TRIZ – Theory of Inventive Problem Solving

Background: "TRIZ" is an acronym for a Russian phrase for "*Teoriya Resheniya Izobretatelskikh Zadatch*" (Теория решения изобретательских задач), that, when translated, means "Theory of Inventive Problem Solving."

TRIZ was developed by Genrich S. Altshuller starting in the 1940's. Altshuller, born in the former Soviet Union in 1926, as a child was always tinkering and trying to invent things. In 9th grade he received his first patent. This led to his pursuit of becoming a mechanical engineer. His first mature invention - a method for escaping from an immobilized submarine without diving gear - led to an offer to join the Soviet Navy as a patent expert. His job was to help inventors apply for patents and, more importantly for the development of TRIZ, to assist them in solving problems as well.

Faced with the challenge of inventing on a routine basis, Altshuller searched literature for some kind of a method for inventing, which he believed must have existed. To his disappointment he could not find such a method. Altshuller chose to develop a method himself.

TRIZ research began with the hypothesis that there are universal principles of invention that are the basis for creative innovations that advance technology, and that if these principles could be identified and codified, they could be taught to people to make the process of invention more predictable.

Over the next few years, Altshuller screened over 200,000 patents looking for inventive problems and how they were solved. Of these only 40,000 had somewhat inventive solutions; the rest were straight forward improvements. Altshuller more clearly defined an inventive problem as one in which the solution causes another problem to appear, such as increasing the strength of a metal plate causing its weight to get heavier. In his study of patents, Altshuller found that many described a solution that eliminated or resolved the contradiction and required no trade-off.

In TRIZ research to date over 2 million patents have been examined, classified by the level of inventiveness, and analyzed to look for principles of innovation. There are three primary findings of this research:

1. Problems and solutions were repeated across industries and sciences
2. Patterns of technical evolution were repeated across industries and sciences
3. Innovations used scientific effects outside the field where they were developed

In the application of TRIZ all three of these findings are applied to create and to improve products, services, and systems.

At a minimum, Altshuller felt a theory of invention should satisfy the following conditions:

1. be a systematic, step-by-step procedure
2. be a guide through a broad solution space to direct to the ideal solution
3. be repeatable and reliable and not dependent on psychological tools
4. be able to access the body of inventive knowledge
5. be able to add to the body of inventive knowledge
6. be familiar enough to inventors by following the general approach to problem solving in figure 1.

Consequently he developed a problem solving approach for TRIZ as a 4 Step Process:

Step 1: Identifying the problem

Step 2: Formulate the Problem: the prism of TRIZ

Step 3: Search for a previously well-solved problems

Step 4: Look for Analogous Solutions and adapt to My Solution

Altshuller categorized the 2 million patents in a novel way. Instead of classifying them by industry, such as automotive, aerospace, etc., he removed the subject matter and categorized them by the problem solving process. He found that often the same problems had been solved over and over again using one of only **forty fundamental inventive principles**. If only later inventors had knowledge of the work of earlier ones, solutions could have been discovered more quickly and efficiently.

In the 1960s and 1970s, he categorized the solutions into five levels as described in table 1 below.

Table 1. Levels of Inventiveness.

Level	Degree of inventiveness	% of solutions	Source of knowledge	Approximate # of solutions to consider
1	Apparent solution	32%	Personal knowledge	10
2	Minor improvement	45%	Knowledge within company	100
3	Major improvement	18%	Knowledge within the industry	1000
4	New concept	4%	Knowledge outside the industry	100,000
5	Discovery	1%	All that is knowable	1,000,000

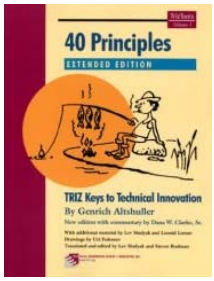
He noted that with each succeeding level, the source of the solution required broader knowledge and more solutions to consider before an ideal one could be found.

What Altshuller tabulated was that over 90% of the problems engineers faced had been solved somewhere before. If engineers could follow a path to an ideal solution, starting with the lowest level, their personal knowledge and experience, and working their way to higher levels, most of the solutions could be derived from knowledge already present in the company, industry, or in another industry.

Over the years of it's development TRIZ has been used in a number of industries. In addition to the 40 Inventive Principles Altshuller also noted 39 Engineering Parameters. All of these work together to provide system of Creative and Inventive Problem Solving.

Application: Facilitators should study and get trained in the use of TRIZ methods as their usual purpose for working with a team or group is to help them solve problems. TRIZ provides a broad range of methods that help do just that.

References:



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TRIZ Journal - http://www.triz-journal.com/ http://www.mazur.net/triz/

http://en.wikipedia.org/wiki/TRIZ

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