

# The Creativity – Innovation Connection

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Drucker's words are as true today as they were in 1973. Likewise, the fundamental principles on how to build a more innovative organization are as applicable today as they have been in past years.

Innovation has been defined in many ways, including:

- "The process by which knowledge is developed and applied in new ways to the needs and material operations of society." (Peter Drucker)
- "Putting into effect something that is new." (Edward de Bono)
- "An innovating organization is one committed to renewing itself." (H. Smith Richardson)
- "The process of bringing any new problem-solving idea into use." (Rosabeth Moss Kanter)
- "To create and bring into profitable commercial use new products, processes and businesses." (Gifford Pinchot)

All definitions of innovation have a vital element in common. They require creative thinking! Therefore, a key challenge in building a more innovative organization is to enhance the environment for creative thinking and educate employees in creativity skills and their practical application.

The Howe School Alliance for Technology Management annual conference in June 2006 was entitled "The Creativity-Innovation Connection." The conference brochure eloquently delineated the connection between creativity and innovation:

*"The genesis of innovation is a creative insight, one that excites the enterprise and stimulates it to undertake the process of implementation to obtain economic value. Where, however, does the concept come from, and how can an organization stimulate more and better ideas?"*

This article describes how the environment for creative thinking was enhanced in the DuPont Industrial Products Division, a group of seven businesses including *Kevlar*, *Nomex*, *Tyvek*, and *nylon*. It will also describe some of the most powerful creative thinking tools and how they were applied to achieve bottom-line results. While the program was initiated by the technical organization, all functions including manufacturing, marketing and business teams participated.

## Creating an Environment for Creative Thinking & Innovation

In the mid-1980's the DuPont Industrial Products Division was under severe competitive pressure, mainly from overseas companies. We had strong programs on TQM – Total Quality Management, but so did everyone else. To maintain a strong competitive position, we needed to generate entirely new ideas and concepts. To accomplish this, it was necessary to enhance the environment for creative thinking and innovation and to educate employees in creative thinking skills.

Initiating a new program in an organization is usually resisted by employees who are fully occupied with their assigned duties and other urgent chores. This would certainly

*"An established company which in an age demanding innovation is not capable of innovation is doomed to decline and extinction. And a management, which in such a period does not know how to manage innovation, is incompetent and unequal to the task."*

Peter Drucker, 1973

be the case in an attempt to initiate a creativity program. We decided to proceed, but in a way that would avoid the usual inertia. The approach taken was not to "announce" a creative thinking program, but to just "start doing" certain things. An action-oriented culture-change model was particularly helpful in providing a path to achieve these goals.

## Culture Change Model

The challenge to provide a more creative, innovative environment is as difficult as any culture change, requiring ongoing support and patience. Many components contribute to culture change. One way to characterize these is through a culture-change model designed by Charlie Krone, a DuPont consultant. A culture can be defined by four components (Figure 1) and changed by shifting these components:

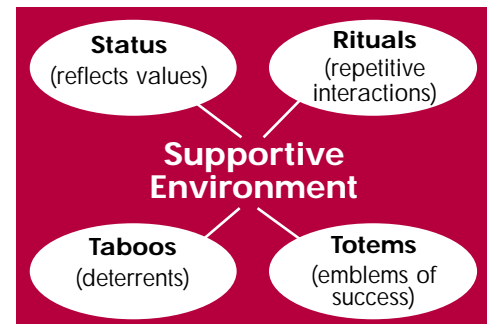


FIGURE 1

**Status** - This is where we are grounded. Giving status to an effort reflects what management values. Technical unit heads gave status to the effort by occasionally substituting monthly day-long technical program

reviews with skill-building creativity seminars and workshops. The substitution emphasized the workshops' significance. In the morning there would be a guest speaker, like Edward de Bono, teaching lateral thinking techniques. In the afternoon, three-four cross functional teams, working on real problems, would apply what they learned in the morning session.

## *The challenge to provide a more creative, innovative environment is as difficult as any culture change, requiring ongoing support and patience*

This approach enabled people to experience in a practical way the value of creative thinking tools. It gave tremendous status to the effort. It began the education process. Site libraries stocked books on creativity and innovation. People began requesting attendance at external workshops and seminars. Champions began to emerge and apply creative thinking tools in their jobs. The "unannounced" program was underway.

**Rituals** - Repetitive interactions are vital to help foster a desired environment and cascade awareness of leadership values throughout the organization. Several repetitive interactions were initiated. For example, during periodic management visits to the sites, the final hour of the visit was reserved for a Creativity Social Hour. These were coffee and cake sessions with a creativity theme.

In advance of the session, unit heads would invite two – three individuals doing creative work to speak to their peers about their work. Over a period of several years, no one turned down this opportunity. People love to discuss their creative work and credit team members for their contributions.

The highlight of the meetings was the enthusiasm of speakers as they described their creative ideas and how they were implementing them in their programs. This helped colleagues understand the meaning and value of creative thinking. It altered perceptions about who could be creative. For example, process engineers initially felt that creativity was only of value for research people. But when they heard a fellow engineer get up and say "I came up with an idea that led to an increase in throughput of 30 – 40% vs. a goal of 5%," the other engineers began to understand the practical value of creative thinking and became

active in the program.

**Totems** - These are emblems of success which can be honored by reward and recognition.

This is a controversial subject. Some believe that this causes jealousy and reduces communication among employees who feel others may use and get credit for

their knowledge. Our experience was that the benefits outweighed the potential negatives. We didn't wait until an idea reached commercial reality, but recognized and rewarded individuals and teams on the run when they generated novel ideas that were being successfully implemented in their programs. For example, in the Creativity Social Hours described above, individuals invited to describe their creative work were all smiles for the recognition. Following their presentations, they were given gift certificates for dinner for two in a local quality restaurant, which was much appreciated.

**Taboos** - These are behaviors contrary to the values we seek to affirm, i.e., things that need to be eliminated from the culture. For example, a taboo is to punish employees for taking a risk that didn't pan out. It is more productive in a creative environment to learn from mistakes rather than to punish. Another taboo is to act negatively when a colleague suggests an idea, even though it appears to be unrealistic. It is more productive to analyze the idea in a way that might lead to other ideas of value.

### **Bottom-Line Results**

The program to generate a more creative environment paid off with many bottom-line results that ultimately led to the DuPont Center for Creativity & Innovation. For example, a joint team of "Kevlar" Technical and Manufacturing, which had been active in the divisional creativity and innovation program, won a corporate award by a broad-based attack on hazardous waste. This effort reduced process waste in the polymer area by over 80% and saved the business \$3 million annually. The manufacturing manager wrote:

*"Many of the efforts undertaken by Kevlar team members were considered or attempted*

*in the past without success. One of the reasons they were successful this time is that over the last several years, Kevlar has had a program to change the environment for creativity and innovation and give to the organization the skills necessary to do their jobs more creatively."*

The phrase – "...and give to the organization the skills necessary to do their jobs more creatively..." sets the stage for the next section of this article.

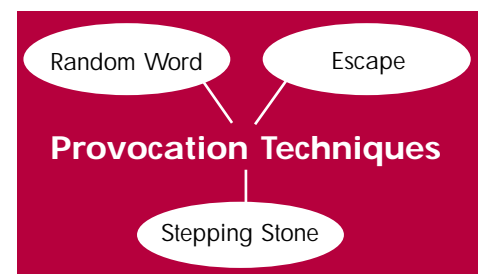
### **Creative Thinking as a Skill**

There is a myth that creativity is limited to a few individuals who are naturally creative. In reality, creativity is a skill that can be learned and applied like any other skill such as driving a car, golfing and swimming. There are many creative thinking techniques that can be organized into three categories: idea collection processes; pattern-breaking tools; and focused thinking frameworks.

**Idea Collection Processes** Idea collection processes include brain storming, mind mapping, and brain writing. These processes help collect and organize ideas generated within normal thinking patterns. In problem-solving sessions, it's best to start collecting ideas applying some of these processes. When teams have exhausted ideas generated within normal thinking patterns, then pattern-breaking techniques such as lateral thinking and metaphoric thinking, discussed below, help trigger a flow of new, more unusual creative ideas.

**Pattern-Breaking Tools** There are several tools that help us break outside the constraints of our normal thinking patterns which can be learned and applied. Two of the most powerful are lateral thinking and metaphoric thinking.

**Lateral Thinking** – This tool is based on the development of "provocations" which jolts the mind out of its normal patterns of thought. The provocation (Figure 2) is an idea related to the problem you are tackling, but it makes no sense, it's foolish,



**FIGURE 2**

*Continued on next page*

impractical, ridiculous. Dr. Edward de Bono, the inventor of lateral thinking, teaches several techniques that systematically help generate provocations:

*Random word* involves creating a new "entry point" by selecting a word at random, e.g., a word from a dictionary or poster that is not connected to the subject.

*Escape* involves examining the subject for what we take for granted and then negating or escaping from it.

*Stepping stone* involves exaggeration, reversal, distortion or wishful thinking about the subject that is a stepping stone to new ideas.

The lateral thinking process involves three steps: 1) selecting the problem area requiring creative new ideas; 2) developing provocations related to the problem using lateral thinking techniques; 3) generating sensible ideas dealing with the problem, stimulated by the provocations.

The bolder the provocation, the better the chance it will lead to unusual new ideas. The challenge is to generate several provocations and ideas until one rings a bell and excites enthusiasm to implement. There are many examples where lateral thinking applied in the Industrial Products Division led to bottom-line results in new products, new processes, cost reduction, and speed of delivery.

**Example** - An information systems team was dealing with the issue:

*How can we reduce costs in the information systems function?*

The group manager had attended a lateral thinking workshop and convened a session to apply her learnings to this issue. Using the technique of escape, they listed things they would take for granted about reducing costs. One of these was to reduce costs by spending less money. Escaping from this, they generated the provocation:

*Reduce costs by spending more money.*

This provocation generated the idea that spending more money on fewer vendors would provide leverage to obtain large discounts. The approach was to reduce the number of vendors and negotiate better prices on high-volume orders. This approach led to an annual savings of over \$300,000. Applying this concept to maintenance saved another several hundred thousand dollars annually. This was the result of about a two-hour meeting.

**Example** - A plant technical group was dealing with this issue:

*How can we improve continuity of our complex continuous-flow filter system?*

The filter system was based on a reciprocating belt with 70 moving parts that had frequent failures. The group manager was a creativity champion whose group was educated in lateral thinking. A reversal provocation paid off:

*The moving belt is stationary.*

This provocation shifted thinking in an entirely new direction and led to the design of a system that reduced the number of moving parts by 80 percent. The result was a major breakthrough in process continuity, product quality and substantial cost savings.

**Metaphoric Thinking** - This technique generates new ideas and concepts by connecting the problem under attack to a problem that occurs in an entirely unrelated system, such as nature. The challenge is to understand how the problem was solved in the other system.

**Example** - A research chemist who had attended creative thinking workshops applied this technique to find a better way to dye "Nomex" fiber, which was used in flame resistant industrial applications. Because the fiber had a very tight molecular structure, the trade dyeing process required swelling agents, which were costly and caused environmental problems.

The chemist applied metaphoric thinking and pondered:

*What in nature can be penetrated despite its tight structure?*

His answer: *The Earth!*

He reasoned that coal miners gain access to the interior of earth by digging holes and propping them open with structure props. Inspired by this analogy, he added a large organic molecule during Nomex manufacture to prop open the structure. This enabled dye molecules to squeeze into the fiber during the mill dyeing step. The new technology led to commercialization of a dyeable, flame-resistant Nomex, trademarked "Colorguard," for applications in carpets, upholstery and draperies.

**Example** - A special task force was addressing the problem of how to reduce dust in their manufacturing plant. The dust was formed by a step in the process and was contaminating the rest of the plant in

spite of newly installed exhaust fans.

The group developed a long list of ideas using normal thinking patterns, but none were very good. A facilitator knowledgeable in creative thinking techniques was enlisted to help solve the problem. The technique that paid off was metaphoric thinking. The group considered how nature removes dust from the environment. One way that nature removes dust is through heavy rainfall. This thought shifted their thinking to an entirely new direction that led to an elegant but simple way to reduce dust in their operation.

## Focused Thinking Processes

Focused thinking frameworks play a vital role in structuring the approach to problem solving, opportunity searching and creatively organizing one's thoughts around a subject or issue. A highly productive framework for focused thinking is the "Six Thinking Hats" (Figure 3).

**The Six Thinking Hats** - This framework, designed by Dr. Edward de Bono, is an ingenious approach to thinking through a subject in a focused way that makes time and space for creative thinking. The underlying principle is that parallel thinking is more productive than argument.

There are six hats. Each one has a different color and represents a different dimension in thinking about the subject being addressed:

The White Hat deals with information, the Red with feelings, the Yellow with benefits, the Black with caution, the Green with creative ideas, and the Blue with managing the thinking. All participants are required to wear the same hat at the same time, fostering parallel thinking. The hats are alternat-

### Six Thinking Hats

White Hat	(Information)
Yellow Hat	(Benefits)
Red Hat	(Feelings)
Green Hat	(Creativity)
Black Hat	(Caution)
Blue Hat	(Managing the Thinking)

FIGURE 3

Continued on next page

ed depending on the sequence of thinking that makes the most sense. It is similar to golfing where each club in the golf bag has a different purpose and can be taken out and put back depending on the situation.

The Six Thinking Hats has been used extensively in companies such as DuPont, IBM, Prudential Life Insurance, British Airways and Siemens as a way to have efficient, productive meetings. The framework is especially valuable when dealing with complex, controversial issues where emotions run high and people might otherwise engage in argumentative recriminations.

**Example** - A technical planning team in the Industrial Products Division recommended to divisional management the formation of a new business that would capitalize on the combined strengths of the existing individual businesses of *Kevlar*, *Nomex*, *Tyvek*, *Sontara* and *Teflon*. The idea was controversial. Business managers felt it would dilute resources from their businesses and were strongly opposed. Technical management was strongly in favor.

A two-hour meeting was scheduled to resolve this controversial issue. Technical people designed the meeting based on the Six Thinking Hats framework. The business managers were agreeable since the division had an ongoing creative thinking program and were familiar with the value of this framework. An experienced divisional facilitator led the session.

The meeting started with a brief White Hat overview and discussion of the proposed idea. Then, instead of Yellow Hat thinking to elucidate benefits, the facilitator initiated Black Hat thinking. An energetic discussion by business directors resulted in many hang

charts listing serious difficulties with the idea. This allowed business managers to air reasons, many justified, why they were opposed. Technical managers also wore the Black Hat, participating in listing potential difficulties.

Next came Yellow Hat thinking, to discuss benefits. There was dead silence. The technical people purposely said nothing. Then, one of the business managers noted a benefit. This started the ball rolling. Soon, all business managers joined in along with technical people. There were as many hang charts listing benefits as those containing difficulties.

Green Hat thinking generated many creative ideas on how to capitalize on benefits while overcoming difficulties. At this point, everyone was energetically engaged in upgrading the idea to make it workable. Finally, everyone donned their Red Hats and took turns expressing their gut feelings on whether there was enough merit in the idea to proceed with next steps. It was decided to charter the planning team to recommend a stepwise implementation plan for further review, embodying inputs from the meeting. The business managers now had strong buy-in to pursue the idea further.

### Impact of Creative Environment on Inventiveness

An environment that fosters creative thinking and innovation is bound to inspire inventiveness. This was indeed the situation in the DuPont Industrial Products Division, where statistics related to patents soared.

The number of notices of invention from R&D people surged from 40 in 1987, when the program started, to 148 in 1989. In the same three year period, patent filings

climbed from 16 to 67. Patent allowances nearly tripled from 10 to 28 and were on the rise.

### A Tie Between Invention and the Arts.

Art and invention are often thought of as being worlds apart. Art is emotional and expressive and concerned with beauty. Invention is pragmatic and technical and concerned with knowledge. But there is a bridge. Both a work of art and a new invention are results of a creative act. Both are the result of solving a problem in a manner that involves creative thinking. Buckminster Fuller, the famous inventor, was asked about the relationship between these two disciplines. He responded:

*When I am working on a technical problem, I don't think about beauty – but when I am finished, if the solution is not beautiful I know it is wrong.*

There is indeed a beauty, an elegance, a strong sense of art in every creative solution to a problem, no matter how technical the problem. If an original idea solves a problem it might be the basis of an invention and possibly a patent protecting an important innovation that assures the future health of a business.

### Maintaining Momentum

Initiating a program on creative thinking is a good first step in building a more innovative organization. The challenge to a management team is to maintain momentum in the program over a period of years so as to achieve ongoing bottom line successes. The culture-change model described earlier in this article provides an excellent mechanism to achieve this goal. ■

## About the Author:



**David Tanner** (daveet@aol.com) was founding Director, DuPont Center for Creativity & Innovation. Prior to that he was Research Director, Pioneering Research Laboratory; Strategic Planning Manager, Fibers Department; and R&D Director, Industrial Products Division. Dr. Tanner has a PhD. in polymer science and holds 33 US patents. After retiring from DuPont with over 30 years of service, he became Executive Director, Edward de Bono International Creative Forum. He is past-president of the American Creativity Association, and has authored two books, "Total Creativity in Business & Industry – Roadmap to Building a More Innovative Organization," 1997, and "Igniting Innovation Through the Power of Creative Thinking," 2007.