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The Integration Of TRIZ Problem Solving Techniques With Other Problem Solving And Assessment Tools

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TRIZ, as a problem-solving process, is seldom used or brought into an organization in a vacuum. There is almost always an existing structure of tools and processes in use into which TRIZ enters. TRIZ can be brought into an organization as a replacement, or in collaboration with the most commonly used innovation and creativity tools in use such as Creative Problem Solving/ brainstorming, Lateral Thinking™, Six Hats™, or social style instruments such as Myers Briggs or 16 Types™. These Jungian instruments are not problem solving tools; their use in characterizing an individual's social style is widespread and the information that they provides can frequently be used in a positive way. Some organizations also use thinking style assessment tools such as Michael Kirton's KAI™ or the BCPI™.

This presentation will summarize the best ways to integrate TRIZ problem-solving techniques and software with these tools, using case studies and examples. It will be shown how to use combinations of these tools can be used to supplement each other in productive ways to improve the output of both the TRIZ process and that of the other tools.

INTRODUCTION

As the use of TRIZ expands beyond its original base in industrial and engineering problem solving into new areas such as organizational development, intellectual property management, ergonomics, and health care, we find that it frequently must be combined, in some fashion, with existing problem definition and problem-solving tools. In addition, many items in the TRIZ toolkit (Su-Field Modeling, TRIZ software, analogies from other industries) require, or are greatly assisted by, the use of analogic thinking to relate a solution from one area of science or technology to another. This is a skill not uniformly used or possessed by all individuals and one that is rarely taught in either academic or industrial settings. Yet it can be critical to an effective TRIZ problem solving effort.

There is a tendency in the TRIZ community, as well as in the other communities of practice using other tools, to have a “winner take all” attitude vs. other tools. This is unfortunate, as all tools that enhance and/or assist in improving an individual’s or organization’s innovation and problem solving capabilities need to be valued. There are many instances where the defender of an existing tool within an organization tries to sabotage the introduction of a “competitive” new tool such as TRIZ, while at the same time, the TRIZ “outsider” criticizes the existing tools and processes, frequently without having had any actual experience with them. Everyone loses in this kind of confrontation. This paper and presentation will review the major existing creativity and innovation tools and how they can be used and integrated with TRIZ both in an organizational and problem solving session sense.

1. OVERVIEW—WORKING WITH EXISTING TOOLS AND PROCESSES

It is well known that TRIZ is usable in combination with such enterprise problem definition tools such as Six Sigma and QFD. These tools do an outstanding job of defining core problems that need to be addressed. Though TRIZ and the various software products can also be used as problem definition tool, their greatest strengths are in resolving contradictions and solving problems defined by other techniques. Several major corporations including Motorola and Dow Chemical have joined these processes at the hip.

What has not been so successful is the integration of TRIZ with other problem solving techniques, with which, in some sense, it competes. Usually, these other tools and processes have been used for a longer time within organizations and there can be legitimate challenge to a new tool that is not understood. Many of these tools have “champions” within organizations who feel threatened by a new process and go into a defensive posture. On the other hand, an organization can also use psychological assessment tools to assist individuals in career development. Though these types of tools are seldom direct competitors to TRIZ, their use and knowledge is seldom used proactively in TRIZ problem solving sessions or in organizational implementation.

Let’s review these other tools and discuss how they can be leveraged with TRIZ.

2. LINKING WITH PSYCHOLOGICALLY BASED CREATIVITY TOOLS AND PROCESSES

2.1 Creative Problem Solving(CPS)/”Brainstorming”

This is probably the oldest known idea generation tool, having been developed by Osbourne and Parnes, advertising executives, in the 1950’s. At its core, it attempts to separate the inventive process into an idea generation phase and an idea evaluation phase. This allows idea generation in large quantity without the hindrance of criticism. Various techniques are used within each of these phases to improve the quality of ideas generated. First, there is simple brainstorming wherein a group is simply asked to generate ideas

without regard to any constraint. Additionally, more structured ideation techniques such as “SCAMPER” (Substitute, Combine, Adapt, Modify, Perform Other Functions, Eliminate, and Rearrange) are used. The 5 W’s (who, what, why, when, where) and H (how) are also used to better define the problem. Lastly, the ladder of abstraction asks the group to focus or broaden their view of the problem to enhance looking “outside the box”. These are all good idea generation and problem definition techniques, but as those in the TRIZ community know, these stimulation processes are somewhat random and do not necessarily have a particular link with the problem at hand. In addition, the knowledge and experience of those in the room limit the scope of the ideas generated. If the problem is relatively simple or requires only an incremental solution, these techniques may suffice.

When attempting to bring TRIZ into a CPS culture, several techniques can be used to combine the two processes. First, the use of stimulating words and examples is a known concept to practitioners of CPS, so the use of Altshuller’s 40 inventive principles, even in random order as stimuli, can be tried. The explanation of where these principles came from will certainly cause an interesting discussion and enhance the interest in the rest of the TRIZ tools. Second, bringing in the concepts of the ideal final result and resources can be introduced within this phase to ask if the objective of the project is bold enough and whether all the available resources that could be used to solve it have been considered. Second, in any CPS session that moves into the evaluation phase, there will invariably surface many statements such as “that’s a good idea, but..”, which is another way of saying that the group has identified a contradiction. Time to bring out the whole contradiction table (not just the 40 principles), as well as the separation principles! In addition, if the problem is complex enough, the use of Su-Field modeling and diagramming tools from the various TRIZ software products can also be introduced to improve the group’s problem definition skills.

Eventually, the group will discover the power of some of the TRIZ techniques and decide what types of problems could use the more powerful TRIZ techniques. For many simple problems, it may be very cost effective to simply add the basic TRIZ tools to the existing problem solving structure.

2.2 Six Hats™ and Lateral Thinking™

Edward DeBono, a world-renowned creativity expert, has developed several effective problem-solving tools based on separating the domains of thinking, as well as techniques to deliberately get people to think “outside the box”. The most widely used tool derived from DeBono’s work is the Six Hats™ Thinking Process wherein the creative problem solving process is deliberately segregated to maximize focus on any particular aspect and minimize contention between the various types of thinking. These six hats are color coded (blue, green, red, black, white, and yellow) and used to segregate the ideation and evaluation process. Four of these hats have overlaps with primary TRIZ tools. The point of this methodology is that everyone in the problem-solving group wears the same hat at the same time, maximizing output around one concept and process and not wasting energy on criticism and negativity.

First, the blue hat is used prior and during breaks to discuss the meeting processes itself. The red hat is used to allow participants to express emotional reaction to ideas or concepts, without necessarily requiring any logic or facts, i.e., “gut feel” reactions. These two hats do not have any serious counterparts in the TRIZ tool kit. However, the other four hats certainly do.

The green hat is put on to require everyone to aggressively ideate without criticism. In DeBono’s techniques, additional techniques such as “po” (provocative operation) and “suppose.....” are used rather than just open up the floor to ideas. Under this hat, the 40 principles could be used at random applied against the problem. The separation principles could also be used as an idea stimulator. Lastly, the TRIZ concept of ideality or ideal final result could be used to trigger “out of the box” ideas. There’s no need to start a war about how the ideas are generated. Use some of the simple TRIZ tools to illustrate and then explain the entire process later when the curiosity rises. Also at this stage, the TRIZ concept of resources cannot be brought out as a way of achieving the ideal result without spending a lot of extra money on complicated additions to the process or product.

The yellow hat is used to have everyone think about what is good or optimistic about this idea. Again, the ideality concepts can be brought out and used to make a good idea even better.

The black hat is put on to have everyone think about what is potentially wrong with an idea. This is the time for individual and group criticism. Under this hat, the “reverse” TRIZ thinking process can be used as well as the TRIZ separation principles and the contradiction table. In the first case, the black hat thinking is accentuated and exaggerated to make sure that the group has thought about all the potential problems with an idea. In the second case, the black hat thinking may be coming from concerns about contradictions in performance or design of a product or process. TRIZ software diagrams can make sure that all issues relating to a system or product’s successful functioning can also be used.

In white hat thinking, the question is asked, “what information is needed to evaluate the idea?” Under this hat, the TRIZ type questions relating to what other industries or technologies deal with the same type of problem, as well as technical data on a system’s performance or design, can be brought into the discussion. In addition, getting the group to think about resources available to achieve their desired result can be brought into play here.

As we can see from the above discussion, the use of these tools does not have to be an either/or situation and appropriate items from the TRIZ tool kit can be brought in as needed to improve an already accepted process, opening the way for additional interest in TRIZ. The integration of TRIZ thinking tools and processes into other ideation processes will generate interest in exploring TRIZ in more depth.

3. LINKING WITH PSYCHOLOGICALLY BASED ASSESSMENT INSTRUMENTS

It is a very unusual organization that hasn't done at least some psychological assessment analysis with its employees. Usually this is done purely for career guidance reasons, but occasionally it is done to assist in team functioning and problem resolution. We will discuss two basic families of these types of tools.

3.1 Social Style Instruments

The most widely used tools in this family have their roots in the pioneering work of Myers and Briggs, who recognized that there were significant differences in how people related to their social and problem solving environments. There are now several different offshoots of this basic methodology (16 Types™, etc.), but all use the same basic parameters of analysis. Many people are aware of their Myers Briggs profile as a four-letter acronym, i.e., ENTJ.

Extroverted/Introverted (E/I)

This first parameter assesses an individual's preference for extroversion vs. introversion. Knowledge of this parameter can assist a TRIZ session leader in making sure that all people in the session are being heard, allowing him/her to know in advance who may be the "quiet ones" and need to be proactively drawn into the discussion.

Intuitive/Sensing (iN/S)

This second parameter evaluates how an individual assimilates information and data. Some people are very attuned to hard data, facts, and information—they tend to take in information through the five hard senses (Sensors), while others are more subjective in how they take in information (iNtuitives). They will tend to see the softer, indirect, relationship aspects of data. One of the simple classic tests to distinguish this difference is to ask someone to give words that describe a leaf. Sensors will say "green, veiny, or other words describing a hard physical aspect of the leaf. Intuitives will say words like "fluffy, light, shiny, reflective" or other words that are more descriptive of an indirect aspect of the leaf's properties. This difference in data analysis can be used within a TRIZ session to separate analysis of ideas generated into direct and indirect effects.

Thinking/Feeling (T/F)

This parameter assesses how an individual treats the effects of action and implementation. The Thinker will care more about the bottom line impact, dollars and cents, and the practical side of new ideas. The Feeler will be far more concerned about the impact on the people side of the organization and how changes will affect morale, personnel practices, etc. These two differences in styles can be used to analyze the impact of ideas generated on the organization in different areas. The two groups could be separated and asked to analyze various ideas generated and then presented to each other to show the difference in analysis.

Perceiving/Judging (J/P)

“Judgers” will want to come to decisions immediately after a problem solving session, while “perceivers” will want to gather more data, analyze additional options. There will be tension between these two camps on driving toward action plans and implementation. Again, knowing these differences in group participants would allow separation of short term and long term judgments and analysis of ideas and concepts generated.

An example of a profile, determined by such, would be INTP. There are 16 possible combinations and thus a wide diversity in any group’s participants. These types are not evenly distributed in the population (for example, 75% of the population are “S”) and so it not good for TRIZ facilitators to assume some “normal” distribution for their group. Long standing hiring practices and cultural cloning will tend to warp even a normal distribution over time.

We have seldom encountered a problem-solving group that is not aware of its Myers Briggs profiles. However, it has not always been possible to use the information proactively in the session.

3.2 Problem-Solving Style Differences

A second very powerful tool is the Kirton KAI™ assessment tool, which measures an individual’s problem solving style. One can think of this instrument as assessing one’s relationship to the problem-solving environment and the problem itself. The KAI™ instrument contains 32 questions, answerable in 15-20 minutes and is globally validated.

Examples of the types of questions would include:

- How easy or difficult is it for you to present yourself, long term and consistently, as someone who:
 - Conforms?
 - Enjoys detailed work?
 - Is stimulating?
 - Is predictable?
 -

The output is a score ranging from 32-160 with the “norm” around 90 and a two-sigma deviation from 70-120. Sub-scores, which can vary significantly, highlight particular areas such as originality, rule/group conformity, and efficiency.

The structure of typical TRIZ problem solving helps both sides of the KAI™ problem-solving spectrum in that it provides stimulus, via its basic concepts and software operators/examples, and structure, in the form of diagrams and models. This is a unique aspect of TRIZ inventive problem solving compared to other tools and processes. Prior to a TRIZ session, the KAI instrument can be completed by participants and then feedback provided as part of the TRIZ session. It is sometimes productive and educational to

segregate the group, via scores known only to the instructor, to illustrate how different people approach problem definition and solution ideas.

In one case study, the KAI™ and TRIZ were combined to provide this feedback within a problem-solving group of 12 individuals from a multibillion-dollar specialty chemical company. The KAI™ scores were not only equally divided, but also segregated very strongly into adaptive (scores 80-85) and innovative (110-130) problem-solving styles. Each group was asked to diagram the problem they were addressing using the Innovation Workbench™ Problem Formulator™. Though the exact nature of the diagram and problem cannot be shared, the types of diagrams developed can be. Figure 1 shows the Problem Formulator™ diagram created by the more adaptive segment of the group. One can see the structure and organization apparent in the diagram and problem definition.

Figure 1:
Problem Formulator™ Diagram Drawn by Low KAI™ (Adaptive) Profile
Individuals

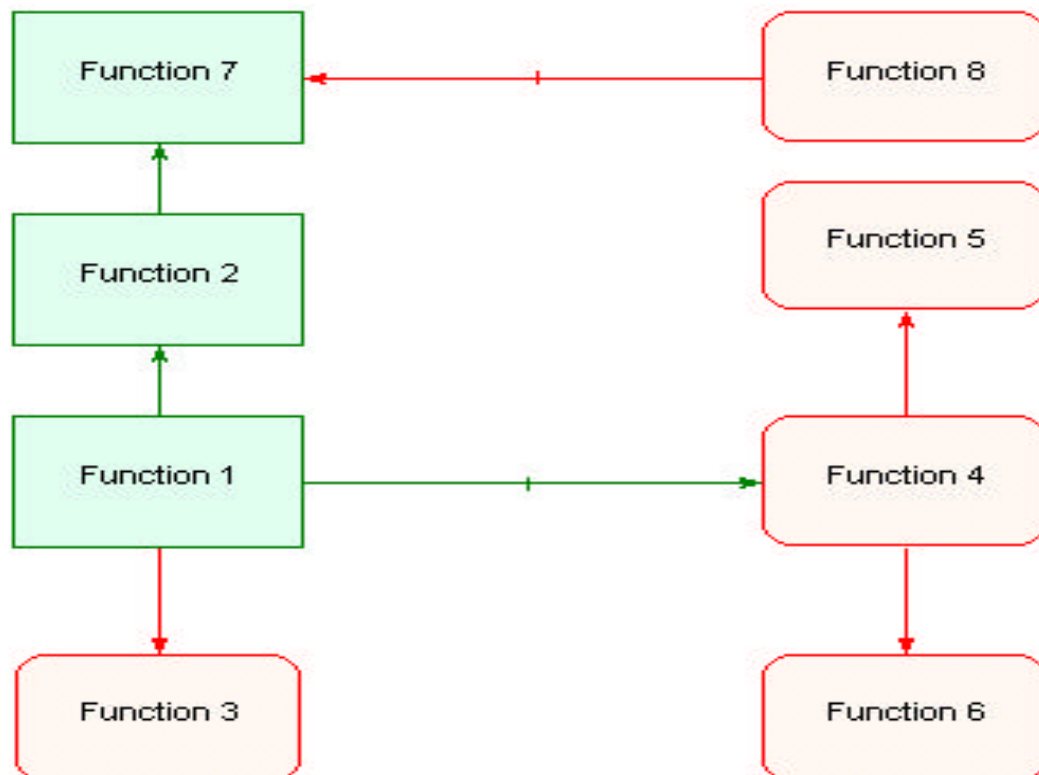
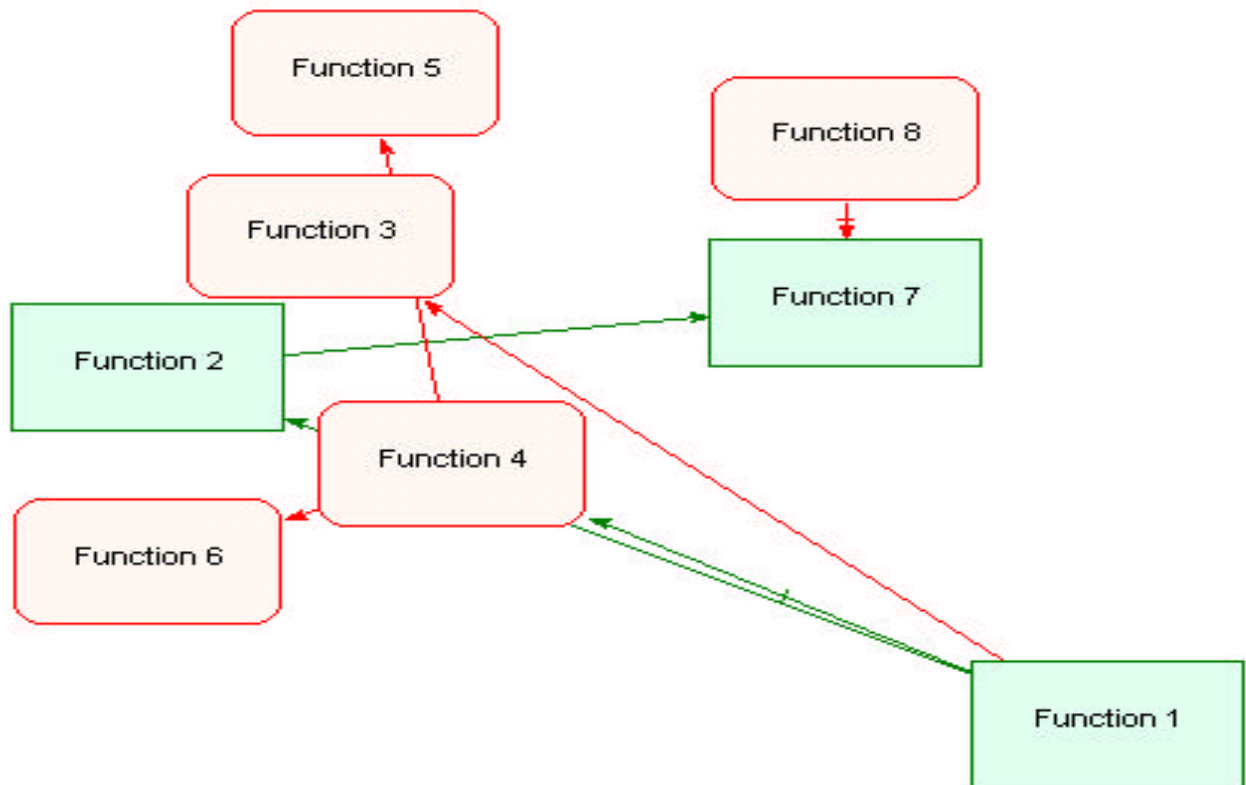


Figure 2 shows the same basic problem diagrammed by the more innovative segment of the group, demonstrating the lack of need for structure and organization needed by this group.

Figure 2:
Problem Formulator™ Diagram Drawn by High KAI™ Profile Individuals



There were also differences in the number of contradictions identified, but this cannot be tied directly to the KAI™ scores as this is seen frequently in TRIZ sessions. The discussion which occurred after the diagrams and their associated idea output were presented consisted of the following types of questions:

- Why do you see the problem that way?
- How can you possibly make any sense of your diagram?
- Why did you choose those particular ideas to pursue?

Links between exact problem definition and the KAI™ needs further research and study.

Summary and Conclusions

The awareness and use of existing problem-solving methodologies in collaboration with TRIZ techniques is something that all TRIZ problem solvers should consider. We have suggested ways of using these tools together rather than getting into an endless debate about which tool is “better”. TRIZ is seldom introduced into an organizational or problem-solving vacuum and we must recognize that all tools have value to varying degrees and under different circumstances. An either/or approach to the use of TRIZ vs. other tools can be counter-productive. It is sometimes productive, both from an acceptance and functional efficiency viewpoint, to combine the strengths of multiple processes. The concepts of TRIZ can be a valuable addition to virtually any existing problem-solving tool.

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Resources

www.kaicentre.com for the Kirton KAI

www.aptt.com for DeBono’s Six Hats and Lateral Thinking

www.cef-cpsi.org for Creative Problem Solving (CPS) and brainstorming

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