

OPPORTUNITY EXPANSION: ENHANCING TRIZ WITH DR. DEMING'S PHILOSOPHY

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ABSTRACT

Many attempts to introduce TRIZ into organizations have suffered from a lack of application results with "bottom line" impact. When TRIZ methods are utilized, the authors have found that the results are not routinely implemented. Where TRIZ applications have led to implementation, experience has shown that TRIZ is often used to solve problems that are narrowly focused. Such a pattern of practice leaves ample room for challenges from TRIZ critics in search of returns on implementation efforts.

An awareness of Dr. Deming's system of "profound knowledge", as the basis for organizational transformation and operation, will help TRIZ practitioners gain management acceptance of the innovative ideas that TRIZ approaches and solutions offer. In return, the TRIZ community has much to offer the Deming community on the topic of innovation. Whereas Dr. Deming's management theory does not include specific guidance on how to generate ideas for system improvement, TRIZ methods are well suited to this task. Improving the dialog between the TRIZ community and the Deming community will provide "win-win" prospects for both communities. The aim of this paper is to encourage and advance this dialog.

TRIZ UTILIZATION: PROBLEM DEFINITION

Got Milk ? Got TRIZ ?

TRIZ applications have not progressed as broadly as would have been predicted by TRIZ practitioners upon their introduction to the "west" in the early 1990's. One significant reason for the slow acceptance of TRIZ in organizations is the perception on the part of many members of management that TRIZ does not produce results that lead to a bottom line impact. This perception leads to two additional problems that reinforce this perception:

1. TRIZ practitioners are often positioned to claim that TRIZ creates exciting, breakthrough solutions to problems, without resources to invest in demonstrating their claim.

2. TRIZ is not used on applications that are significant to the organization.

It follows that TRIZ successes are often associated with applications that are not considered worthwhile investment opportunities. A related challenge for TRIZ practitioners is the understandable reluctance of organizations possessing significant TRIZ application and implementation success to publicize these accomplishments and case studies, such that proprietary interests are preserved.

TRIZ Implementation Efforts

A recent conference at Stevens Institute of Technology (Ref. 1) provided considerable data on the difficulties of implementing organization-wide use of TRIZ methods. Reports from Johnson & Johnson, Eaton, Agilent, and Rohm & Haas were remarkably similar in their conclusions:

- Individual TRIZ advocates keep the methods alive in their companies. In most cases, these are individuals with outstanding reputations as innovators in their organizations, and the survival of TRIZ has depended on their personal reputations.
- Management wants to see tests on significant projects, and in some cases authorizes the initiation of those projects, but terminates them before the tests can be completed. TRIZ is then relegated to the status of personal tool for the individual user, not corporate methodology.
- The issues surrounding the choice of TRIZ-related software, the cost of the software, and the complexity of training people on both the TRIZ methodology and the use of software complicate the decisions related to TRIZ, and frequently result in an early decision against the use of TRIZ.

Dana Clarke of Ideation International presented a classification of TRIZ adoption patterns among large companies that reinforces these observations:

1. Systematic implementation, fully supported by management—2 companies
2. Repeated attempts, spending large amounts each time, then losing momentum—20 companies
3. Started, or made some attempts, no support—30 companies

The presentations by Domb in this forum on the use of TRIZ with Total Quality Management and Six Sigma Quality (Refs. 2-4) contain similar data. Many companies recognize that their quality improvement initiatives require a method for creative problem solving, but even those that have introduced TRIZ as a tool or technique have usually failed to integrate it with their organization-wide systems.

Taguchi Methods Implementation Efforts

In the authors' experience with repeated applications of Taguchi Methods involving highly visible problem resolution activities, the high potential of these techniques became more and more evident. The early applications also revealed the narrow focus of these applications – to fix or repair products and processes. An obvious “reactive” application pattern was developing. In borrowing from the concepts of Dr. Deming, a theory was developed to explain why this costly “intervention” application pattern was apparently widespread across industries. Dr. Deming's management theory offers an explanation for how organizations can provide for more strategic applications of both TRIZ and Taguchi Methods.

The Prevailing Style of Management

Dr. Deming used the term “the prevailing style of management” (Ref. 5) to describe the administration style of organizations that are characterized by activities that promote widespread local sub-optimization. Additional symptoms of these organizations are the apparent existence of a “most important part” (as opposed to a strong sense of the purpose of all parts), a prevalence of blame placed on individuals (rather than the system in which they work), and a general lack of creativity on the part of a significant percentage of the work force. The management actions that unknowingly sustain such non-systemic behaviors are driven by an unrecognized and, therefore, un-stated, set of beliefs and assumptions. The tell-tale signs of these beliefs are management practices that ignore, if not underestimate, non-linear causal loops. Instead, organizational actions are viewed as linear (“cause and effect”) and orientations such as “upstream” and “downstream” are used to denote endpoint positions within it.

Contrast the linear view of organizational actions and activities with the recursive model that Deming advocated (Figure 1), where a so-called “zeroth stage” action set the system in motion with the initial “design” idea. Organizations that follow the Deming management model are characterized by a widespread awareness of non-linear system dynamics, especially as related to the “plan-do-study-act” (PDSA) learning cycle (Ref. 6). These attributes, coupled with a high value placed on innovation and a sense of unity (“one company”) that extends beyond the organization to include suppliers and customers, result in low levels of sub-optimization and, therefore, high levels of profitability.

Transformation of an organization, from one that resembles the “win-lose” environment of the “prevailing style of management” to one that is Deming-based (“win-win”), has been shown repeatedly to require systemic change (Refs. 7-10). Vital to this transformation is “better thinking” by individuals in these organizations about systems, variation, knowledge, and psychology. In such an environment of enlightened thinking, the introduction of new tools and techniques becomes much easier, since this atmosphere offers freedom for employees to experiment, innovate, integrate, and learn. In his 1993 text, *The New Economics* (Ref. 5, Chapter 4), Dr. Deming offered this perspective;

“The prevailing style of management must undergo transformation. A system can not understand itself. The transformation requires a view from outside.”

Without the ability to “see the forest through the trees”, organizations that have been weakened by the “prevailing style of management” are unlikely to be unaware that problems exist or that opportunities for investment are being over looked.

A Deming-based transformation is often a challenging road for organizations to travel upon, with ample opportunities for the organization to become detoured or even reverse course and chart a path back to the “prevailing system of management”. Organizations that have embraced a Deming transformation have become models for successful change in many areas. These may well be the most likely organizations to adopt TRIZ and maintain application momentum. Herein lies a vast investment opportunity for many TRIZ practitioners.

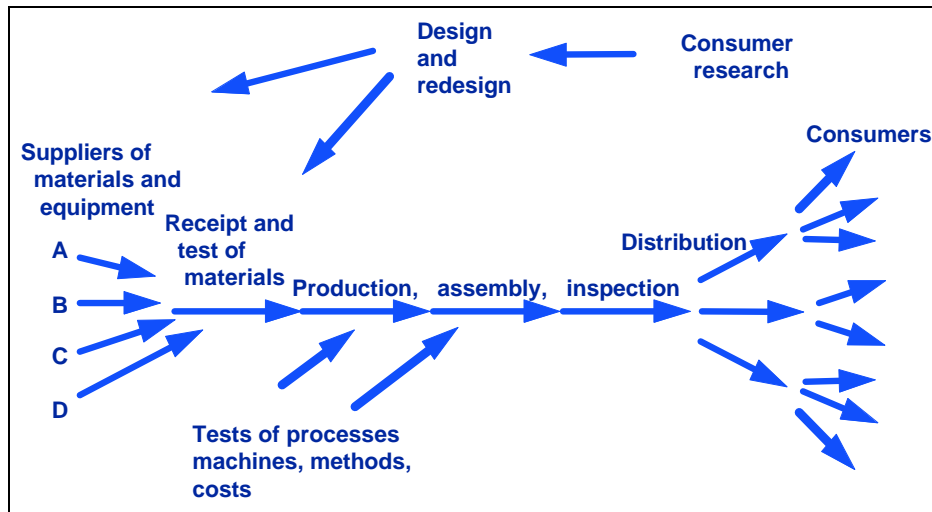


Figure 1. “Production viewed as a system”, as introduced by Dr. Deming to Japanese engineers and managers in the summer of 1950. (Ref. 5)

TRIZ UTILIZATION: SOLUTION PROPOSAL

Guidance From a System of Profound Knowledge

The proposed solution to the TRIZ utilization problem follows directly from the use of Deming’s management philosophy, as detailed in *The New Economics* (Ref. 5). Quoting from Chapter 4, Deming states;

“The aim of this chapter is to provide an outside view - a lens - that I call a system of profound knowledge. The system of profound knowledge

provides a lens. It provides a map of theory by which to understand the organizations that we work in.”

More specifically, Deming’s concept of a “system of profound knowledge” offers TRIZ practitioners a framework in which they can better understand the organizational dynamics that can serve to hinder or promote the implementation of TRIZ solutions. The elements of Deming’s system of profound knowledge consist of the four parts below, and their interrelationships.

1. Appreciation for a system
2. Knowledge about variation
3. Theory of knowledge
4. Psychology

Awareness of systemic behaviors and interrelationships, between people or elements of an automobile is crucial to the concept of profound knowledge. So, too, is the realization that variation exists in the performance and content of all systems and sub-system elements. Deming’s concept of profound knowledge integrates these fundamentals with the explicit assumption that “management is prediction” and “predictions are based on theories” (Ref. 5).

The authors propose that the introduction of TRIZ solutions, be they concepts for new systems, new processes, or new products, will be much more successful in an environment that has been studied through the “lens” of profound knowledge than one in which such efforts are not considered. Lacking an appreciation of Deming’s system of profound knowledge, one may unwittingly introduce new ideas into organizations that routinely act to slow their implementation and eventually, to abandon and/or reject them.

The authors have guided implementations of a wide variety of new methods in large, moderate, and small organizations, including the following:

- Quality Function Deployment
- Statistical Process Control
- Design of Experiments
- Taguchi Methods
- Six Thinking Hats
- Policy Deployment (Hoshin Kanri)
- Total Quality Management
- Business Process Re-Engineering
- TRIZ

Aided by this experience, the authors have learned that the more an organization is guided by profound knowledge, the more the organization will choose applications of these techniques that are based on its vision and values and principles. In keeping with Deming’s management philosophy, the influences of the business situation, customers,

suppliers, employees, and society on the acceptance of these new ideas will also be considered.

Water Logic and Rock Logic

There are many underlying causes of an under-use of TRIZ, as well as the narrow focus of TRIZ applications. The guidance of better thinking about systems, variation, psychology, and knowledge, and their inter-relationships is proposed as being essential to expanding the use of TRIZ. A brief explanation of some aspects of such “better thinking” follows.

First, consider the simple question, “What is this part of ?” Embedded in this question is an explicit reference to a connection. The systemic thought is revealed by the concept “part of”, as opposed to “part”. Without the “of”, one could only inquire about the part, as in the question, “What is this part?” Given this inquiry, the connections would be lost as we return to a worldview of “fragmented pieces”.

From Where ? → **This Part** → Lead To ?

In reference to the “from-this-to” sequence, questions such as “What is this part of?” “Where did this come from?” and “What will this lead to?” represent the essence of understanding relationships and inter-connections. The thinking revealed by these questions has been termed “water logic” by the noted thinking consultant and author, Dr. Edward de Bono (Ref. 11). By contrast, references to events, parts, and pieces, are termed “rock logic”.

To view the world with “rock logic” is to view it in the form of an “exploded view diagram” - parts floating in space without any apparent connections. Rock logic also leads to disconnected, mechanistic perspectives, such as “black”/“white”, “good”/“bad”, and “us”/“them”. Compare this with water logic and its holistic, continuous perspectives, such as “continuous shades of gray”, “continuous improvement”, and “one company”. It follows that to view the world with “water logic” is to view it without seeing parts, as in the environmental sentiment of the “circle of life”. Such a view reveals the world to be a pattern of relationships.

Advice is offered here on a likely point of confusion. It does not follow that water logic is better than rock logic. Rather, it can be said that they are different as well as complementary. “Better thinking” is needed to recognize the difference between these perspectives, as well to understand their relative strengths and weaknesses. In doing so, one should recognize the need for a decision and utilize the appropriate logic in the appropriate situation.

TRIZ practitioners should note that there is complete harmony between the “water logic” viewpoint of Edward de Bono and Genrich Altshuller’s understanding of a system. In keeping with the “Su-Field” modeling language, a system consists of at least two objects

and the field that links them or two objects and the action that links them, coupled with the environment in which they operate, using more general modeling language.

Investment Thinking

Next, consider two age-old adages: “a stitch in time saves nine” and “an ounce of prevention is worth a pound of cure”. What these two adages have in common is an awareness of connections - a sense of water logic. Notice also that the *pro-action*, the addition of a stitch and the application of an ounce, are far cheaper than the nine stitches or the pound of cure. To act in this manner, with a consciousness of connections, is to practice the economics of “investment thinking” (Ref. 12). To pick up nails to prevent a flat tire is to “minimize loss to society” and be reminded of Dr. Genichi Taguchi’s concept of quality (Ref. 13).

The general attributes of investment thinking are an allocation of resources (time, money, energy, etc.) to prevent a greater expenditure of resources, or to cause a greater gain in resources. Both scenarios are heavily dependent on water logic. Subject to a distorted view of these connections, as in a rock logic view of activities, many investment decisions would be needlessly delayed, if not overlooked entirely. Take, for example, the classical (if ungrammatical) dictum, “If it ain’t broke, don’t fix it”, a decision guideline easily attributed to the “prevailing style of management”. This dictum is a natural extension of a rock logic contrast of a given situation, that is, a “good” – “broken” set of positions with nothing in between. To not act until “it” breaks is to overlook a potentially valuable application of a “stitch in time” or “a preventive ounce”. To wait until “it” is broken is to miss this investment opportunity and pay the expense of a potentially costlier intervention.

A greater degree of appreciation of rock logic and water logic, as related to investment thinking, are needed to improve decision making related to TRIZ implementation in many organizations. That is, better thinking about management decisions related to the allocation of corporate resources-- money, time, people or energy-- towards these applications. The challenge is to move acknowledge the limitations of “If it ain’t broke, don’t fix it” and entertain TRIZ applications that are guided by better investment thinking.

Better Thinking

In keeping with the theme of water logic, a theory on the role of better thinking about systems, variation, knowledge, and psychology is offered. This theory is presented, step-by-step, in Figure 2 as a non-linear model. As proposed, educational programs and mentoring activities that cultivate better thinking (“increase awareness on better thinking”) will provoke a challenge to the belief systems rooted within the “prevailing system of management”. These actions will, in turn, “change the way we behave” in these systems, where “we” is a reference to all members included in the stated system.

Subsequently, these members will “change the way we work together”, as when information, ideas, or products are delivered in a condition that a member would deliver to themselves. In turn, “we” will then “change the way we run the organizations” (to treat others as we would treat ourselves is to change the operation of the organization.) Such behaviors will have a reinforcing effect on “increasing awareness on thinking” leading to higher and higher levels of system consciousness and “working together.”

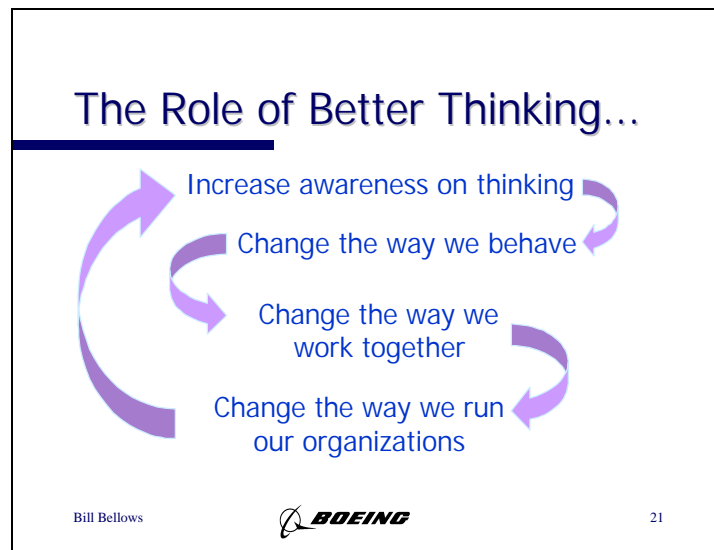


Figure 2. Awareness of better thinking translates into a change in organizational behaviors. (Ref. 14)

Individual Solutions

The solutions to the resistance to TRIZ implementation that have been discussed here deal with organizations. But, many of the successes of TRIZ have been at the level of individuals who learn TRIZ well enough to apply it to their own problems, and become convinced that TRIZ will work for them on the problems that they encounter in their own environment. Individuals who work in organizations governed by “the prevailing style of management” may be very successful using TRIZ in their own areas, without waiting for the company to adopt the use of TRIZ as a general policy. Ian Mitchell of Ilford Film (Ref. 15) presented an excellent set of examples at the ETRIA meeting, showing how he is applying TRIZ to the maintenance of complex equipment, and using his experience to organize a community TRIZ discussion group for individual TRIZ advocates from 10 other companies.

This could be considered another example of using TRIZ thinking to solve the problems of TRIZ implementation. Figure 3 shows the application of the system operator (9-windows) to this problem.

	<i>Past</i>	<i>Present</i>	<i>Future</i>
<i>Sub-system</i>		Individual learning TRIZ	Individual using TRIZ on technical and business projects
<i>System</i>		Local department under-utilizing/resisting TRIZ use	Lead individual helps others use TRIZ when they are ready
<i>Super-system</i>	History of use of other tools	Organization under-utilizing/resisting TRIZ use	Organization-wide use of TRIZ in Deming-based organization

Figure 3. The system operator for the problem of resistance to TRIZ use. The individual who is interested in TRIZ can use the “future/sub-system” or “future/system” solutions, even if the “future/super-system solution is out of reach. (Ref. 16)

CONCLUSION

The authors’ experience with the pattern of introduction, acceptance, utilization, and eventual decline in use of quality control and quality improvement systems over the last two decades suggest significant parallels between the current status of TRIZ implementation and the experiences of total quality management (TQM) advocates since 1980. Given these similarities, it is likely that many of the obstacles to broader TRIZ implementation are not unique to TRIZ and the general lessons learned by TQM advocates may be of broader use.

In exchange for the invaluable TRIZ implementation guidance that can be gained by an increased awareness of profound knowledge, the TRIZ community has much to offer the Deming community. Whereas Dr. Deming’s philosophy invites solutions that offer “win-win” prospects for the stakeholders in the affected system, his methods do not offer specific guidance on how to generate exact solutions that possess these attributes. By comparison, this is a function that TRIZ performs well.

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