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CASE STUDY | TRIZ and the Separation Principles

The Theory of Inventive Problem Solving (or TRIZ)

TRIZ is a Russian acronym that, translated, means “theory of inventive problem solving.” The roots of TRIZ go back to the mid-1940s, when Russian engineer Genrich Altshuller initiated extensive research into the world’s database of patented inventions.

Forty years and 1500 person-years of research later, Altshuller had probed into more than two million globally distributed patents, and had discovered that innovation isn’t a random process. Rather, it’s governed by certain objective principles and follows certain well-worn patterns, and all this can be taught to anyone.

As a result of his investigative and analytical work, the Russian and his colleagues codified 11 evolutionary principles, 40 inventive principles and 39 generalized parameters for solving engineering contradictions, which lie at the root of all innovation problems.

If you understand these universal principles, you can resolve the contradictions of nearly any innovation problem, whether it exists under a microscope, in outer space or anywhere in between. Thinking analogically with Altshuller’s contradiction matrix, you can locate the inventive principles that will guide you to a successful solution and innovation.

Because of Genrich Altshuller and TRIZ, the ability to spawn something new is no longer a function of happenstance or enigmatic breakthrough. What was once the property of geniuses is now the property of all.

The TRZ Separation Principles

In TRIZ, there are two main types of innovation problems, or engineering contradictions.

A physical contradiction is when one element of a system conflicts with itself, like when you need the temperature of the water to be both hot and cold to satisfy different design requirements.

A technical contradiction is when two different elements of a system conflict with each other, like when you need the temperature of the water to be hot, but making it hot then interferes with some other functional requirement. In other words, as one element improves, the other degrades.

The important fork in the road is that physical contradictions lead you to the four separation principles of TRIZ, while technical contradictions lead you to the 40 inventive principles.

In the case of physical contradictions, the principles of Time, Space, Scale and Condition are used to essentially divorce the bi-polarity of the element. If the water has to be hot and cold at the same time, then we have to detach the water from this dilemma.

Can we create a Time differential for when the system needs cold water and when it needs hot water, thereby rotating its temperature by some schedule? Can we manipulate the system so it can have a separate Space for cold water and another Space for hot water, thereby enabling the conflicting needs to coexist?

These are the types of questions TRIZ practitioners asks as they go about applying the four separation principles.

Case Study: Separating Steel in Space

A steel mill that manufactured coiled sheets of stainless steel wanted to be flexible in delivering different coil widths to different customers. At the same time, the mill didn’t want to commit to more than one manufacturing configuration – as the complexity and downtime involved in multiple configuration changes would be significant.

Therefore the easily-identified problem was a physical contradiction: the mill wanted to produce custom configurations for a wider customer base, but it didn’t want to do this because of the associated manufacturing difficulties.

The separation in space principle presented an interesting solution to the problem. In one part of the mill, workers could manufacture only steel coils that matched the maximum width required by customers. Then, this maximum-width coil could be transported to inventory, where it could be pulled for width-customization by other workers in other parts of the mill.

The key is that post-production customization techniques were already available in the other parts of the mill – so no new equipment, personnel, processes or procedures were needed. By implementing this new system, the mill overcame its physical contradiction: it was able to meet a wide range of customer needs while keeping manufacturing complexity to an absolute minimum.

This case study was excerpted with permission from Insourcing Innovation, an Auerbach Publications book, the lead author of which is BMGI’s CEO David Silverstein.