

THE CHALLENGE OF THE FUTURE

For those who live in the past, there is no future.

*“If you take no part in the design of your future, it will be
designed for you by others.”*

—*Edward de Bono*

Drivers of the Future

The environment in which we live is changing rapidly and in unpredictable ways. Individuals who are creative are able to bring about change and visualize future opportunities. **Creative leaders are a critical resource needed to find answers to difficult problems.** They are the ones who can navigate the future. They are able to embrace ambiguity and reframe problems as opportunities. They have competencies that include how to read and understand the environment, build alliances, recognize the importance of social responsibility, manage complexity, use information technology, and encourage creativity. Increasingly, leaders are using a proactive stance in taking their organizations into uncharted territory.

Leaders are willing to confront adversity, but in no situation should they be the end of the line. They must continuously interact with their

constituencies, whether in politics, production, education, religion, and so on. Each of these groups has its own opinion about what is desirable. They influence what a leader can do. Like a tightrope acrobat, the leader balances on a slender wire, where any misstep can result in disaster. **Effective leaders are willing to take risks, think outside the box, and recognize that empowerment provides a sense of ownership to stakeholders that helps to assure proposed changes will be accepted.**

An insightful view of leadership is found in *The Contrarian's Guide to Leadership*, a book co-authored by Dr. Stephen Sample, President of the University of Southern California, and Distinguished Professor Warren Bennis. They discuss the need to open vistas not previously explored or accepted. Contrarian leaders do not follow the pack. They believe in their own ideas of what is best. However, they listen openly and are responsive to new ideas, and are willing to constantly adjust their position in response to impending change. They also know the value of creative contributions from employees. A single innovation was what led to Intel's microprocessor. This is the kind of quantum jump that can be achieved by motivated employees.

Warren Bennis, a leader in the field of leadership, has published numerous books and articles on the subject. He conducted a research study with Robert Thomas in which they found that extraordinary leaders are the ones who have the skills needed to conquer adversity and emerge stronger because of it. Their research also showed that great leaders have the ability to create a sense of inclusion, where people share meaning with one another. These leaders have a distinct ability to communicate with a compelling voice that inspires a strong sense of values. Strong leaders are able to transcend adversity and reinvent themselves. They learn from their ordeals and have the perseverance to carry on even under adversity. Other factors that describe great leaders include knowing how to interact with people to gain commitment and having the ability to recognize what is important to members of an organization that make them feel a sense of excitement where all want to join in.

Leaders understand that creative ideas require recognition for those who are willing to stick their necks out. The difference between creative and non-creative people often depends on their willingness to take risks. Inventors such as Thomas Edison immersed themselves in their work and carried out hundreds of unsuccessful experiments before finding ones that worked. Individuals considered geniuses also turned out to be very hard workers, often producing a high volume of work. What these geniuses had in common was a deep understanding of their area of expertise, along with an ability to recognize anomalies that most people miss. They also were highly motivated and able to concentrate on problems or ideas for long periods of time.

Leaders who focus on encouraging and supporting their organizations to achieve new products and ideas will be the ones who will be out in front. Richard Lewis, founder and past CEO of Accountants Overload, balanced his inspirational style with his imaginative style. He was described by his employees as warmly enthusiastic, imaginative, and as having a flair for problem-solving. He constantly looked for ways to encourage and reward people. Lewis decided to make every employee a manager. With his senior management team, he developed what he termed “Chairman’s Projects.” He placed employees in leadership roles as project managers even though they had no prior experience in those positions. With his many ideas and a genuine desire to encourage his employees to be creative, he produced an environment in which innovation was a day-to-day activity. Organizations that have a strong interest in promoting creativity are the ones that become more competitive.

Successful leaders take moribund companies and turn them around so that they become viable, productive entities. Examples include Lou Gerstner at IBM, Lee Iacocca at Chrysler, and Jack Welch at GE. All exuded confidence, enthusiasm, and energy, and relied on a vision that could bring about desired change. Charisma is obviously a desirable trait in a leader, but by itself, it is not sufficient to assure desired outcomes. Studies have shown that, at best, all a leader can achieve is per-

haps a 25–30% improvement after taking into account the impact of industry and economic factors. The question then is how does a strong, charismatic leader recognize the importance of bringing the organization along with his or her vision. Jack Welch at GE was willing to “lay waste” to parts of the company so that the remaining units would have a greater chance of success. This assured that the least profitable units would not encumber the units that would move GE ahead.

Responding to fierce global competition, Jack Welch focused GE’s efforts in areas where he felt the company could be number one or two in the world, and gave up on all other divisions of the company. He introduced an employee “Workout Program” that used a form of town meeting, where employees could share ideas and make suggestions. In turn, managers were required to make decisions on the spot. In this kind of open environment, GE was able to correct many of its problems in a timely fashion.

Other companies have also set up informal work systems and networks for generating and sharing ideas. This approach fosters teamwork, which can contribute to huge dividends. Team members not only learn from each other, but also are able to generate better ideas together than they could separately. An important benefit of the team approach is that when a member leaves, his or her knowledge does not leave as well. An additional benefit of investing in team members is to help them increase their knowledge so they are encouraged to stay with the company.

How Creative Leaders Function

A leader’s creative style and Creative Intelligence will often determine the likelihood of successful change. The intuitive-style leader often introduces change by announcing it. The response to this approach generally creates rigidity. The inspirational leader, on the other hand, discusses change, holds meetings, and explains why change is needed.

This creates a more open, trusting organizational culture. The innovative-style leader tends to focus on technical matters and often overlooks the needs of people. The result is that there is typically resistance to change. The imaginative leader has a clear view of future needs and opportunities. However, because of the concern with future needs, current problems can sometimes be overlooked. In general, the imaginative leader also understands the needs of the organization and finds ways to include people in the vision. An inspirational leader, such as Richard Lewis, brings the organization along with his or her ideas. Thus, the creative styles of senior managers often determine whether change will be accepted at all. Customers, suppliers, government agencies, and the entire network that embraces our social and political structure must also accept innovation. For example, plasma is a gas used in super-thin, wide-screen televisions that provide excellent displays and are flicker-free. However, the price is extraordinarily high and customers may not see the added value of an exceptionally bright picture on a wide screen. This is an example of the difficulty of introducing a new product that has severe economic hurdles.

Over a period of time, even workers who are creative lose their motivation if they feel management is no longer interested in them. At Ore-Ida, the J. J. Heinz Co. producer of frozen potatoes, there was limited new product development even though innovation had been a strategic priority for years. The research department at Ore-Ida did not believe that management was serious about new product development. Shortly after managers shared their thinking with the research group, there were positive results. A million dollars in cost savings was uncovered in one year, and over a three-year period, there were numerous new products and product line extensions.

In many instances, it is not the sheer effort or willingness to be creative that assures results. Perseverance and patience are the qualities required for breakthrough achievements. Consider Edison's many experiments to find a filament for his light bulb, or Darwin spending years traveling around the globe gathering evidence for what became

his Theory of Evolution. Most organizations don't have the time or resources to pursue long-term, complex projects. A company that was ahead of the curve in the development of a computer program that could transmit motion pictures over ordinary telephone lines had to give it up because of the complexity of inventing a new approach and the need for very talented workers. Resources were not available to complete the program in a reasonable period of time. As Amabile, Hadley, and Kramer described it, creativity gets killed when it is under the gun.

How Change Is Introduced

Many of the old rules governing how to institute change will have to be thrown out. Slow, incremental change in bureaucratic structures no longer works in meeting rapidly changing environmental crises. **A quantum leap is needed to deal with changing external forces.** Leaders will need to focus on opportunities along with productivity to achieve effective performance. Leaders who are concerned with significant change need to convince their organizations to accept new ideas. To accomplish this goal, language becomes an important aspect of portraying organizational vision. Using the right words is especially important when trying to convince employees to accept personal risk. This is more easily said than done. Gaining the confidence of employees is difficult. They will need to embrace a new culture, with new expectations. This requires sensitivity on the part of the leaders and must be backed up with credible behavior. Dealing with personal values and deeply held beliefs requires a leader who is sensitive to individual needs and is able to build confidence and gain commitment.

Bernard Denburg, an expert in turning troubled companies around, recognized the importance of empowering employees. He focused their efforts on innovation, not cost reduction, to turn sick companies around. Using this basic logic with over 45 troubled companies, he was able to make every one of them profitable. He recognized that the cre-

ative power of employees could work wonders. An example was the successful outcome at A&E PlastiPac, which used his strategy and their innovation to save the company. A&E produced plastic bags for food chains. When the large plastic manufacturers entered the field, they nearly drove A&E into bankruptcy. To counter this threat, Denburg challenged his staff to change the product so that it would be unique. With Denburg's help, they came up with the idea of adding the names of the food chains to the plastic bags and thereby A&E was able to recapture the market.

In his book *Leading the Revolution*, Gary Hamel maintains that in recent years, businesses have engaged in a technology race much like the international arms race. **In most cases, investments in technology have improved profits across the board. However, radical innovation is critical for companies to stay ahead of the pack. Fresh thinking and a passion for work are the key elements needed.** Hamel suggests that we recognize the need for innovative upheaval on the job rather than using incremental change. Two individuals at IBM, a programmer named David Grossman and a staff executive named John Patrick, kept pushing the unpopular idea of the Internet to their superiors. They found a variety of innovative ways to demonstrate the potential power of the Web. They were finally able to gather a group of believers, including CEO Louis V. Gerstner Jr., which eventually made IBM a major player in the Internet world.

Hamel claims that only radical change will lead to innovation, and that revolution is needed to achieve the goal of reinvention. Business has experienced rapid and often disruptive change in markets and technology over the past decade, and companies will have to make fundamental changes—reinvent themselves—to survive and prosper. On the other hand, there are those who contend that revolutionary change may not be best for all organizations because it causes monumental stress and not all organizations would survive intact. Those organizations believe that effective change can best be accomplished through well-planned, incremental means. The best advice is: If the shoe fits, wear it!

Part of the problem in introducing innovation is that companies flip back and forth between change practices. The first is economic change, such as restructuring and downsizing. Then it is organizational change, which includes the enhancement of employee attitudes and skills. Beer and Nohria contend that 70% of change projects fail because companies don't use both of these approaches together in a consistent and well-integrated manner. They do not feel that the revolutionary approach, so often advocated in recent years, is the correct way to proceed. Obviously, because of the differences regarding how best to introduce change, there is no one best answer. Some industries are better suited to change because that is how they remain ahead of the pack. Companies in biotechnology, the computer field, and advertising are examples of where change is both needed and accepted. In other companies, such as farm products and transportation, evolutionary change is preferred.

An example of balancing risk with a potentially high payoff was tried at Ballard Power Systems. Geoffrey Ballad wanted someone with a fresh and creative perspective—with few preconceived notions—to help design fuel cells. He hired a chemistry professor, Keith Prater, to work on fuel cell technology, even though the professor had no prior experience in the field. Obviously, Professor Prater's innovative style was transferable from chemistry to fuel cells. Consequently, Ballard's gamble paid off. Given the opportunity and the challenge, Prater made important breakthroughs in the development of fuel cells, which now power many of the buses and cars we use.

Microsoft recognized that there had to be a balance between innovation and discipline, so it hired Robert Herbold, a management consultant, to handle the crisis caused by an informal, creative atmosphere that was not meeting revenue targets. During his seven years at Microsoft, he was able to assist in quadrupling revenue and achieving a seven-fold increase in profits, while at the same time reducing operating expenses from 51% to 40%. How did he accomplish this? He started by identifying products that would excite customers, and then

introduced a creative, new approach to sales. He had to overcome the isolated fiefdoms that existed within Microsoft, and to form an integrated information system that would be used by all managers throughout the company. A key success factor was his ability to “explain” why particular changes were needed. However, gaining acceptance of the changes required the leadership of a CEO who was sensitive to the creative needs of the organization as well as meeting customer needs.

Organizational Change

Organizational change, in general, is an exceedingly difficult task. Every leader recognizes that organizations must continuously adapt to changes in the external environment. Nonetheless, the introduction of organizational change creates anxiety and fear. When a major adjustment is required because of some newly proposed reorganization, it can lead to high levels of “fight, flight, or freeze.” **To introduce continuous change, such as that required in today’s turbulent environment, leaders need to recognize the importance of motivation and the involvement of employees.**

An example of how effective leadership helped to keep innovation and entrepreneurial energy alive was the approach taken by CEO George Hatsopoulos of Thermo Electron Corporation. He allowed each new project to spin off as a separate company, with Thermo Electron as the majority stakeholder. While thought by some to be primarily an innovation in capital financing, he believed it provided a strong incentive to employees, while at the same time being helpful in bringing in funding. His approach has been an ongoing success.

On the other hand, companies can inadvertently discourage innovation. A new marketing director was hired to help in meeting fierce competition. The director had an imaginative Creative Intelligence style that was different from everyone else in the conservative, family-

owned company. He came up with many creative ideas that challenged the status quo and made people uncomfortable. His fellow employees were excited and not threatened by his ideas. However, when he presented a new product line to senior management, it was rejected out of hand, leading to stifled creativity. This is a classic case that illustrates the conflict that exists between the need for innovation in a changing marketplace on the one hand, and tradition-bound corporate culture on the other.

The alternative to rigidity and tradition is an approach taken by Chris Bangle, Global Chief of Design for BMW in Munich, Germany. He sees himself as living at the intersection of art and commerce. He constantly looks for ways to produce the “ultimate driving machine,” while at the same time looking to make a profit. He uses three key principles. His first goal is to protect the creative team from the rest of the company as much as possible. Second, he insists on protecting the creative process from time pressures that could disrupt the focus of the work. Third, he communicates continuously with the team and mediates creatively between the design and business sides of the company. He says that the constant quest to convince non-designers that a BMW, like a fine wine, cannot be hurried is a most difficult task. He has to appeal to a deeply held, nonverbal belief about BMW-ness. Designers have a sense of pride about the product that they share with everyone in the company. The designers view perfection as ephemeral, an almost spiritual quest. They realize that it is a goal that needs to be achieved in stages. Engineers, on the other hand, feel that perfection is measurable and should be done right.

While technological innovation may be the foundation for competitive advantage, if not accepted or properly implemented, the advantage disappears. To assure acceptance of radical change, leaders also need to rely on their Emotional Intelligence. Daniel Goleman describes five components of Emotional Intelligence that include the following: self-awareness, self-confidence, relating to others, being open to change, and knowing what motivates you to pursue difficult goals. **Leaders need to**

know that others have feelings, and they must be persuasive in getting change accepted. Goleman describes how Emotional Intelligence is used to gain cooperation and encourage others to embrace high levels of innovation and creativity. Bangle often has to translate the language of art into a form that can be understood by the rest of the corporation. In persuading people to focus on the relevant aspects of creative design, he applies techniques such as keeping things concrete by speaking in descriptive, amusing terms, comparing design features to animals and people (a rear bumper sagging like a baby with a full diaper). He also uses pictures as much as possible to illustrate his points.

From another perspective, intrinsic motivation is also crucial for individuals who have a sense of personal purpose and who tend to devote their energy to the creative process. Extrinsic motivation includes public recognition, promotions, and tangible rewards. A study conducted at Pillsbury showed that brand managers valued rewarding both intrinsic and extrinsic motivation to stimulate innovation and creativity.

How can Creative Intelligence be used effectively in an organization? Using the following steps, any organization can increase its creativity quotient, that is, the ratio of available talent to that used:

- Start with identifying each individual's Creative Intelligence. An organization should strive to match abilities with requirements. Placing people in positions that utilize their abilities achieves better performance and more satisfied employees.
- Allow greater flexibility in positions within an organization. Creative people easily become bored. By providing rotation and new or challenging positions, management is able to retain valuable employees.
- Allow greater use of teamwork and recognize accomplishment. Although creative individuals have high levels of personal satisfaction in what they do, they also enjoy recognition by others of their accomplishments.

- Make the organization more flexible by introducing training that expands the horizons of the employees rather than emphasizes increased proficiency on the job.
- Encourage an “open” organization, where questioning and differences are accepted and respected. The creative mind thoroughly dislikes “limits” or having to adhere to the “party line.”
- Most important, recognize that a small investment in individuals often has tremendous payback. Papermate had a major problem with leaking ballpoint pens. A young engineer volunteered to study quality control and reduced the rejected pens from 17% to 4%. This was a win-win solution. The engineer was thrilled at making that significant a contribution and Papermate saved its pen business.

Creativity and Organizational Culture

William C. Miller, President of Global Creativity Corporation, is concerned with fostering creativity. He considers Theresa Amabile’s assertions about the failure of stretch goals to be very important. Amabile describes how a culture that emphasizes performance evaluation creates a climate of fear and an unwillingness to take risks. **Organizations cannot convince their best people to take personal risks if it entails a possible cost to their careers.** The answer is clear: People are not willing to expose themselves to being chastised for being different. Successful organizations have recognized that they need to tolerate differences among employees.

Organizational culture has a direct impact on how creativity and innovation are received. This is especially important where the underlying feelings and beliefs of a group go counter to those of creative individuals. The concept of organizational culture emphasizes shared, unspoken understanding in the minds of the organization’s members. One example of the power of shared values was the phenomenal suc-

cess of the Ford Taurus, where a change in focus emphasized quality as the top priority and led to radical changes. A new approach was used for the design of the cars: the Planning, Engineering, Design, and Manufacturing divisions acted together as the team that took final responsibility for the cars. The result was an outstanding success.

Organizational culture also reflects the basic assumptions and preferences that guide individual behavior. Culture links both the tangible and intangible factors reflecting these shared values. In addition, shared values often determine the degree of commitment that individuals are willing to make to the goals of the organization. **To obtain a commitment to innovation and creativity, leaders need to recognize that an individual's values and the organization's cultural norms must be compatible.** Or, stated differently, successful implementation requires that people be willing to change when required.

A major challenge facing leaders is how to reconcile individual values with cultural norms. One approach that has been highly successful in gaining commitment on the part of an individual is to provide the person the freedom to explore his or her own ideas. Where this approach has been used, unusual results have been achieved. A case in point was the development of the first IBM personal computer. By allowing a team in Boca Raton, Florida complete freedom, unfettered by the usual corporate constraints, it was able to leapfrog the competition and bring out one of the first personal computers.

John Akers, who was President of IBM, on the other hand, was a captive of IBM's traditionally rigid environment and wound up leaving the company because of his failure to turn it around. His successor, Lou Gerstner, came with an open mind and the mission of reinventing IBM. He devised an agile corporation that could leapfrog past its competition, and encouraged radical rather than incremental change. However, even Gerstner ran into problems when he tried to coerce Jim Manzi, a true entrepreneur, into taking a backseat. Manzi was known for being "strong-willed," sometimes abrasive, and gener-

ally a loner. He could not work for anyone; he wanted to be his own boss, and he ultimately left IBM.

Intrinsic motivation and creative performance are very often influenced by the way in which jobs are structured. Complex and demanding jobs generally foster greater motivation than simple and routine jobs. Individuals with high intrinsic involvement in their work are likely to be more focused, persistent, and open to alternatives that lead to greater creative potential. In addition to the structure of individual jobs, organizational systems are needed to support and encourage creative effort. Organizational environments that are most conducive to creative activity on the part of their employees have open communication between levels of the organization, encourage employee input into decisions, and allow considerable flexibility. Where there is a lack of organizational support coupled with rigid controls, employees often become discouraged and are unwilling to take the unusual risks that creativity demands.

Creativity at Work

In his study of organizations that foster innovation and creativity, Robert Sutton found that the most creative ones are also the least efficient, least organized, and often the least pleasant places in which to work. **Some managers find it difficult to support innovation and creativity, partly because their primary focus is on performance and any change could be disruptive.** As an example, Sutton describes how Gary Starkweather at Xerox invented the laser printer but was confronted with the problem of introducing change. Despite enormous resistance from Xerox managers and fellow researchers, Starkweather complained to senior management about how his idea and career were being ruined by “laboratory dogma.” To correct the situation, Starkweather was transferred to the research facility in Palo Alto, California.

The result was that he was able to perfect the Xerox 9700 laser printer, which was introduced to the market and became a best-selling product.

Sutton describes “**successful heretics**” as ones who believe passionately in what they envision, and are often very good at convincing others to buy into their ideas. Apple cofounder Steve Jobs has what he calls his “reality distortion field,” in which he convinces those around him to suspend disbelief and give him their full commitment. Burt Rutan did something similar with the development team for the Voyager aircraft that can fly around the globe without refueling. Rutan’s edict to his engineers was to have confidence in nonsense because any idea might be the answer. Creative ideas come from the most persuasive and committed people. They have the best chance of success.

Introducing creativity into an organization generates many problems because of the reluctance to accept change. Creative individuals follow their own compass and can drive their colleagues and managers crazy. However, they can also push their companies into making winning gambles that they would never have made on their own. Richard Drew directly defied 3M’s CEO, William McKnight, to continue work on what became masking tape. His work also made key contributions to Scotch tape. At Hewlett-Packard (HP), engineer Chuck House was ordered by David Packard to stop work on a display monitor that was deemed unsuccessful. House believed so strongly in the monitor that he used his own vacation time to show the prototype to potential customers. He was able to convince HP to put it into production, and it ended up producing \$35 million in revenue for the company. David Packard later gave House a medal for having extraordinary contempt and defiance beyond the normal expectation of an engineer’s duty.

“Innovation” is becoming a key word in today’s competitive world. Microsoft and Merck have both been successful at hiring talented people who are pathfinders and who are good at improvising. Jack Welch at GE set up 60 independent ventures designed to teach people to be entrepreneurial. He recognized, however, that some of the 60 would fail. When General Motors (GM) first went into business, it

was innovative and offered cars in a choice of colors at a time when the Ford Motor Company only offered cars in black. GM also introduced an innovation in financing that allowed people to buy cars without having cash in hand.

The Importance of Creative Individuals

Individuals, not organizations, are generally responsible for the innovations that bring about change. Geniuses, with their flashes of insight, imagination, and Creative Intelligence help move society forward. Unfortunately, geniuses in the arts and sciences can be very difficult to work with. They have fierce individuality and are impatient with those they see as less capable. Their egos are surprisingly fragile, making them emotionally vulnerable. However, organizations need to learn how to work effectively with geniuses if they want to compete effectively in the future.

Mark Morris, a choreographer and creative genius, constantly thinks and works at high speed. Impatient with those who can't keep up, he often hurts other dancers' feelings. He is described as being very bossy. In his role as the head of a dance company, he is faced with managing and directing other geniuses. He hates mentoring, but is willing to help dancers with their careers. He believes that inner motivation is critical. His business partners do the firing of employees who can't make it. Above all, he feels that he cannot tell a big star what to do. On the other hand, artists and geniuses appreciate the truth about themselves. They totally dislike false praise and meaningless encouragement. They do, however, look for recognition of their accomplishments.

Intellectual capability, along with creativity, determine a nation's or a corporation's potential. Intellect consists of factual knowledge, expert skills, and creativity. However, self-motivation is needed to assure that intellect is utilized. Another consideration is that motivated individuals who are creative are significantly more important

than employees who rely on factual knowledge. Nonetheless, most companies still spend more money on basic training that emphasizes factual knowledge than on stimulating creativity. Those companies that encourage intellectual pursuits are able to exploit the exponential value of new knowledge. Knowledge and intellect grow where they are encouraged. **Innovative thinking attracts other talent that further stimulates creativity and enhances the ability to compete.** Think tanks, such as the Rand Corporation, at one time had the largest number of outstanding thinkers in the country, many of whom were Nobel Prize winners. This is an example of where intellectual individuals were attracted to an organization that encouraged creativity.

One way of achieving the best possible output from the intellectual members of an organization is to reduce mindless tasks and bureaucratic paperwork. Another is to eliminate the infighting that can occur because of rigid structures and formal rules. Manufacturing jobs have rarely been able to tap into the creative potential of workers. After doing the same task hundreds of times a day, there is little initiative for considering change in the workplace. Rather, the creative outlets for these workers are typically the hobbies or projects they pursue at home. Changes in the workplace and task requirements are needed to encourage creativity on the job. Typically, Japan has rewarded suggestions that have been adopted. The U.S., for the most part, does not consider suggestions as being important, which has led to low interest on the part of employees.

Creative individuals consider recognition for their contributions very important. An example is Kary Mullis, who was a chemist at Cetus, a small biotechnology company. He described how an idea came to him on how to achieve polymerase chain reaction (PCR) for quickly growing batches of DNA from mere fragments as he was driving his car. However, it was problematic to make the idea work in the laboratory. He worked alone on it unsuccessfully for three months. Cetus was becoming impatient and recommended that Mullis work on the problem with three of his colleagues. Their joint effort was eventu-

ally successful. In many cases, the experimental phase of getting an idea to work is as important as the original idea. Mullis, however, felt that he had been robbed by Cetus of the credit due him and eventually left the company. However, in 1993, Mullis received the Nobel Prize for the discovery of PCR. He felt that his role in discovering PCR was finally vindicated.

The world generally recognizes the value of a first discovery, though at times, credit is spread among those who independently came to the same conclusions. An example is Leibnitz and Newton and the discovery of calculus. Although Leibnitz published his book on calculus first, Newton had been working with the basic concepts for about 10 years prior to publishing his results.

How Creative People Behave

Paul MacCready, founder of AeroVironment, recognized that he had a restless mind that was always darting around. The American Society of Mechanical Engineers, however, named MacCready the Engineer of the Century for creating the world's first man-powered and solar-powered aircraft. He never stops coming up with innovative ideas, and he hires creative teams to carry them out. When discussing his innovative productivity, he plays down his abilities, but admits that he's especially good at synthesizing concepts and making connections. He says daydreaming is particularly productive and he has had some of his best ideas while on vacation.

Bill Gross is another example of a uniquely creative individual. Ben Rosen, co-founder of Compaq, described Gross as an extraordinary entrepreneur, a terrible manager, and a tragic figure of the Internet bust. His brain really sets him apart. He speaks fast and bubbles over with ideas and optimism. Together with his overpowering intellect, he has a personal charisma that entices people to follow him and buy into his

visions. It seems as though ideas just pour out of him with each being more original than the previous one and each having genuine promise.

Many business leaders talk about creativity and innovation, but few believe their companies are doing a good job fostering either one. Dr. Stanley S. Grysiewicz, who has studied organizations for 25 years, says that innovation requires both creativity and implementation of new ideas. He found that some organizational structures are better at supporting innovation and creativity than others. The ones that were considered innovative had to be consciously designed to encourage creativity. He suggests that innovation and creativity involve positive turbulence. This is not chaos, but rather turmoil that provides the stimulation needed to encourage change. Organizations that make a commitment to supporting creativity will need to budget sufficient resources to carry it out, and they will need to consider both the individual's and organization's needs. Companies such as Nortel Network's Broadband division committed 10–15% of their budgets at quarterly management meetings to obtaining new ideas from the outside world.

Dr. Alim Louis Benabid, a French neurosurgeon researching treatments for Parkinson's disease, came up with the idea of electrical stimulation of the brain to control tremors. He used electrodes during surgery to stimulate and identify specific parts of the brain needed to correct the disease. This gave him the idea of using electrical stimulation for long-term ailments, not just as a diagnostic tool. He worked with Medtronic, a Minneapolis-based maker of medical electrode devices. With their collaboration, he developed Aptiva, a safe device approved by the FDA in 1997. The success was attributed to Medtronic because it was "safe" to take this kind of innovative risk. This electrode treatment shows great promise. Drugs are only effective for a few years for Parkinson's patients, and often have unpleasant side effects. Electrodes have the advantage of affecting only the precise spot where they're needed in the brain. Scientists are now looking at other possible uses for deep-brain stimulation, such as for treating epilepsy and possibly some psychiatric disorders.

Applying Creativity

Advances in biotechnology have contributed significantly to improving the health and saving the lives of people with chronic illnesses. Researchers have found that copying the way our bodies fight disease can cure many problems for which we currently have no effective treatment. Monoclonal antibodies are now genetically engineered to find and destroy cancers and other foreign bodies. Synthetic antibodies are also being tried as a way of treating certain diseases. Additionally, vaccines that target cancers of the brain, breast, ovaries, prostate, and other parts of the body are being tested. Imagine the impact that biotechnology can have on our health because of innovative research conducted by dedicated people. Other advances in understanding the genetic functions of plants and animals can significantly contribute to important needs of society. Plants have provided many of the chemicals used for pharmaceuticals, and now the possibility of using plants as a renewable source of energy is being explored.

These technological advances portend radical changes in society, lifestyles, health, longevity, and the way in which our brains function. Science is working on decoding the fundamental rules of nature. Furthermore, **scientific discovery is moving at an ever-increasing pace, both because of tools such as super-computers and the growth of knowledge regarding the fundamental laws that govern almost every aspect of life.**

One significant change that is being pursued is the availability of abundant forms of energy that can sustain continued growth while maintaining or increasing our standard of living. To some extent, advances in science contribute to leaps in creativity that can lead to unprecedented changes in our political and social systems. Considering the extent of major scientific breakthroughs, one that stands out is the computer, which will become ubiquitous as it is imbedded in “intelligent” devices. Computers potentially will have a significant impact on education, the transmission of medical information, military opera-

tions, and the distribution of wealth, agriculture, and more. All portend important advances, but also significant challenges, including the impact on human behavior and the greater need to both understand creativity and employ it in a positive way. Chip implants are being tested for blind spots in the eye, relieve deafness, and stimulate our ability to mentally process information using icons and other “visual” constructs that convey “meaning” rather than “data.”

Michio Kaku describes three basic scientific advances that will change civilization as we know it. First is quantum theory, which states that energy is not continuous, but rather comprised of energy bundles called “quanta.” An example is the photon, which defines a quantum or packet of light and follows well-defined laws that allow us to form new kinds of basic materials. The second advance is the information revolution spawned by the computer. As more transistors are placed on microchips, whole new dimensions will evolve because of the ability to add intelligence to information via the Internet. Changes in lifestyles and medicine resulting from computer applications will dramatically affect the quality of life. The third revolution, bio-molecular technology, is revealing the details of DNA, including how atoms bond and the DNA code for all living organisms such as viruses and bacteria.

In *Intelligent Information Systems*, Rowe and Davis describe how to match the phenomenal capability of the computer with the cumbersome processing of information by human managers. Recent advances in computer programs such as SAP and Peoplesoft are beginning to integrate the information needs of managers and others in organizations. Even business strategy will be made by computer because of the rapid changes that are taking place.

Smart cards are now being used to store and transmit information. Smart cars are emerging that can help drivers sense and avert dangers. Displays help motorists find the best route to a desired destination. Virtual reality is being used to transform physical objects into computer code that allows manipulation of the design or can improve the sales potential of home products.

According to Kaku, bionics are moving toward harnessing the remarkable speed of quantum transistors to interface directly with neurons in the brain. Doctors at Harvard Medical School are working on a bionic eye that will use implanted chips to restore vision. Scientists predict that using computer chips could reactivate a number of paralyzed body organs. Quantum cryptography will be used to develop unbreakable computer codes. Jobs that can be done on the Internet will eliminate scores of routine tasks. Finally, increasingly “intelligent” robots will be able to carry out many functions without human intervention.

The Futurist, a publication of the World Future Society, describes the projected changes and trends for the next 25 years. Can we really forecast the future, and if so, with what accuracy? Forecasts, in many instances, are extensions of what we know today. But what about creativity and the ability to see what no one else sees? Can radical departures be predicted? In the late 1800s, it was suggested that the U.S. Patent Office be closed because everything had been invented that could be! With knowledge growing exponentially, who can say what the future holds? Nonetheless, we can “conjecture” about what experts in various fields believe will be coming and that will have a profound impact on all our lives.

In their Special Report, *Forecasts for the Next 25 Years*, the World Future Society forecasts a number of changes. For example, the group forecasts that the 80 million people born between 1977 and 1997 will have significantly more power than their parents dreamed possible. Within the next 25 years, we should be able to grow new organs, tissue, and cartilage. To root out terrorism, world powers will spend up to \$9 billion per year to aid developing countries. Will this solve the problem or are value systems more critical in shaping people’s behavior?

New technologies that are forecast include: mapping the human genome, super-strength materials, new energy sources, smart manufacturing, anti-aging products, and many others. One of the most critical forecasts is that we will run out of water by 2040 for 3.5 billion people. Even using the polar ice cap for water will not suffice. A cre-

ative solution for water purification, such as using ocean water, could prevent this disastrous forecast.

Successful innovation seldom is based on a “flash of inspiration.” Rather, it requires a disciplined pursuit of a desired outcome and knowing what to do to achieve objectives. There are numerous instances of brilliant ideas that eventually become successful products. Accidental or unexpected events can often trigger innovative change, such as the discovery of penicillin or X-rays. Bringing new ideas or products to fruition, however, requires considerable effort, including public acceptance, the ability to produce at an acceptable price, and finding new ways of distribution such as on the Internet. This is the case with almost every major advance that has been made. Computers and their applications, including robotics and artificial intelligence, have had a profound impact on the world and are becoming an integral part of every major product. From wristwatches to spacecraft, computers have made advances possible way beyond anything their inventors could have imagined.

Where is innovation today? A major advance beyond computers is information use and the Internet. Intel's silicon wafer will contribute to wireless, worldwide communication. Biomedicine will produce new drugs and diagnostic technology that can be tailored for the individual based on genetic makeup. This will lead to DNA chips that will be able to guide physicians in prescribing medication that takes into account the patient's blood pressure or other specific needs. The Massachusetts Institute of Technology is working on a biosensor to instantly determine a “point of care diagnosis.”

Research is progressing on the extension of a biosensor chip that would determine how well enzymes are metabolizing drugs that are prescribed. Toxic effects or other reactions could be detected easily during a routine examination in the doctor's office.

Nano-technology will be able to provide a rapid, inexpensive capability to perform tasks previously considered impossible. Computers will be able to incorporate memory in each molecule to provide more

efficient information storage. This in turn may lead to very sensitive devices, such as flat-panel screens or lasers that operate at super-speed. Computers would fit into any device that could benefit from their small size, including powerful devices such as airplane instruments, telephone transmission, automobile applications, and so on.

Medicine continues to make major advances, such as the recently announced method of surgery using high-frequency sound waves that focus in on and destroy cancer cells that are then absorbed by the body. The high-frequency device uses waves that are at a level that is too high for people to hear. Combined with the high-frequency waves are low-frequency sound waves that create three-dimensional images similar to ultrasound and show the physician what is happening inside the body. Imagine doing brain surgery without having to open the skull. The precision of the high-frequency sound waves has the potential of being better than the scalpel normally used by surgeons.

Another significant change is the design of “smart engines” that cruise along with minimal human intervention. Global positioning could become a standard feature on cars of the future. Flying airplanes is a tedious task that requires constant attention. New technology using ultra-smart, ultra-small computers could help pilots avoid airline crashes, and to find the best routes to travel to reduce time, energy, and effort. If all these technological marvels could be applied to the problems confronting us, what a wonderful world this could be!

The Future Is Now

Ten chairmen of the board and 32 company presidents were included in a research study done by the author. Each was interviewed regarding how they planned the future of their company. The sample included both large and small companies from a variety of industries. Some were entrepreneurs and others were single proprietors. The results were very informative in that they pointed out the differences among industries

and different sized organizations. The findings were discussed individually with the executives who were concerned about planning the future of their organizations. Although this study cannot be extrapolated to all industries, it did emphasize a concern for creativity. Because of rapid change in technology and severe international competition, these leaders increasingly recognized the value of innovation. They increasingly accepted that creativity is not a discretionary item, but is an integral part of assuring the success and survival of their companies.

Those who dare to challenge the enormous problems we face are most likely to embrace creative solutions. Not only must we consider how to achieve effective organizational performance, but we also need to recognize the impact of the vast disparities in the way people live around the world. Creativity by itself does not change things. However, it offers the possibility of changing our world for the better.

Applying the Creative Potential Profile, we can improve organizational performance by appropriately using the following steps:

1. Start by recognizing that every individual is different and use the test instrument to better align talent with requirements.
2. Apply the test instrument to identify each individual's Creative Intelligence style.
3. When considering a restructuring or downsizing of an organization, apply the test instrument to match the requirements needed.
4. Recognize that each individual has different aspiration levels and find a way to accommodate these differences.
5. The current environment requires adaptability and flexibility, which often demand rapid response. The test instrument can be a valuable adjunct for knowing who would be best at making critical decisions.

6. Recognize the need for a learning organization that is continuously transforming as demands of the external environment change.
7. Apply the test instrument to establish teams by matching requirements with available talent.

Applying the Creative Potential Profile will increasingly become a requirement to meet the ever-changing demands on an organization.

General Eisenhower, who was an extraordinary leader, recognized that people who value privilege above principle wind up losing both. His words of wisdom can be applied to creativity. We have a choice. Will we use our vast talents to make our lives better or will we miss the opportunity to bring about significant change?

What have you learned after reading this book? You should have a better idea of what creativity entails, how difficult it can be to introduce creativity into an organization, including education, and the need for great leaders to assure that we embrace creativity. By examining the lives of the many people covered in the book, you should have a better understanding of who creative people are, what they do, how they behave, and what makes them successful. Most important, you should recognize the significance of creativity in every aspect of our lives. To fully appreciate the role of creativity, you should examine your Creative Potential Profile and determine your Creative Intelligence styles to have a better understanding of who you are, what you can do, and how you can be creative about your own future.