leadership role for several years. From February, 1992, until March, 1998, I was president of Xerox Business Services (XBS), the document outsourcing and solutions division of Xerox Corporation, a global, $20 billion company. Because of the success we had with XBS, we decided that we would expand on a world-wide basis in March, 1998, creating the new Xerox Document Services Group.

Our organization is focused on improving the productivity of our customers' businesses by enabling them to bring value to their customers. The marketplace demands that we be fast, flexible, and therefore we operate in a flat structure. We must be fast, so we can respond quickly to customer requirements. We must be flexible, so we can respond to a broadening array of customer requirements. We must have a flat organizational structure, because that is the only way that our organization will have empowered employees that are able to act freely, and consistently exceed our customers' expectations.

Since XBS began in February, 1992, our annual revenue has grown from $300 million to $2.3 billion in 1997 (see Figure 1). We've grown from 6,000 employees in...
CASE STUDY

Xerox Business Services, Malcolm Baldrige National Quality Award Winner, 1997

1992 to more than 21,000 today. Over 80% of our employees work right at our customers’ sites. In the past few years we’ve been growing by more than 40% a year. One reason for the relative ease of this expansion is that our leadership system and the fabric of quality at XBS was outstanding.

Early history of Xerox Corporation

Quality has really been the guiding business principle of XBS and Xerox for many years. In 1959, Xerox introduced the world to the first copier, revolutionizing the way business was done around the world. However, our initial success attracted fierce competition from Japanese companies. After several major setbacks in the early 1980s, many people were wondering if we could survive as an entity. David Kerns, our CEO at the time, made quality management a priority for everyone in the company, and the rest is history. Our quality management processes, beliefs, and tools helped turn Xerox around. We became one of the first American companies to face such fierce competition from Japan, and without tariffs or government help, win back our market share.

A “crisis of survival”

In the mid 1980s, we were facing a crisis of survival (see Figure 2). Our profits declined for 20 straight quarters, and our Japanese competitors were making significant inroads into our market, particularly at the low end. We also faced severe competition from IBM and Kodak at the top end of our market. As our former CEO David Kernes said, that’s world class competition.
We have survived our crisis of survival, and we have won 23 quality awards over the years, including the Baldrige Award (twice as a corporation, in 1989 and 1997), the European Quality Award, and the Deming Award. However, it’s important to remember that we are not in this to win awards, but the self-assessment process is a great opportunity to learn and move quicker than you ordinarily could. We’ve learned three years worth in just a 15 month period.

The award self-assessment process has had a major influence on the evolution of the Xerox mission and the XBS vision. In 1992, the senior leadership team developed a mission statement that would have gotten an A+ at any elite business school. Unfortunately, when we brought it back to our employees, they had no idea what the mission statement meant, since they had not participated in creating it. During the next staff meeting, I asked everyone to write down the mission statement. If we had to give ourselves a grade for this little test, we would have all failed.

We decided to develop a process where 900 people in the organization would participate in developing this mission statement, periodically updating it but still using the same process. The lesson here was that a mission statement is much more than words. People have their own fingerprints, emotion, and ownership in it. Today our vision is “Together, we will lead the way to document solutions and business services with a passion for delighting our customers and their customers. Our commitment is to create value by seeing our client’s business through their eyes.”

Over the past several years, our economy has shifted from strictly a manufacturing-based economy to one that is a combination of manufacturing and services. We are really glad that we continually use a quality process, because it allowed us to respond very quickly to that shift. Today, we have not a crisis of survival but a crisis of opportunity (see Figure 3). CEO Paul Allaire summed up this perspective in 1993: “On the one hand, we see attractive markets and we have superior technology. On the other hand, we won’t be able to take advantage of this situation unless we can overcome cumbersome, functionally driven bureaucracy and use our quality processes to become more productive.”

When we were at our lowest, our return on assets was just 7%, and we were getting more and more global competition. Today, we’re reaching 20%, and we plan to go beyond that, all because of the quality process.
Three themes for continual change

We rely on three central themes to continually change the organization:
1. The customer is the center of everything that we do
2. We must have continuous improvement in everything that we do
3. We must have a continuous, proactive learning environment.

The key phrase that I continue to use when talking to our people is “learn to learn, and learn to change.” If you embody that philosophy, and utilize the Baldrige self-assessment process, you’ll have a formula for lasting success.

The Xerox Management Model

Our business operates on the Xerox Management Model, which embodies our leadership through quality processes. This model has evolved over time, and it continues to evolve. We first developed it in 1991, and over the years we have had further input from five basic areas:
1. 1993 Green Book, our quality bible developed by the Xerox senior management team to set the direction for our quality movement
2. The Baldrige Criteria
3. The Deming Prize Criteria
4. The European Quality Award Criteria
5. 1989 feedback from the Baldrige Examiner Team that came to our sites for four days.

The Xerox Management Model (see Figure 4) is composed of 26 elements, divided into 6 categories: Leadership, Human Resources, Business Process Management, Customer and Market Focus, Information Utilization and Quality Tools, and Results. Each category includes three elements: Practices, definitions of the Desired State, and identification of Core Measurement Processes. The Practices help us figure out what to do, the Desired State gives us an idea of what we’re trying to achieve, and the Core Measurement Processes help us benchmark against our global competition. We use this model to improve performance on a continuous basis, and it’s buttressed by a yearly self-assessment in all of our organizations around the world.

Figure 4. The Xerox Management Model

[Diagram of the Xerox Management Model]

[Figure 4. The Xerox Management Model]

Management Leadership

Human Resource Management

Business Process Management

Customer and Market Focus

Information Utilization and Quality Tools

Business Results
Strategic thinking

Our objective is to set our strategy and direction, and then deploy it. Then we can manage that direction and learn from it. We first try to understand our customer's expectations, anticipate where the market is moving, look at where our competition is, and what competition may only exist on the horizon. Then we look at our business objectives. Our strategy is developed through our three-year outlook of where we're going to go.

For instance, this year we will set our strategy by taking into account the current year, 1998, and project out for 1999 and 2000. More importantly, our strategy process in not only about developing it, but it’s also about deploying the strategy and getting feedback on it.

Creating a learning environment

Our change strategy is really about creating an environment where learning and empowerment prevail. We are trying to be proactive with our learning, so that people are not just spectators, they participate. Our responsibility is to ensure that there are opportunities where people can learn. The responsibility of the individual is to seize those opportunities so they can learn and grow.

A culture that develops people and respects them

You have heard this many times, but our most important assets are our people. Our people really differentiate us from our competition. We have a retention rate of over 90% of all our associates in the field. Our top competitors are lucky to have a 70% retention rate. Our goal is to create a culture that produces effective business people, where everyone thinks about the future, continues to amaze customers, and manage the bottom line. We treat our customers' businesses as if they were our own, and many customers tell us that they chose XBS because of our people, despite better offers from our competitors.

Quickening pace of technology advances, change and competition

Change comes in many sizes, and today it comes faster, and it's more complex. We have to anticipate technology changes and ensure that we're able to effectively handle the pressure of competition. Fast growth and good profitability attracts further competition, but we cannot forget that the customer is always at the center of everything we do. We continue to measure that with an objective third party and our customer satisfaction in 1997 hit an all-time high of 96%.

Our growth has been fantastic, we're moving into more advanced applications and solutions, and we're adopting them for our clients on a world-wide basis. In 1997 our revenue was about $2.3 billion, and by the year 2000 we expect to reach $6 billion.

We've learned so much from the Baldrige Award process. The actions that stem from those initial learnings will help prepare us for the tremendous growth that lies ahead. Winning the award was a fantastic milestone for us, but it's not an end; it's just a step along our never ending quality journey.
A rapidly growing, customer-centered, service business

Strategic Planning

Mark V. Shimelonis—Our business practices have improved through many iterations. Many are borrowed from, or built on those of our parent organization. Some have been adapted to work in our service environment, while others are unique to XBS.

As a service business, every one of our people has a major role in determining our success. It is their individual performance in meeting the needs of customers that will distinguish us from our competition. Our strategy is to make everyone a responsible business person who always thinks about the future, amazes customers, and is responsible for the bottom line.

We pursue a balanced score card, considering all our stakeholders—customers, employees, suppliers, and shareholders. The endpoint is profitable revenue growth. A major portion of our growth comes from growing the revenue both horizontally, by expanding our geographic coverage to other locations within the customers operation, and vertically by adding new services for our customers. Our ability to grow our business is highly dependent on the satisfaction with the current services that we provide. Hence the dependence on all our employees to be responsible business persons.

We also grow through the acquisition of new clients. We can either take over a competitive outsourcing contract, or more often, convert a customer from the self manage mode into an outsourcing situation. Again, our dependence on our people is key—we rely on their experience, process knowledge, and ability to take learnings from other client services to add value for the new customer. Also, our successful efforts to move into the future relies on our ability to grow our people and their skills to support new technology or new initiatives. Our planning process, our customers, and our people are all critically linked.

Strategic planning takes place on three planes: (1) the enterprise level; (2) the business level; and (3) the business unit level. At the enterprise level we use the strategic framework described earlier in the article, and the Xerox Management Model, against which we continuously evaluate our growth and maturity. The Management Model helps define the way we run the company, what we're good at, what's working for us, and what we need to improve on. It also helps us determine the “vital few” areas that we need to focus on. For example, in 1992-1993 at XBS, the vital few were the essential processes needed for governance, planning and empowerment. In 1994-1996, the need shifted to consider market segmentation, business processes, and productivity. In 1997-1998 the strategic focus was on customer intimacy, operational excellence, and people development/skills.

The second plane of strategic planning is at the business level. Our business strategy is something we call Xerox 2005, which looks eight years into the future, and is a update of Xerox 2000, which we created in 1992. Xerox 2000 created
Three planes of strategic planning, continued

major changes for the company—it forced us to think about documents in a much broader sense, including printing, faxing and scanning, in addition to copying. It also initiated our corporate name change to Xerox: The Document Company. The recently completed Xerox 2005 strategy reaffirmed our position as The Document Company, and encouraged us to grow our focus on services and solutions. It also created a new business unit to bring Xerox products and services to the home and small office environment.

The third plane of strategic planning is at the business unit level for XBS and other divisions. Our Strategy Contract is our formal three year plan, which shows our commitment to the corporation to deliver certain business results. Our strategy at XBS needs to address our customers, our competition, our market focus and our business objectives. We need to know our customers’ critical mission processes and documents, and how our solutions and technology can improve their effectiveness. We need to know today’s competitors for basic outsourcing services, and as our strategy takes us into solutions and higher level professional services, we need to know who our new competitors will be, and whether we are preparing ourselves for this shift. We need to understand our expertise by industry, and whether we can create platforms that are replicable in other markets or industries, and leverage learning from one application to the next. Finally, we must understand our business objectives for the six results areas—customer satisfaction, employee satisfaction, market share, revenue growth, profit, and productivity.

Testing the strategy, gathering input, focusing on improvement

We test our strategy contract against the following set of questions. Where will XBS win? Why will customers choose XBS? Why will we be more successful than our competitors? What programs will enable us to win? How will we know when we’re on track? What will be the value of winning? And what are the risks of the proposed plan? The answers to these questions guide us in prioritizing our actions, and help us stay customer focused.

We first gather input and intelligence, then we follow a process to understand our strengths, weaknesses, opportunities, and threats. We want to validate the current or create new initiatives to capture opportunities or to close gaps. Finally, we have our planning outputs.

We also spend considerable time on the people implications. As a service business, it is our people, not our plant or equipment, that represents our capacity in productivity. We define and communicate the vital few, and we work very hard to align the energy and resources of the organization to focus on those key areas.

Our vital few for 1997-1998 included customer intimacy, operational excellence, and key enablers. Customer intimacy is all about relationships, creating a trust based on the knowledge we have, and our ability to improve our customers’ ability to serve their customers.

Our operational excellence has to do with understanding that our people create
Testing the strategy, gathering input, focusing on improvement, continued

Tracking six results measures

We track six results measures: Customer satisfaction, employee satisfaction, market share, revenue growth, profit, and productivity. Supporting these results measures are a series of metrics that are used to measure progress. For example, within customer satisfaction, we track overall satisfaction, the percentage that are very satisfied, and our benchmark position through a third party survey. For market share we measure customer loyalty through account retention and market share growth. For our financial measures, we target the various cost components, as well as profitability by the type of service. These metrics provide the means for our organizations to map into the key measures on a consistent basis. The results are referenced by all the organizations, work groups, and individuals as they establish their performance objectives for the year.

Our process begins with setting direction after self-assessment, and ends with deploying and managing direction. Strategic plans are turned into annual plans, which are translated into operations, work groups and individual objectives. The vital few highlight the process improvements on which we will focus throughout the organization. We predefine the types and frequency of meetings, what performances are to be reviewed and acted on, who conducts the meeting, who’s in attendance, what information and measures will be provided. All of this is documented and communicated. A primary role of the quality office is to facilitate and guide this managing for results process.

Customer & Market Focus

Penny Sanchez-Burruss—Our founder, Joseph C. Wilson, talked about focus on our customer and the importance of serving the customer, the responsibility of every Xerox employee. The Xerox management model also reinforced that the customer is number one. And we need to understand our markets and customers in order to fulfill our customers’ needs and requirements. We use a number of tools to gather this information, and to understand the customer’s changing needs, and/or rising expectations.

We understand that the customer is the center of everything that we do, and we recognize that our success lies in knowing the customer’s business and caring about it as if it were our own. That’s why customer satisfaction has been our number one objective for the past 10 years.

“Listening posts” capture the voice of the customer

By listening to and capturing the voice of the customer, we make sure that we
“Listening posts” capture the voice of the customer, continued

We use a variety of ways, or “listening posts,” to understand our customers’ changing needs. They include daily customer contact, market research, surveys and customer forms. We also have an ongoing dialogue with our customers throughout the relationship. These listening posts directly impact the customer solutions that we offer, and help us understand the industry collectively. Therefore we can shape the solutions to be consistent with the industry direction.

We have maintained our customer focus efforts for many years. In 1995 we needed to reenergize the whole organization around the customer. We came up with a strategy called Customer First, which includes a collection of learning activities, and served as an opportunity to make a renewed, organization-wide commitment to the customer. We developed training, using a shared language, and focused on behaviors we wanted to see in all our employees.

The first behavior we wanted to encourage was a “can do” attitude. One of the key initiatives in our strategy is the response system that allows us to capture the voice of the customer in a systematic way. Then we can analyze the input and take appropriate actions. As an organization, we’re committed to changing the way we think about customer complaints. We consider complaints as gifts, and we recognize the need for and value of customer feedback. This is especially critical for root cause analysis, process improvement, and employee recognition.

To capture the voice of the customer, we really must listen closely. That does not mean assuming or superimposing our thoughts on what we hear. We value our customers’ and our employees’ input, which helps us understand our customers.

Another behavior that we have developed is to ensure that we create an environment that is trusting, open, and honest. We are working hard on creating this environment so that the customer input, as well as the employees’ input, is viewed in a positive way.

It is also very important to acknowledge our mistakes, learn from them, and implement the right solutions. First we look at what went wrong with the process, not the person. This helps to foster trust and encourage more input.

The final behavior is to amaze our customers. We do all of these things to ultimately amaze and delight our customers with the solutions that we offer, and therefore we will build a loyal base of customers.

Customer satisfaction has remained high

Customer satisfaction has remained high over the years, as measured by our customer satisfaction survey. We create customer value by understanding and anticipating customer needs, unconditionally guaranteeing our work, and being empowered to do what's right for our customers. We delight our customers by having empowered and satisfied employees.
We measure customer loyalty by our retention rates, and by our revenue growth per account. Retaining our customers is very inexpensive, and our goal is to retain 100 percent of our customers. In the end, customer loyalty is our ultimate measure.

Excellence in strategy is tied to understanding our customers, our competitors, our market environment, and our business objectives. Excellence in strategy leads to excellence in plans and objectives. This results in excellence of applying and delivering on our promises at our customer sites. Our people, process, technology, and Xerox quality values, which are all committed to making the customer number one, make us the vendor of choice in the global marketplace.

Information & Analysis

Ken Kaisen—Many people in XBS call information the dashboard by which we drive the business. A dashboard is great for telling you a lot about the current state, but by turning that information into knowledge, you can predictably and proactively guide your future state as well. It is no small task to gather information and turn it into knowledge for a business that is growing as fast as ours. But we have managed to focus on selected efforts that will sustain our success into the future, transforming information into business excellence.

Empowerment is a true reality in XBS. I believe that our empowered culture is the number one reason for our success. Our top leadership has done a tremendous job of establishing and nurturing this crucial aspect of our organization. For empowerment to succeed, it must come with boundaries and roles. But equally important is having consistent and accurate information so that the entire organization can be fleet of foot. It is critical in an empowered nature to eliminate hierarchy of organizational layers and information.

Decisions based on knowledge, information and data

Data, information, and knowledge all relate to decision making. Data exists in localized input devices, databases or even documents. It is passive. Information is an organized collection of data. You can turn data into information by organizing it into collections that can be analyzed. Knowledge is created when information is analyzed by an individual or group, in such a way that conclusions can be drawn. From this knowledge, we can make informed decisions. Xerox and other companies are working on ways to capture and manage the actual knowledge that is created. Unlike data and information, the knowledge that is created within a corporation is too transient. In fact, I wonder if in future Baldrige applications we’ll be reading about knowledge management as a new category of excellence.
Communities of practice

In general, knowledge is created when information is analyzed. When information is linked, it can be made available to widespread communities of practice. This linking of information enables increased communication, knowledge creation, and sharing. This concept of linking information is very important to us, since our employees and customers are dispersed all over the world. By combining application software with the Internet, Intranet, and a dedicated wide area network, we link our people and our customers to information.

Electronic media for document management

For example, we use our XBS Intranet as an important source of communications and sharing among our workforce. Since the vast majority of our people are serving customers at the customers' sites, the Internet is an ideal mechanism to provide consistent activity to our employees. One of XBS's offerings is Internet Document Services. We actually help our customers develop their own Internet solutions for collaboration, document management and electronic commerce.

One of XBS's core competencies is the management of documents in electronic and paper form. With our sophisticated laser printing equipment and software, we support the concept of printing on demand—printing what you want, when you want it, and only in the quantities you need. This greatly reduces the cost associated with warehousing, inventory management, and waste, when compared to the old model of printing several thousand copies in advance, and storing them until they are needed. Not only do you print what, when, and how much you need, but you also can print where you need it. This eliminates the other large flaw in the old model, which is the cost and time associated with the distribution of documents.

Two examples of the decision-making process

We have several decision applications that support our business and operational reviews. I'll briefly explain two of these.

Our sales force uses a marketing and opportunities management tool, which uses a drill down approach to accessing information, spotting opportunities, analyzing, filtering and gathering competitive information, and tracking progress of accounts. It provides a repository of knowledge about our accounts that becomes better over time. It is a client-server tool that runs on our sales people's laptop computers.

We also have a standardized set of performance metrics that our management uses to monitor progress at each of our 38 operations in the United States. These metrics are defined against the Xerox management model described earlier in this article (see Figure 4 on page 36), and includes customer satisfaction, employee satisfaction, and financial performance. This information is collected, distributed, and updated via our Intranet. This means that our managers can access the information wherever they are whenever they want. Since the templates and metrics are standardized, managers can focus on analyzing the information, rather than having to interpret disparate methods of reporting.
The purpose of these business applications, of course, is to enable the kind of analysis that can proactively spot gaps, or even the potential for future gaps. Once we spot these gaps, we address them with the tools, techniques and processes that are part of Xerox’s deeply ingrained quality culture.

One aid in decision making is our problem solving process (Figure 5). This is a structured approach to problem solving that requires thoughtful analysis to precede solution identification. It’s simple, but amazingly powerful. We all know what can happen if we jump to a solution without really understanding what caused our problem. The problem solving process ensures that we do not make the mistake again.

**Figure 5. Problem Solving Process**

1. Identify & Select Problem
2. Analyze Problem
3. Generate Potential Solutions
4. Select & Plan Solution
5. Implement Solution
6. Evaluate Solution

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**Process Management**

Richard J. Kievit—Process management is a foundation for change. It’s a beginning, never an end. Once a process is in place, further ground for change and continuous improvement exists. What this means is that process is not an end unto itself. It’s a starting point for improvement.

We use process management to deliver the promise to our customers. The Xerox Management Model is the way that we run our business, and process management figures prominently in that model. Processes are managed using the principles of the Business Process Management element of the Xerox Management Model. When gaps in performance are identified, we use Quality Improvement Teams and Problem Solving Processes to identify root causes and develop corrective action plans.

Process management delivers structure to the way we deliver services to our customers. The four principles that we use in business process management are:

- Owner identification (we assign an owner to each process)
- Documentation (flowcharts, etc.)
- Measurement (both the process itself and the results)
- Continuous Improvement.
Some challenges

We faced several challenges in developing a business process management approach. When dealing with customized services, business processes do not come as naturally as they do in manufacturing, nor are they as easily accepted. Also, some people think processes constrain creativity. The challenge was to change the culture to enable people to understand that process management can enable creativity and improve the delivery of service to our customers.

Over the years, various processes have been used in the field and at our headquarters. We had to link those processes into an integrated value chain. The value chain is the process architecture under which we operate. For example, we use two different methods to develop and deliver services to our customers: 1) customized services to meet the needs of individual customers, and 2) new services based on learnings from customers, the marketplace, and our competition.

Customized services represent over 90% of our revenue. We use our selling process to design customized services, which has been continuously improved over a ten year period. To deliver these customized services we use an approach that was designed in our field organization, identified as a better practice, improved, tested, piloted, and then launched on a national basis.

One example of a new service was our “printing on demand” capability. If a customer is producing training manuals in Dallas, and they want to get those materials to the United Kingdom, under the old way they would have to produce them in Dallas and have them shipped to the U.K. for further distribution. An easier way to do that is ship them digitally over a network directly to U.K. and have the printing and distribution done there at the point of need, just in time.

To design and deliver new services, we use our Service Delivery and Management process. This incorporates reviews to ensure rapid time to market and customer acceptance. It is a six-step process:

1. Define the service
2. Deliver the technology and plan its introduction
3. Design and develop
4. Demonstrate, or run a pilot program
5. Introduce the service
6. Deliver the service and delight the customer.

Continuous improvement and gap analysis

We evaluate and improve our processes through gap analysis. We compare our current state to the desired state, and then use our quality processes, better practices, customer focus groups, and roundtables to develop an action plan to improve the process. The combination of information analysis and process management helps us achieve excellence in execution for our customers and, more importantly, to their customers.
Human Resources

Edward J. Ciaschi — XBS is the fastest growing division of Xerox Corporation. In 1995 we employed 10,000 people; by the beginning of 1998 we were up to 14,000 people, and by the year 2000 we expect to have 30,000 people.

As we have grown, our business has changed dramatically. We have transitioned from a stand-alone provider of copying services to a digital network environment. About 80 percent of our people work at customer locations, with only occasional visits to the home office. This presents a significant challenge to us when we think about maintaining a learning and empowered work environment. In order to keep our competitive advantage, prepare for even faster growth, learn faster than our competitors, and apply this learning in the marketplace, we focus on learning in our day to day work environment. We constantly ask ourselves questions like what opportunities are we providing for our people in their day to day work environment, and how can our people learn (through socializing, from one another, from their supervisor, or from our customers?

To achieve superior business results, we have created an empowered work environment, where learning flourishes. This is the purpose of our change strategy, our architecture for learning. It prevails throughout the organization. As we have moved to a new kind of business, we have realized that learning helps us be an organization of effective business people, where everyone thinks about the future, amazes customers, and manages the bottom line. That's why XBS is so dedicated to providing our people with development opportunities in their day to day work life. They have the relationship with our customers. They see their customers on a daily basis, and they have the opportunity to run it as their own business.

To create and shape an empowered work environment, we've made a significant investment in the change strategy. It's not about changing people to accommodate an environment, it's about an environment that accommodates our people and their various learning styles. All people learn differently, and as our managers and supervisors create the work environment, we try to take those learning styles into consideration.

Our game plan for the future is based on systemic organization learning. At XBS, learning does not begin and end with classes, seminars, and workbooks. Instead of the traditional “one size fits all” training approach, skill development programs stress different learning sources. They allow people to use the approach that's best for them. We view continuous learning as a shared responsibility between employees and managers, and within their work groups. We encourage them to engage in learning experiences and personal development opportunities. We use classroom training on occasion, inside and outside the organization, and we also

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Organizational learning, continued

have an extensive computer delivery process. We have interactive learning on the job, and individual self-paced methods.

The Camp Learning event

Lori Skjeveland—XBS is challenged with growing our employee base dramatically. While we grow, it's critical for us to better enable our people to acquire and develop the skills that they need to meet our customers' changing requirements.

One vehicle for this objective is our Camp Learning. This was a unique nationwide learning event designed to develop our leadership skills and business abilities, using a variety of learning techniques. Camp was held at the Xerox National Training Facility in Leesburg, Virginia. It involved four days of group meetings, keynote presentations, and breakout sessions, where we learned new skills to better manage our business. There were also camp activities, where we had some competition and information sharing sessions.

Some lessons from Camp Learning

One of the key learnings from camp was the development of a framework that would help each one of us at XBS become effective business people. We learned that there were four key roles that XBS people could play in our organization, regardless of their job title, that would contribute to the organization's success. The roles were as follows:

- Customer Amazers go beyond day to day responsibilities to solve business problems for our customers, thus helping them to amaze their customers
- Systems Thinkers use quality tools and exhibit role model behavior as change agents, leading work groups to productivity and improvements through process enhancements
- Future Scouts know our customers' businesses, and help to provide them competitive advantages to creative solutions
- Profit Makers help improve bottom line results through expense management, productivity improvements, and revenue growth.

Our camp experience also gave us some practical skills to apply to these roles. We learned about managing profitability by playing games. We learned about process improvement by conducting a musical exercise. We learned about the importance of measurements like customer satisfaction through another exercise. We learned about seeing our customers' businesses through their eyes, through a competition. We finished the event with a great deal of energy, a clear understanding of how our individual activities could impact the organization as a whole, and a new set of skills that would be useful in our personal and professional lives.

Continuing the effort to build knowledge leads to successful results

But we did not stop learning when we left camp. We were challenged with sharing our knowledge with our peers and encouraging the passion for learning to continue in our day to day work life. We did three important things. First, we asked...
Continuing the effort to build knowledge leads to successful results, continued

our employees to take ownership for their own development, and we began by helping them to assess their skills and create learning plans to close their skill gaps and achieve their personal objectives. Second, we helped enable the learning process by bringing the tools that we learned at camp to all the people in the field, encouraging every individual to accept the challenge of empowerment. Finally, we created a local recognition program around the four roles mentioned earlier.

As a result of these activities and the focus on learning and skills development, we've improved our revenue growth rate, we've improved our profitability, and we've elevated our level of employee satisfaction.

Rising levels of employee satisfaction

Edward J. Ciaschi—Employee satisfaction is critical, because we all know that you can't have happy customers if you have unhappy employees. Our people tell us that, and our customers tell us that. As you can see from Figure 6, our people are increasingly satisfied with XBS as a place to work. We have the distinction of being the benchmark in our industry, which we're very proud of.

XBS aligns employee compensation and recognition programs with performance and learning objectives. Our managers are measured on learning opportunities within their group. On our employee satisfaction survey, we have a set of questions on the empowered work environment, and on learning and teamwork. All three of those categories are part of our measurement system.

An annual analysis of base salary and benefits ensures that XBS employees receive salaries in line with the market. XBS offers world-class benefits packages, and as a result we have enjoyed a very high level of employee satisfaction.

Our work force reflects the diversity of the communities in which we live and work. In October, 1996, Xerox Chairman and CEO Paul Allaire recognized XBS for its leadership position on diversity and minority employment.

XBS believes that satisfied employees bring satisfied customers, which brings revenue, profit, and satisfied shareholders.
CASE STUDY

Xerox Business Services, Malcolm Baldrige National Quality Award Winner, 1997

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Business Results

William T. Patterson III — Over the past five years, the document outsourcing market has grown about 30% every year. During that same period, Xerox Business Services sales, revenues, and profits have outpaced the market. Why have we done so well? The answer is simple. We have differentiated ourselves in the marketplace. We understand the market's needs better than our competitors. We offer solutions that help our customers increase productivity and reduce cost through operational excellence. We deliver, day after day, on the promise of increasing our customers' productivity.

We're different than our competitors because we are more passionate about customer satisfaction. We strive not only to satisfy customers, but to delight them. This is the key to our growth — we will retain our existing accounts, and we will gain new ones. To stay ahead of the competition, we must continue to lead the market with world class people, innovative business processes, and advanced technology. The fusion of these three forces will unleash productivity gains for our customers, as the world moves to a digital environment. The magnet that brings these three forces together for us is leadership through quality. It empowers our people, moves innovative processes and drives those processes. Leadership through quality is why we won the Baldrige Award. It's why customers stay with us. It's why we've grown faster than the market.

Because our people embraced leadership through quality, they embrace the customer. Everything we do revolves around a clear understanding that the customer is number one. That he or she is our reason for being. We take care of them, we act in their best interests, and help them make their businesses better. This attitude is a reflection of our tremendous commitment to quality. Quality isn't just jargon at Xerox, it's part of our core values.

We've built an environment for learning and empowerment. Only with this type of climate can we attract and develop people who can help us capture growth opportunities in a changing world. It can be hard to maintain quality, discipline and consistency when you're growing as fast as we are. But Xerox Business Services will do it. Delighted customers, satisfied through the right mix of people, process, and technology, will fuel our growth. However, you cannot have delighted customers without satisfied employees, and we intend to have both.

Our business is changing, because our customers' businesses are changing. Work everywhere has become more specialized and more customized. This is the trend that is driving our digital technology, as our clients' environments are becoming networked, databases are growing, printing needs are changing, and there is a lot more power now on the desktop computer.
A constantly changing business, continued

Our customers want mass customization, so they can give special treatment to their clients. We're helping them leap into the networked document services and solutions arena. But the technology cannot help our customers improve productivity, unless it supports new work processes.

Delighting the customer

Our understanding of how change gets done, coupled with the commitment to quality, are the reasons why our customer satisfaction ratings have remained consistently higher than our national competition. In fact, our customer satisfaction scores have risen steadily over the years, reaching a high of 96 percent this past year. However, simply satisfying customers is not enough. We must delight them. That's why we carefully watch ratings of our measurement systems. "Very satisfied" customers are many times more likely to remain loyal than ones that are simply "satisfied." This makes them critical to our overall success. Our very satisfied scores are currently over 60 percent. This is a big reason why our retention rate was the highest ever last year, over 97 percent.

Employee retention is also important to innovation and customer satisfaction

Satisfied employees result in satisfied customers. In general, we're doing pretty well in the employee satisfaction department. Our employee satisfaction levels are at their highest point ever. In fact, our scores are high for our industry.

Because of our high employee satisfaction scores, our employee retention rate is the best in the industry. When you're planning to double in size, this is important for recruiting more world-class people. In the field, I directly observed the relationship between satisfied employees and delighted customers. I also understand from many painful experiences why it takes 10 times more energy to regain a lost customer as it does to retain an existing one. There are irrefutable links between satisfied employees, innovative processes, advanced technology and delighted customers. At Xerox Business Services, we own these links, which create our roadmap to growth and profits.

Delivering excellent results year after year

Kenneth P. Yurgelun—Clearly, one key business objective of XBS is to grow our business at rates at or above the growth of our market. We are the marketplace leaders by a considerable margin, and we have every intention of retaining or increasing our current market position.

To accomplish this we must deliver year over year results that far surpass the overall growth rates of our parent company, not to mention our competition. XBS has in fact delivered these results. Annual growth rate in the U.S. has averaged 30 percent since 1992. More notably, our rate of growth in 1997 alone was 53 percent, well above the five-year average. We're extremely proud of this accomplishment, which is considered a critical success factor.
To ensure that we understand and properly focus on our revenue growth, we measure our results in several distinct categories. First, there is our base of existing customers, which in any given year provides growth based on the success of the prior year. Simply stated, we have more revenue in December than we had in January, and we keep those customers. It’s a source of growth for us year over year. The operational word though is retain. This growth depends on the fact that we retain our customers during the year, and for that reason, we rigorously measure in managed retention rates, and analyze each and every one of our customer losses in detail. Our revenue retention (see Figure 7) is currently in excess of 97 percent, and we’re driving that toward a goal of 100 percent retention.

Second, we strive to grow our revenue within existing accounts, by improving our customer capabilities and adding new value-added services. Once again, the keys are customer satisfaction, confidence in XBS, and having a knowledgeable and motivated on-site presence. We have 80 percent of our workforce at the customer site, who understand and are ready to meet expanded customer requirements.

Third, we must gain new customers, by establishing XBS as the leader of document knowledge, and document management. We offer a full portfolio of leading-edge technology solutions, in terms they can understand through their eyes. Our revenue growth objectives are captured in three simple words: retain, gain, and grow.

While revenue growth is important to our business goals, it must be profitable revenue, against the backdrop of significant revenue growth, and intense competitive price pressure. Our return on sales in the U.S. has shown steady improvement over the last five years. This is the result of continuous focus on productivity and process improvement at our headquarters and field organizations. We continue to invest substantially in the services and tools that will enhance our business today, and impact our future offerings from both the customer and the shareholder perspective.

Higher revenues and higher returns are a powerful combination toward achieving our bottom line financial objective—profit (see Figure 8 on the following page). XBS profits in the U.S. have increased steadily since 1992, with an outstand-
Maximizing profitability, continued

103% improvement in 1997. These results are clear proof that our continuing focus on customers, employees, and overall excellence in everything we do is not only good common sense, but very good business sense.

Sustained achievement can only be realized if we have created and nurtured an environment of continuous learning. Only when you continuously learn can you continuously improve. We're a much better organization than we were several years ago. We also understand that future results will depend on being a far better organization several years from now than we are today.

We do not fight change, we embrace it. We know change brings us closer to the organization we want to be and closer to the organization our customers want us to be.

Lessons Learned

John Lawrence—Our learnings within XBS, and from Xerox Corporation as a whole, have instilled in us a relentless pursuit for excellence. But there were tough lessons learned in the unforgiving school of the marketplace, which is changing very rapidly. I will first discuss some lessons learned from Xerox, the Corporation.

At one point in our company’s history, we had 20 straight quarters of eroding financial conditions, and a loss in market share. The company that invented an industry began with a monopoly, and in five years we had only a 13 percent share of the market. We had a reason to change.

We started with benchmarking, and it's still very much a part of what we do today. Today, if we are not the benchmark in a critical area, we look for 20% improvement year after year, until we become the benchmark. And when we are the benchmark in a particular area, we look for a 10% improvement. We continue to raise the bar. We're not going to settle for just being the benchmark. It's about continuous improvement, and continually getting better.

We also set very aggressive targets. We used to be satisfied with simply having productivity improvements that kept pace with the inflation rates so that we could
offset inflation. We were dealing with competitors who were aiming at 10 and 15 percent improvement rates per year. That meant setting our targets at 20 or 30 percent improvement rates.

So what did all of this mean? This meant enormous cultural change, which is not comfortable, normal, or easy. In 1983, we put in place our leadership through quality approach to changing the culture. It was about changing the way we did business. Fundamentally, it comes down to this—leadership through quality was built on a clear, unambiguous, measurable understanding of quality. Quality meant meeting customers’ requirements. It was led by senior management, and it included role modeling, or leadership by example. Today there are 23 leadership attributes by which we measure whether our leaders are on the right track. It was based on involving everyone, and engaging the brainpower of each employee, because that is far superior to only involving the management team (who had nearly led us out of business!). Finally, it was based on providing a set of tools that began to shape the way people think.

At XBS, we understood the enormous number of changes that we again had to make. Only a couple of years ago, XBS was growing from 10,000 people to 30,000 people, from a $1 billion business to a $6 billion business, from stand alone to network technology. We were not ready to make these changes, so we needed to reflect on how to go about making improvements. The Baldrige Criteria had been the foundation for a lot of what we had done as a corporation, and they came to the forefront again as a mechanism to help us bring about change.

For over 10 years, the strategy at Xerox has been that the customer is number one. It’s the foundation of what has happened at XBS since 1992. Do you realize the significance of the consistency of having that one single priority the same for 10 years? It means people begin to make decisions in a culture where they can think at every level. If I make a decision that’s right for the customer, people are going to see it as right for the business. And they make that decision without fear. It is no longer a test. They can make that decision day in and day out.

To meet customer expectations, we’ve implemented an approach to organizational change that focuses on an environment of empowerment, creativity, and learning. In this environment, XBS people are encouraged to embrace change, and use it as a competitive advantage.

We’ve also implemented a collection of learning activities developed specifically for XBS. The goal of the program is to develop practices that demonstrate that customers are always first and foremost at XBS. Activities include daily customer contact sessions, market research, surveys, close customer follow-up on expectations and requirements.
People are our greatest asset

Our explosive growth has taught us a very important lesson. The people at XBS are our greatest asset. But they’re also our greatest challenge. Their skills, ingenuity, and commitment to customers give us an advantage over our competitors, but we have to develop and retain that asset. Our focus on customer satisfaction and commitment to our employees, has made us the market leader in document outsourcing.

Building for the future

The principles that we use to run the company, and build the legacy, are the same ones that we’re going to use to build the future. We must continually learn and apply our learnings to improvement efforts. But how do we enable people to learn, and how do we create marketplace advantages quickly? We must grow and develop our people, and create a constant learning environment. XBS spends more than $10 million a year on skill building, quality practices, product knowledge, and first line management. A broad range of opportunities are also available. We have college and university programs, technical courses, and programs at our world class training facility.

Creating the right kind of empowerment

We define empowerment in terms of the customer. In its most basic form, empowerment for us is enabling our people to be able to say “yes” to their customers. It’s giving them the confidence that they can explore what is going to really delight a customer, and the company is going to support them.

We need to become a different kind of organization. Our change strategy is one of the most important ways for making this happen. It’s about creating an environment where learning and empowerment can flourish. And that’s one of the jobs of management— to create that environment.

It’s also about our management system. It steers the business through the marketplace. We pride ourselves on being fast to respond to customer requirements, flat to avoid the hang-ups of hierarchy, and flexible to handle the wide range of customer expectations.

Challenges in people, process, and technology

Our challenges come down to people, process, and technology. Today, the management of copy centers, mail rooms, and other document services, make up nearly 80% of our business. In just five years most of our business will come from customized document solutions, applying digital products and electronic networks to meet customer requirements.

From creation and production, to electronic storage and management, managing that explosive growth demands careful planning, and the acquisition, development, and retention of people in record numbers. To do this, we need people who can handle new technology, and help our customers move up the value chain.

We must also create an environment where people can take technologies and
Challenges in people, process, and technology, continued

use them creatively. We're continually evaluating and improving our processes at individual sites in the field and at our headquarters.

We must bring to market the technologies developed in our laboratories. Xerox is legendary for lost opportunities when it comes to technologies. We're the ones who invented the fax machine, the mouse, windows architecture, the laser, desk top computing. All of these things were made popular by other companies.

The way we run the business will continue to be refined. It's the architecture of how we bring everything together. We continue to push the boundaries of understanding the business models that work best in our marketplace and for our customers. We continue to refine our business systems, and our delivery system. We look to our leadership system to tell us whether the things we are asking the people in the enterprise to do are the right things for the business. We look for a delivery system to tell us whether or not we're capable of keeping the promises that we make to our customers, our people, our shareholders, and stockholders.

Outlook for the future

Our market outlook has never been better. We've come a long way, but we still have some great challenges in front of us. We expect to double our number of employees in just a few years. We need to capture the growth opportunities in the global market. The growth of global enterprises is driving us to do just that. There are great opportunities for our customers, there are great opportunities for our people, and there are great opportunities for our shareholders.

At the end of the day, for us, it's not about the management of quality. It's about the quality of management.

Author information

Norman Rickard joined Xerox in 1967 as a senior financial analyst and subsequently held several key financial assignments including Controller of Rank Xerox Limited from 1975 to 1978. In 1978 he was promoted to Vice President of Planning and Control for the Reprographics Manufacturing Group. Rickard joined the corporate staff in 1981 as Director of Business Effectiveness. In 1987, he was named Vice President of Quality and for five years was responsible for the corporate quality office. During that time, Xerox won the Baldrige Award (1989) and the European Quality Award (1992). In 1992 he became President of Xerox Business Services and in 1997 was appointed as the first president of the newly-formed Xerox Document Services Group. Rickard received a B.A. from St. John Fisher College in 1958, and an M.B.A. from St. John University in 1962.

Mark Shimelonis re-joined Xerox in 1996 as Vice President, Quality after serving for three years as a senior vice president at Allied Signal Aerospace. Shimelonis originally joined Xerox in 1972 as a planning analyst and subsequently held finance and operations positions in the United States and Europe. Before his retirement in 1998, Shimelonis was responsible for leading the continuous improvement effort in Xerox Document Services.
Group’s management processes, and for marketing and delivering Xerox Quality Services offerings on a world-wide basis. Shimelonis had been a senior examiner for the Malcolm Baldrige National Quality Award from 1993 through 1997. Shimelonis earned a Bachelor’s degree in Engineering from the General Motors Institute and a Master’s degree from Purdue University.

Penny Sanchez-Burruss joined Xerox in 1979 as a sales representative in the United States Customer Operations Group and has held field management positions including Sales Manager, District Sales Manager and Regional Marketing Manager. She joined Xerox Business Services in 1992 as the General Manager for the Pittsburgh Operations. Shortly thereafter, Sanchez-Burruss joined the XBS headquarters staff as the Customer First Manager, where she was responsible for implementing Xerox Business Services Customer First Strategy and was a key member of the “Baldrige Core Team.” In her current assignment, she is responsible for Customer Loyalty initiatives and activities. Sanchez-Burruss received a Bachelor’s degree in Political Science from Trinity College.

Ken Kaisen is the CIO for Industry Solution Operations of Xerox. In this capacity, Kaisen coordinates Information Management and Process Improvement Initiatives on a world-wide basis. This includes oversight of the outsourcing of Information Technology, as well as leadership of an Enterprise-Level Systems project based on ERP and proprietary software. Kaisen has 18 years of experience in Project Management, Systems Engineering, and Technology-Based Marketing.

Since joining Xerox in 1967, Richard Kievit has held a variety of management positions for Xerox Business Services and Xerox Engineering Systems. Before assuming his current position, he was Worldwide Business Operations Manager, XBS. In his current position, Kievit is responsible for the XBS sales coverage, pricing and contracts, compensation, business process, and President’s Club and sales promotions. Kievit graduated from the US Naval Academy and served in the US Marine Corps for six years. He received his MBA from the Simon School at the University of Rochester.

Edward Ciaschi joined Xerox in 1977 in the employment office. During his career at Xerox, Ciaschi has held several personnel, training and consulting positions in the field and at headquarters. Before assuming his current position, he was Vice President of Human Resources for the United States Customer Operations. In his current position, Ciaschi is responsible for all Human Resource policies, programs and initiatives in the United States, Xerox Limited and Americas Customer Operations. Ciaschi received his Bachelor’s degree in Accounting from Bentley College and has a Master’s degree in Human Resource Management from the New School of Social Research in New York City.

Lori Skjeveland joined Xerox in 1990 as an XBS Sales Trainee. Since that time Skjeveland worked in a variety of sales-related positions. Before assuming her current position, she was site manager in the New York Metro Operations. In her current position, Skjeveland is New Business Sales Manager out of the New York City Operation. Skjeveland earned a Bachelor’s degree in Business from the State University of New York.
Author information, continued

William Patterson joined Xerox in 1973 as a Sales Representative and has held various headquarters assignments including Industry Marketing Manager, District Manager of Sales, and Worldwide Product Marketing Manager. Prior to joining XBS, Patterson was Manager, Marketing Operations and Planning within the High-Volume Reprographics Business Unit for the Xerox Document Production Systems Division. Patterson was named Vice President and Region General Manager for the Southwest Region in August 1994 and for the Southern Region in May 1996. His current responsibilities include leading the Operations Senior Management Teams and ensuring the achievement of the revenue and profit plans. Patterson received his Bachelor's degree in Business Administration and has completed various Executive Education Programs at Harvard and the University of North Carolina Business Schools.

Kenneth Yurgelun joined Xerox in 1973 in the financial support area. During his 24 years with Xerox, Yurgelun has held a number of financial positions within Xerox, including job responsibilities in Engineering, Strategic Finance, International Marketing and Manufacturing. Prior to joining Xerox Business Services in July 1996, Yurgelun was controller for the departmental business team focusing on a major segment of the Xerox equipment portfolio. In his current position with XBS, Yurgelun is responsible for all planning, reporting, and analysis of financial and resource information as well as the full range of division-wide administrative functions. Yurgelun received both his Bachelor's and Master's degrees from Cornell University.

John Lawrence joined Xerox in 1969 in the manufacturing support area, where he was involved in some of Xerox's key product development and manufacturing initiatives, and was named the Head of Engineering for International Trade. In 1990, Lawrence joined the sales and marketing side of Xerox where he held a number of key positions. He has been involved in three of Xerox's major change initiatives: the 1989 Baldrige win by Xerox Business Products and Systems; the 1992 European Quality Award; and the 1997 Baldrige win by Xerox Business Services. Lawrence received a Bachelor's degree in Business and Humanities from St. Michael's College.
Pilot Projects Expand Baldrige Award into Education and Health Care

Susan West Engelkemeyer, Ph.D., Assistant Professor of Management, Babson College, Babson Park, Massachusetts

In October, 1998, Congress approved funding to expand the Malcolm Baldrige National Quality Award into education and health care, beginning in 1999. Over the last five years, I have been involved with the Baldrige Award— as an evaluator for the Education Pilot, as a Baldrige Examiner in the business sector awards, and as the primary author of the Babson College pilot application. Now that education and health care organizations are eligible to apply, one question remains: Are any educational institutions and health care organizations ready for the nation's highest award for performance excellence? I believe that there are several organizations with a possibility of winning.

Some people in the education and health care communities may scoff at the Baldrige Criteria, dismissing them with the thought that education and health care are “different” and held to a higher purpose than traditional businesses. However, the Baldrige Criteria offers a powerful standard for excellence, and a method of self-assessment against these standards. The Baldrige Criteria are about knowledge; they help facilitate organizational learning by measuring progress against plans, while revising plans and processes based on performance measures.

More important than the award may be the impact it would have on the education and health care communities. The results of the for-profit sector awards included cost savings and significant information sharing.\(^1\) As Figure 1 shows, from 1988-1997, college tuition rose at approximately three times the rate of change in the consumer price index (CPI), and medical care price increases were about twice that of the CPI. Perhaps the Baldrige Award in Education and Health Care could help to control the price increases that are making education and health care ever less affordable to students/patients and their families.

![Figure 1. Higher Education and Health Affordability](chart.png)
The Malcolm Baldrige National Quality Award was established in 1987. The Award tries to promote two things:

1) Understanding of the requirements for performance excellence and competitiveness improvement; and
2) Sharing of information on successful performance strategies and the benefits derived from using these strategies.2

The three initial award categories were for-profit organizations in manufacturing, service, and small business. Up to two awards may be given annually in each category. There have been 34 award recipients from 1988 (the first year of awards) through 1998, including 17 manufacturing, 8 service, and 9 small business organizations.

This article will present some results from the 1995 Baldrige Award process, and, specifically, results from the education and health care pilots as compared to business and service sector data.

In the early 1990s, professionals in health care and education began to discover the value of a systemic approach in managing their organizations. Many began to translate the Baldrige business criteria and apply it to their own institution. Consequently, a decision was made in 1993 to launch pilot programs for education and health care. In 1994, training programs were developed and tested and criteria were developed. In 1995 pilot programs were launched to explore the possible expansion of the Baldrige Award to include the categories of education and health care.

The pilot program received applications from 45 health care and 19 education organizations. In addition, over 20,000 copies of the criteria for the pilot programs were distributed. Given the interest in the pilot programs, there was a commitment in 1995 to establish funding to launch a full-scale award program.3 Securing funding in the 1999 national budget was the final step in a process that involved several years of effort on the part of Baldrige Award staff and supporters who had lobbied Congress for Award expansion into education and health care.

Although organizations applying within the Pilot categories were not eligible for a Baldrige Award, all applicants received Feedback Reports. These reports were similar to those received by the business award applicants and included feedback within each of the seven Award Criteria Categories on strengths and areas for improvement as well as comments on the organization’s performance management system. Scoring data for the pilot programs offered insight into the maturity of quality systems in the pilot sectors and enabled discussion of the readiness of these sectors to provide potential award winners in the near future.

Criteria for the Education and Health Care Pilot Programs were based on the 1995 Business Award Criteria. The Pilot Criteria utilized the same framework that was used for the business award, although the categories and items were modified to address the specific culture and focus of education and health care. The criteria modification was primarily a translation of the language and basic concepts of business excellence to education and health care-specific terms. Table 1 details the award...
categories for the 1995 Business Award and the 1995 Education and Health Care Pilots.

The Education and Health Care Pilot Criteria framework, like the Business Criteria framework, consists of four basic elements that connects and integrates the seven categories. These four basic elements include Driver, System, Measures of Progress, and Goal, and are detailed in Figure 2.4.

Table 1. Comparison of 1995 Business, Education, and Health Care Criteria Categories

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>1.0 Leadership</td>
<td>1.0 Leadership</td>
<td>1.0 Leadership</td>
</tr>
<tr>
<td>2.0 Information &amp; Analysis</td>
<td>2.0 Information &amp; Analysis</td>
<td>2.0 Information &amp; Analysis</td>
</tr>
<tr>
<td>3.0 Strategic Planning</td>
<td>3.0 Strategic &amp; Operational Planning</td>
<td>3.0 Strategic Planning</td>
</tr>
<tr>
<td>4.0 Human Resource Development &amp; Mgmt.</td>
<td>4.0 Human Resource Development &amp; Mgmt.</td>
<td>4.0 Human Resource Development &amp; Mgmt.</td>
</tr>
<tr>
<td>5.0 Process Management</td>
<td>5.0 Educational &amp; Business Process Management</td>
<td>5.0 Process Management</td>
</tr>
<tr>
<td>6.0 Business Results</td>
<td>6.0 School Performance Results</td>
<td>6.0 Organizational Performance Results</td>
</tr>
<tr>
<td>7.0 Customer Focus and Satisfaction</td>
<td>7.0 Student Focus, and Student and Stakeholder Satisfaction</td>
<td>7.0 Focus on, and Satisfaction of Patients and Other Stakeholders</td>
</tr>
</tbody>
</table>

Figure 2. Baldrige Award Criteria Framework—Dynamic Relationships

The Education Pilot Criteria includes the seven criteria categories shown in Table 1 and 28 items within the categories. Table 2 lists the 28 items within the seven categories and includes category point values. The Health Care Pilot Criteria also includes 28 items within the seven categories, as shown in Table 3.

Education and Health Care pilot results

One of the objectives of the Pilot Programs was “to determine the interest and readiness of educational and health care organizations to participate in a national level
Pilot Projects Expand Baldrige Award into Education and Health Care

The number of Education and Health Care Pilot Program participants and scoring data would help determine the extent to which this objective was met. There were 19 participants in the Education Pilot (10 Higher Ed and 9 K-12) and 46 Health Care applicants. This compares favorably to the 47 applications for the 1995 Business Award. Scoring data for the Pilot are shown in Figure 3. Scores represent the proportion of available points received by participants on average.

The data in Figure 3, on the following page, demonstrate that the pattern of scoring for education and health care was similar, although education outscored health care in all seven categories. Both sectors scored the highest in Categories 1.0 (Leadership) and 4.0 (Human Resource Development and Management) and lowest in Categories 6.0 (Performance Results) and 7.0 (Student/Patient Focus and Stakeholder Satisfaction).

Insight into the scoring system may yield some explanation for the pattern of scoring. Baldrige scoring occurs along three dimensions: approach, deployment and results. The Baldrige Criteria describes the scoring elements as follows:

- "Approach" — the method(s) used to address requirements in the category/item; recognition program based upon the ability to demonstrate overall performance improvement."7 The number of Education and Health Care Pilot Program participants and scoring data would help determine the extent to which this objective was met. There were 19 participants in the Education Pilot (10 Higher Ed and 9 K-12) and 46 Health Care applicants. This compares favorably to the 47 applications for the 1995 Business Award. Scoring data for the Pilot are shown in Figure 3. Scores represent the proportion of available points received by participants on average.

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- "Approach" — the method(s) used to address requirements in the category/item;
Pilot Projects Expand Baldrige Award into Education and Health Care

appropriateness, effectiveness and innovation,
• “Deployment”— the extent to which the applicant’s approach is applied to all requirements of the item and to all appropriate areas of the organization, and
• “Results”— the achievement of the purposes of the category/items; levels, trends, and comparative performance.

Items within the seven categories were designated as either “approach/deployment” or “results.” Table 4 contains the scoring guidelines used by Baldrige Examiners for approach/deployment and results items.

The scoring guidelines for approach/deployment items can be thought of as a continuum, where possible scores range from 0% to 100%. Evaluators scored Pilot Applications in 10% increments for each item (which is consistent with scoring for business applications). A score of 0% for an item would indicate that the applicant could demonstrate no process was in place to address the item; anecdotal informa-

Table 4A. Scoring Guidelines: Approach/Deployment

<table>
<thead>
<tr>
<th>Score</th>
<th>Approach/Deployment</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>• No systematic approach evident; anecdotal information.</td>
</tr>
<tr>
<td>10% to 30%</td>
<td>• Beginning of a systematic approach to the primary purposes of the item</td>
</tr>
<tr>
<td></td>
<td>• Early stages of a transition from reacting to problems to a general improvement</td>
</tr>
<tr>
<td></td>
<td>orientation</td>
</tr>
<tr>
<td></td>
<td>• Major gaps exist in deployment that would inhibit progress in achieving the</td>
</tr>
<tr>
<td></td>
<td>primary purposes of the item</td>
</tr>
<tr>
<td>40% to 60%</td>
<td>• A sound, systematic approach, responsive to the primary purposes of the item</td>
</tr>
<tr>
<td></td>
<td>• A fact-based improvement process in place in key areas; more emphasis is placed</td>
</tr>
<tr>
<td></td>
<td>on improvement than on reaction to problems</td>
</tr>
<tr>
<td></td>
<td>• No major gaps in deployment; though some areas or units may be in very early</td>
</tr>
<tr>
<td></td>
<td>stages of deployment.</td>
</tr>
<tr>
<td>70% to 90%</td>
<td>• A sound, systematic approach, responsive to the overall purposes of the item</td>
</tr>
<tr>
<td></td>
<td>• A fact-based improvement process is a key management tool; clear evidence of</td>
</tr>
<tr>
<td></td>
<td>refinement and improved integration as a result of improvement cycles and analysis</td>
</tr>
<tr>
<td></td>
<td>• Approach is well-deployed, with no major gaps; deployment may vary in some areas</td>
</tr>
<tr>
<td></td>
<td>of units.</td>
</tr>
<tr>
<td>100%</td>
<td>• A sound, systematic approach, fully responsive to all the requirements of the</td>
</tr>
<tr>
<td></td>
<td>item</td>
</tr>
<tr>
<td></td>
<td>• A very strong, fact-based improvement process is a key management tool; strong</td>
</tr>
<tr>
<td></td>
<td>refinement and integration—backed by excellent analysis</td>
</tr>
<tr>
<td></td>
<td>• Approach is fully deployed without any significant weaknesses or gaps in any areas</td>
</tr>
<tr>
<td></td>
<td>or units.</td>
</tr>
</tbody>
</table>
Education and Health Care pilot results, continued

tion and activities would have been described in the application. A mid-point score, around 50%, would indicate a systematic approach was in place, a fact-based improvement process existed in key areas, and there were no major gaps in deployment. However, some areas might have been in very early stages of deployment. A score of 100% would indicate a sound, systematic approach that addressed all elements of the item, a fact-based continuous improvement process/learning cycle, and full deployment to all appropriate areas of the organization.

It seems logical to assume that an organization that was in the early stages of implementation of a systematic, continuous improvement framework would have a sound approach, but a system that was not yet mature enough to have very extensive deployment. The system would not yet have experienced cycles of learning from measurement systems that track, monitor and improve process performance and results. This would keep the scoring weighted more in the 10-30% scoring band.

A similar argument can be made for results scoring (Table 4B). A score of 0% would indicate poor or no results for the items. A mid-point score would represent good levels and/or trends as well as areas of strength against comparative or benchmark organizations. A score of 100% would indicate excellent levels and and/or trends as well as several areas of benchmark performance.

To provide some calibration for scoring, only 6% (3 out of 47) of the applicants for the 1995 business award had scores in the 651-750 range (65-75%), and no companies scored above 750. Therefore, winners score somewhere around the 70% level overall. A score in the 50% range would indicate relatively strong overall performance, and a score around 25% may simply indicate an organization in the early stages of development with regard to strong, integrated processes and systems for performance excellence. The distribution of scoring for the 1995 Business and Education/Health Care Pilots are shown in Table 5.

<table>
<thead>
<tr>
<th>Score</th>
<th>Approach/Deployment</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>No results or poor results reported.</td>
</tr>
<tr>
<td>10% to 30%</td>
<td>Early stages of developing trends; some improvements and/or early good performance levels in a few areas. Results not reported for many to most areas of importance to the participant’s key requirements.</td>
</tr>
<tr>
<td>40% to 60%</td>
<td>Improvement trends and/or good performance levels reported for many to most areas of importance to the participant’s key requirements. No pattern of adverse trends and/or poor performance levels in areas of importance to the participant’s key requirements. Some trends and/or current performance levels—evaluated against relevant comparisons and/or benchmarks—show areas of strength and/or good to very good relative performance levels.</td>
</tr>
<tr>
<td>70% to 90%</td>
<td>Current performance is good to excellent in most areas of importance to the participant’s key requirements. Most improvement trends and/or performance levels are sustained. Many to most trends and/or current performance levels—evaluated against relevant comparisons.</td>
</tr>
<tr>
<td>100%</td>
<td>Current performance is excellent in most areas of importance to the participant’s key requirements. Excellent improvement trends and/or sustained excellent performance levels in most areas. Strong evidence of benchmark leadership demonstrated in many areas.</td>
</tr>
</tbody>
</table>
Table 5 shows that although no pilot application scores were in the range of typical Baldrige winners (651-750), there were two education and three health care applications that scored in the 451-550 (45-55%) range. This would indicate a well-developed continuous improvement framework; a sound approach to the items, although some elements of the items might not be extensively addressed or fully deployed. Results would have demonstrated good levels and/or trends and strong comparative performance.

Scoring levels and patterns provide insight into the maturity of quality management systems in the education and health care sectors. Comparing education and health care scores to service scores on the 1995 Baldrige Applications provides additional insight into education and health care’s readiness to compete for a Baldrige Award. Service scores (as opposed to manufacturing, small business, or aggregate scores) were selected because it would seem Education and Health Care scoring would be more likely to correspond to service sector scores than other award category scores. Figure 4 compares average category scores for Service, Education, and Health Care.

Figure 4 shows the pattern of scoring appears similar across all three industries. The two highest scoring categories were 1.0 (Leadership) and 4.0 (Human Resource Development and Management) for all three industries. The lowest scoring category for all three is 6.0 (Performance Results for Education, Health Care and Business Results for services). Although the ranking of scores differs in the other four categories, the overall scoring pattern appears quite similar. However, there is much higher scoring in all the categories for service. Data provided by the Baldrige Award Program states there is a significant difference between education and service industries and between health care and service industries for all seven categories. Since scoring along the continuum represents the maturity level of quality management systems, it is possible that the significant scoring differences represent education and health care sectors that are in the early stages of their quality management journey. Since the pattern of scoring is similar but the level of scoring is significantly higher in all categories for service, this would support this claim. Education and Health Care Pilot applicants may have demonstrated a sound approach, but are in the early stages of deployment and implementation of feedback and cycles of improvement for processes.
Although the pattern of scoring across all seven categories is similar, some interesting differences emerge when the scoring gap is compared across all three industries. The largest scoring differences occur in Categories 6.0 and 7.0. Category 6.0 contains “results” items. One possible explanation for the greater difference in category scores is maturity level with respect to a continuous improvement management system. It is possible that approach and deployment, as measured in categories 1.0-5.0, is not yet mature enough to be reflected in results. It seems reasonable that there will be a lag between effective process design, implementation of measurement systems and positive results. Even if education and health care applicants are beginning to experience good levels in results, positive trends cannot be demonstrated for at least three years.

Another factor might contribute to the large scoring difference for Category 7.0. This category examines student/patient focus and student/patient and stakeholder satisfaction. This is the parallel of customer focus and satisfaction in the business criteria. The “customer” discussion has undergone intense debate in both the educational and health care communities. To measure and address student/patient satisfaction would imply a “customer” orientation to students and patients, one that many educational and health care organizations are not yet ready to internalize. In addition, both education and health care have multiple “customer” (stakeholder) groups—students, parents, alumni, hiring companies, etc. for education; and patients, families, insurers, the community, etc. for health care. Determining how to simulta-
Education and Health Care pilot versus Service results, continued

neously address and balance the often conflicting needs and expectations of these multiple customer groups is a daunting undertaking, one that some schools and health care organizations are working hard to address, while others continue to ignore.

Overall, the smallest scoring differences occur in Categories 1.0 (Leadership), 2.0 (Information and Analysis), and 3.0 (Strategic Planning). This indicates strong leadership for performance improvement, clear strategies for mission attainment, and appropriate information and analysis to indicate progress against strategic goals and objectives. However, the large scoring differences in results could be indicative of lack of a mature performance excellence system (as indicated above), or it could also indicate misalignment of systems and lack of organizational focus on students/patients and other stakeholders.

It appears that Education and Health Care is ready for the 1999 Baldrige Award. Based on 1995 Pilot scoring data it is possible as many as five education and health care organizations could have moved into potential award winning scoring range. This would include the five pilot applicants that scored in the 451-550 range. The four years since the pilot may have seen these organizations move to more extensive deployment (which would increase scoring in “approach/deployment” items). In addition, these organizations may now be seeing the impact of their systemic approach to organizational excellence more clearly reflected in results through higher comparable and competitive levels of performance, and positive results trends. The four years may have allowed these organizations to move along the continuum from the 50% to the 70% award-winning level.

Educational and health care organizations will fare well against the Baldrige Criteria if they have clearly articulated missions and internal systems aligned with that mission that yield high performing results. In contrast, those educational and health care organizations that talk of excellence but cannot document that the institution is delivering on its mission will not perform well against the Baldrige Criteria.

It is important to note, however, that organizations who apply become “winners” even if they do not receive an award. Invariably, the private sector winners have said that while winning the award is great, a major benefit is the organizational learning that happens from going through the process of self-assessment during preparation of the 70-page application, and having the examiner feedback report.

For the industry, having benchmark organizations in education and health care will benefit the entire education and health care communities. All could learn from the education and health care winners, then adapt and implement best practices that would enable performance excellence for all. It will be interesting to see if educational and health care organizations will be recognized as a benchmark for performance excellence in 1999.

For additional information on the Baldrige Award contact: Malcolm Baldrige National Quality Award, National Institute of Standards and Technology, Route 270 and Quince Orchard Road, Administration Building, Room A537, National Institute of Standards and Technology, Route 270 and Quince Orchard Road, Administration Building, Room A537.
Pilot Projects Expand Baldrige Award into Education and Health Care

Gaithersburg, MD 20899-0001. Phone: (301) 975-2036.
You may also visit the Baldrige website at http://www.quality.nist.gov.

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1. 1996 Basic Slide Set, The Malcolm Baldrige National Quality Award. This package contains information on the award provided to examiners for use in public presentations and information sessions on the Baldrige program.


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The Path to Prosperous Innovation

Debra M. Amidon, Founder, Entovation International, Wilmington, Massachusetts

My research into knowledge management began at Digital Equipment Corporation, where our activities included funding research at universities and research consortia around the world. My responsibility was to move the knowledge from those research projects into the company so that we could productize—move from R&D concept to commercial product—faster than our competition. I have continued my research into innovation and knowledge strategy at Entovation, a global research and consulting network. This article will discuss how managers can evaluate their organization’s management practices, gauge their organization’s ability to innovate, and create an innovation strategy for their organizations.

Innovation is not just invention—it is a combination of invention, creativity and quality improvements. Our task as leaders is to enable innovation. In organizations that have been downsized and right-sized, this will be very difficult. This risk-averse business environment is often hostile to innovation and requires managing in a different way. Modern management methods are not focused on information or technology—they’re focused on knowledge, the innovation process, and collaboration.

Charles Handy says that companies must create new products and services while they are successful, not when they reach the point of decline. Unfortunately, people want to mass-produce products and reap the profits. But once the product life cycle has started to decline—it’s too late. The decline is much faster than it used to be. It takes courageous and astute leadership to balance the competing demands of short-term profitability and long-term growth. Leaders must retain the best of the past while simultaneously introducing new concepts for sustained innovation.

Creating an organizational environment that nurtures and directs innovation now requires managers to manage the knowledge—the intellectual capital—of the organization. Many organizations still use older models, or generations, of management. Figure 1 on the following page shows the progression of core strategies and change factors through the generations of management practice. In his book Fifth Generation Management, Charles Savage outlines a new set of principles: peer-to-peer networking, integrative processes, work as dialogue, human-time and timing, and virtual-task-focusing teams. He described “invisible networks”—which have come to be known as “communities of practice”—as constituting the real strength of a company. Understanding these communities of practice and their dynamics is required before managers can create innovation strategy for future success. The matrix shows the shift from a focus on the product as the asset, to the project, to the enterprise, to the customer, to finally knowledge as the asset. We now have a better
An evolution in business models, continued

understanding of the five domains of management operations: performance, structure, people, process and technology. We now know that it is not the skill base that usually requires management attention. It is people's motivation— their emotional intelligence, their commitment, their intuition, and how that intuition is brought alive—that is important. The reality is that often we are living in fifth generation kaleidoscopic change dynamics and using second or third generation management technologies.

This matrix also shows an important shift in the organization's relationship to its customers. Early management generations strive to retain customers, then they strive to achieve customer satisfaction. Fourth and fifth generations strive to help their customers become successful, creating a symbiotic relationship with them. This requires some major changes in the organization's sales model, increasing the amount and quality of customer interaction from making contact, to having a dialogue, then to creating a learning network. Making this shift will enable organization to innovate with their customers, meeting their customer's unarticulated needs.

You can use this matrix to evaluate what generation of management your organization uses. In real-life, different business units of the same organization often place themselves in different boxes. It is not important where you place yourself in the organization, but why. Use this matrix to generate dialogue about your management practices. From this dialogue you can develop a strategy to move forward.

This model is not prescriptive; management judgement is still required. At times a competitive strategy is the appropriate strategy or mode of interaction. And

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**Figure 1. Management Generation Matrix**

<table>
<thead>
<tr>
<th>Core Strategy</th>
<th>1st: Product as the Asset</th>
<th>2nd: Project as the Asset</th>
<th>3rd: Enterprise as the Asset</th>
<th>4th: Customer as the Asset</th>
<th>5th: Knowledge as the Asset</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Function in Isolation</strong></td>
<td>Link to Business</td>
<td>Technology/ Business Integration</td>
<td>Integration with Customer R&amp;D</td>
<td>Collaborative Innovation System</td>
<td></td>
</tr>
<tr>
<td><strong>Unpredictable Serendipity</strong></td>
<td>Inter- dependence</td>
<td>Systematic Management</td>
<td>Accelerated Discontinuous Global Change</td>
<td>Kaleidoscopic Dynamics</td>
<td></td>
</tr>
<tr>
<td><strong>R&amp;D as Overhead</strong></td>
<td>Cost-Sharing</td>
<td>Balancing Risk/Reward</td>
<td>“Productivity Paradox”</td>
<td>Intellectual Capacity/ Impact</td>
<td></td>
</tr>
<tr>
<td><strong>Hierarchical; Functionally Driven</strong></td>
<td>Matrix</td>
<td>Distributed Coordination</td>
<td>Multi-Dimensional Communities of Practice</td>
<td>Symbiotic Networks</td>
<td></td>
</tr>
<tr>
<td><strong>We/They Competition</strong></td>
<td>Proactive Cooperation</td>
<td>Structured Collaboration</td>
<td>Focus on Values and Capability</td>
<td>Self-Managing Knowledge Workers</td>
<td></td>
</tr>
<tr>
<td><strong>Minimal Communication</strong></td>
<td>Project-to-Project Basis</td>
<td>Purposeful R&amp;D Portfolio</td>
<td>Feedback Loops and Information Persistence</td>
<td>Cross-Boundary Learning and Knowledge Flow</td>
<td></td>
</tr>
<tr>
<td><strong>Embryonic</strong></td>
<td>Data-Based</td>
<td>Information Based</td>
<td>IT as a Competitive Weapon</td>
<td>Intelligent Knowledge Processors</td>
<td></td>
</tr>
</tbody>
</table>

*Source: This chart originally appeared in the “The Challenge of Fifth Generation R&D.” Research-Technology Management Journal, July-August 1996*
at times some distrust of borders is appropriate. A thorough understanding of these
generations of management and how they are best used will increase your
organization's adaptability and agility.

The fifth generation of management, which considers knowledge to be the asset is, unfortunately, the model we understand the least. Too often managers measure the wrong things. They measure what they can measure. If you use first or second generation measures to manage the innovation process, you are asking the wrong questions and getting the wrong answers.

Consider for a moment what knowledge is. Information is data with context. Knowledge is information with meaning. By definition, knowledge is inside human beings, and the agenda to improve knowledge management is therefore human. Managers, therefore, must not only be concerned with expert systems, they must manage the entire process—not just data and the flow of information—the path of knowledge throughout the organization.

The Economist said recently that there's something different about managing knowledge as an asset. "It seems to defy the basic economic principle of scarcity...the more you use it and pass it on, the more it proliferates...What is scarce in the new economy is the ability to understand and use knowledge." By sharing knowledge and collaborating, people can develop symbiotic relationships that enable them to discover, anticipate, and operationalize something that they couldn't have done individually. Fifth generation management does focus attention on enabling collaboration within the organization, within alliances and, most importantly, with its customers.

Collaboration with customers, creating an open dialogue, is necessary to create new products and services in new markets. There is an important difference between your customer's knowledge and your knowledge of customers. Customers have knowledge about your products and services, and your competitor's products and services. They may even have a better understanding of your competitor's direction than you might glean from your own competitive analysis. More importantly, they know what they need, or what they think they need. What you need to know to create innovative products and services is what it will take to make them successful. Creating this symbiotic relationship with your customers will enable you to satisfy unarticulated needs and unserved customers.

How can managers transform their organizations, even ones that have been down-sized and right-sized, to enable sustained innovation? The following five activities will help you begin to lead your organization forward.

1. Make innovation a widely understood strategy

Make innovation—moving an idea to market—an explicit and widely communicated strategy. One problem many companies now face is the internal competition for resources—financial, and more importantly attention of the leadership. A organization can be mobilized and motivated to capitalize on the opportunities
1. Make innovation a widely understood strategy, continued

2. Test your organization’s innovation prowess

created by unarticulated needs and unserved markets when they share a sense of purpose. (Some practical advice—many managers underestimate the number of times a message must be repeated before people take it to heart.)

Perform an honest assessment of your organization’s innovation capacity; its ability to create and move ideas into the marketplace. To help you do this we have created the following ten-question test to gauge how innovative your organization is. This test will help you more fully understand the scope of the innovation process.

Answer the following questions yes or no.

1. Has one person been chartered with the overall responsibility to manage the corporate-wide innovation/collaborative process?

In short, is anyone minding the store? Is the collaborative process required for innovation anyone’s responsibility? If there isn’t somebody assigned explicitly, then the CEO is de facto chief knowledge officer. When you start looking at the innovation process, you realize it’s much more complex than the R&D charter.

2. Are there performance measures—both tangible and intangible—to assess the quality of your innovation practices?

To manage the process, you have to measure the process. Do your measures assess the innovation process, or are they only measuring what you can measure? Dow Corporation is probably the most renowned for its intellectual asset management model. The 3M Company has set a goal of 30 percent of their sales to come from products less than five years old, and 40 percent from products less than three years old. Many other companies are trying to develop metrics like this to monitor the rate of new product introductions. Rover developed a model that monitors flow of best practice.

3. Do your training/education programs have provisions to incubate and spin-off new products and businesses?

These programs are overlooked sources of innovation. Are you cataloguing material from the past? Or are you creating incentives and mechanisms to incubate new businesses, to spin out new products and services? This question also requires managers to actually look at the value of people’s time being brought to a corporate laboratory in some way. How are they spending their time? How are you measuring their progress? If that’s the place to generate ideas, how many of them are you incubating? It usually takes about 18 months to figure out if the idea could become a viable—and profitable—product or service. Monsanto probably has the best industrial incubation facilities. Hewlett-Packard has experimented with a simulation game called tango to help managers learn the intangible value of the firm.

4. Does your local, regional, or international presence operate as a distributed network of expertise that learns from as well as distributes to customers?

Does your organization’s presence operate as a node in a network, cross-fertilizing? Or does it operate as a delivery mechanism? Ordinarily we create something in one place, we transform it in another location, and then distribute it from a third. What is needed is an understanding of the entire innovation process—from idea to action. Organizations need to develop their geographic presence as a learning
2. Test your organization's innovation prowess, continued

network, so that they can learn from their alliances and suppliers as well as customers. Hughes has what they call the Information Super-Highway. Skandia has its Futures Centers and 3G Planning—a planning technique to bring together the expertise of the firm, from newly hired to veteran employees.

5. Is there a formal intelligence gathering strategy to monitor the positioning of both current and potential competitors?

Because of the rapid advancements in technologies and diversifying of markets, managers must have a radar scope wide enough to track current and potential competitors. Furthermore, processes must be systematic and updated on a “real-time” basis in order to capture and capitalize upon the intensified market dynamics.

6. Does the rate of introduction of new products and services exceed the norms of your industry, and create new markets in which you can excel?

Steelcase Corporation is no longer in the office furniture business; they still sell office equipment, but now they are in the optimal learning environment business. A former Vice-President for Research and Business Development once asked, “How can I create the business plan for the product that does not yet exist. There’s nobody to benchmark. No one to tap into. How do I do that?” Companies are beginning to learn how to do that by shifting from transactions to partnering. Hoffman-LaRoche increases innovation through knowing what, understanding why, and making sense through prototyping.

7. Has a strategic alliance manager been designated to create and manage the network of partnerships and joint ventures to leverage your firm?

How are your alliances managed? Are you learning from your alliances? We learned that the Japanese get in and out of alliances quickly. The purpose of their alliance may or may not be what’s written on the agreement. Most European companies don’t want to let anything go, so they add and add to the contractual agreement. Here are some examples of networks of partnerships. Ernst & Young worked with MIT for the Management of the ‘90s program. Steelcase, working with the Institute for the Research on Learning to develop the notion of community of practice, probably has done the most innovative work with customers.

8. Does your marketing image portray an organization with the capacity to create and move ideas into the marketplace to make your customers successful?

Do your business customers perceive you as a company that’s viable in the future? They’re not investing in your past—they are looking for who’s going to be successful in the future. Some examples of knowledge advertising are—National Bioscientist—If you can think it, we can make it. MRI is a staffing and executive search firm—Intelligent staffing solutions. Old tradition, new thinking—Harvard Funds. Hewlett-Packard—Prepare to have that idea shattered. Eli Lilly—Knowledge is powerful medicine. Ask what kind of research your company is doing? Service organizations in particular are not noted for doing any research. In fact, most consulting organizations won’t use consultants at all, because they figure they know it all.

9. Have resources been allocated to articulate a compelling vision internally, and share company expertise externally through publications and participation in major forums?

The knowledge economy requires a new kind of leadership. It isn’t an
Test your organization’s innovation management prowess, continued

economy where everything is kept closed. It’s an economy where you learn and you share with as many people as you possibly can—to make the vision as visible as you possibly can. Gone are the days when a company develops a competitive advantage through the hoarding of knowledge—even their own!

10. Is the computer/communications capability treated as a learning tool for internal conferencing and external business leverage on the World Wide Web?

If your website isn’t used to enable dialogue, it’s just another way to publish your brochure. Are you learning from those who visit your website as well as disseminating information to them. I get almost 8,000 hits every week on my website from 52 countries, and I’m negligent in converting that as quickly as I possibly can into dialogue. The organizations that are pursuing interactive dialogue are benefiting from the wonders of the technology.

If you answered seven out of the above ten questions in the affirmative, your organization probably has a good grasp of the innovative process and knows how to create an environment for the optimal flow of ideas. If you answered no to more than three or four questions, you may want to take a closer look at how you leverage your intellectual capital.

Once you have completed this litmus test, you can perform a gap analysis (Figure 2) on these questions, and systematically plot where you are and where you’d like to be. Then you can create a strategy to close the gap.

Figure 2. Example of radar chart gap analysis

Gap analysis reveals a range of strengths and weaknesses

3. Assign responsibility for innovation process

As you assess your organization’s ability to innovate, the next step, if you haven’t already, is to assign someone the responsibility/authority for the corporate-wide innovation process. Few organizations have an explicit innovation process, never mind a designated senior executive responsible for the process. Moving an idea to market requires every function in the organization—and increasingly suppliers and contractors outside the organization—to play interdependent roles. When the CEO is the only one really in charge, the process fails to receive the attention it requires.
4. Build an environment for collaboration

Create a collaborative initiative that binds the whole enterprise, including all stakeholders (for example, partners, suppliers, customers, perhaps even competitors). An important shift in values must take place in an organization before it can improve its innovation process. Creating communities of knowledge practice requires creating a common language and a sense of trust and respect, so that people can work with one another instead of competing against one another in organizations and alliances. Managers must create a sense of collaboration amidst growing global competition. Creation of an innovation strategy may be the bonding initiative that creates the common language, capitalizes on distinctive competencies, and fuses collective knowledge into a shared purpose.

5. Monitor your progress

Once you begin to implement your innovation strategy, monitor your own progress against goals consistent with your corporate culture and practice (re)design.

Knowledge management laggards and leaders

Although every organization in every industry is knowledge-intensive, our research revealed a wide range of strengths and weaknesses in knowledge management practices. The laggards have a simplistic notion of what knowledge sharing is really all about. They downsize/outsource without considering the knowledge dimension. They understand that knowledge is power, but don’t consider that managing knowledge is more powerful still.

The leaders realize that there’s a comprehensive dynamic vision unfolding here; they understand there are systematic processes and knowledge frameworks. The leaders are pioneering. They create broad interaction both internally and externally. They are inquisitive, open to the new ideas; they are not nay-sayers. They realize that collaborative knowledge is more powerful than individual knowledge.

You can place your organization on the path to prosperous innovation by evaluating your organization using the management generation matrix and by (1) making innovation a widely understood strategy, (2) testing your organization’s innovation prowess, (3) assigning responsibility for the innovation process, (4) building an environment for collaboration, and (5) monitoring your progress.

References


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