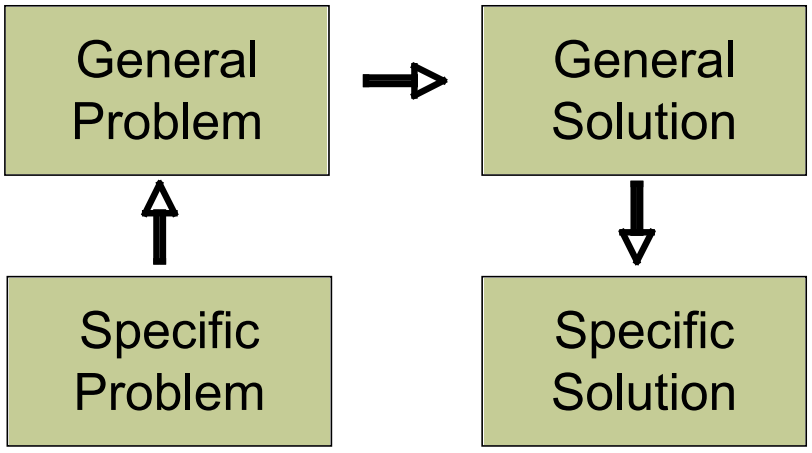
TRIZ for Lean Innovation

Increase your ability to leverage innovation across the enterprise and beyond

by Katherine Radeka



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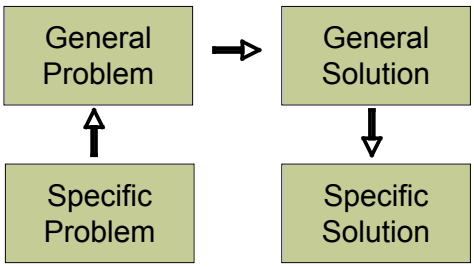
Key Takeaways

- TRIZ is a structured problem-solving method based on patterns of problems and solutions.
- Product developers use TRIZ to create breakthrough solutions by applying existing knowledge to problems in unexpected and innovative ways.
- TRIZ supports lean product development by strengthening a team's ability to leverage and reuse knowledge across the enterprise and pull in knowledge from other companies and industries.

What is TRIZ?

TRIZ (pronounced "treez") was developed in the former USSR between 1946 and 1985 by G.S. Altshuller and his colleagues. The name translates in English to the "Theory of Inventive Problem Solving." Atshuller observed that there were patterns to innovation and universal principles that could be used to identify solutions to problems more rapidly. In short: "Somebody someplace has already solved this problem (or one very similar to it.)" (Barry, p. 1).

The theory says that specific problems are instances of general problems. By looking at general solutions to the general problem, one can identify candidate solutions for the specific problem. Over the decades, TRIZ researchers analyzed over three million patents to identify repeatable patterns in contradictions and trade-off analysis, scientific effects, technical evolution and standard solutions.



By using these patterns to generate solutions, teams can avoid the waste of reinvention, overcome the limitations of their own knowledge and intuition, generate more robust solutions in less time and anticipate the future evolution of their product lines.

TRIZ as a Lean Problem-Solving Method

To use these patterns, one must have a good understanding of the specific problem. The first step in TRIZ problem-solving is to analyze the problem, looking for ways of framing the problem to create a more ideal solution. Any TRIZ problem can be stated in terms of the "Ideal Final Result" which is the solution that includes no waste and produces no harm. In the auto industry, the Ideal Final Result is simply stated: the car just right for a particular buyer materializes in their driveway with perfect quality and no labor, raw materials or supply chain. This should sound familiar to Lean practitioners - it is the 5th Lean Thinking principle, Perfection.

After the Ideal Final Result is articulated, TRIZ has a number of General TRIZ Solutions for understanding the problem more deeply. Functional Analysis ensures that the team understands the system components and how they work together. Zones of Conflict looks for root causes and resources available to solve the problem. The System Operator provides nine perspectives on the problem to augment the team's usual system-level perspective.

From there, the team identifies the contradictions in the system. Physical contradictions are inherently unresolvable in the same place at the same time: something cannot be hot and cold or hard and soft simultaneously. Technical contradictions involve trade-offs: how do we get a stronger material that weighs less? TRIZ researchers have identified Separation Principles that resolve physical contradictions, and 40 Inventive Principles to improve or eliminate technical contradictions.

Teams use these general solutions to generate a list of promising solutions for their specific problem. Not every general solution needs to be applied to every problem for TRIZ to generate enough useful ideas to fuel an investigation process, perhaps using set-based design to converge on a final solution.

General TRIZ Solutions

- The Ideal Final Result and Ideality: Methods to identify the perfect solution to the problem, and articulate the aspects of the solution that would bring it closest to the ideal solution.
- Functional Modeling, Analysis and Trimming: Methods to get a good understanding of the components of the system, their interactions and how they contribute/detract from the Ideal Final Result. Since the Ideal Final Result usually contains fewer system components, TRIZ emphasizes looking for ways to eliminate components to simplify the overall system.
- Locating the Zones of Conflict: These methods help identify the root causes of problems and the resources already available in the system to solve the problem by asking basic questions about it: Who, what, where, when, why and how.
- System Operator: This tool provides nine different ways to look at the problem to broaden a team's perspective.
- 40 Inventive Principles: These features describe general ways to solve problems, such as Separation and Symmetry Change. They are tied to 39 different aspects of systems, including things like weight, strength, productivity and complexity, which often contradict each other, leading to trade-off decisions. TRIZ researchers have created a matrix that shows which principles are most likely to provide a solution when a problem involves a trade-off between two different system aspects.

  For example, "Composite Materials" is a general solution to a general problem where there is a trade-off between strength and weight. As a general solution, Composite Materials does not refer to a specific composite, but instead relays the concept of a material that has different parts: reinforced concrete, glass fiber-reinforced plastics, honeycombed materials that include air as a composite, and cross-disciplinary teams all fit under this principle.
- Separation Principles: These principles provide clues to solutions that resolve physical contradictions - such as a system's nee to be both hot and cold at the same time.
- Laws of Technical Evolution: These eight patterns of innovation have been documented in everything from the printing press to microchips. Understanding these patterns can help guide advanced research and product line evolution.

TRIZ and the Waste of Reinvention

TRIZ helps eliminate the waste of reinvention by making reusable knowledge more accessible. Just as the TRIZ researchers did with patents, organizations can analyze their own knowledge base from the perspective of the repeatable patterns of innovation, using TRIZ as a means of generalizing and classifying their knowledge for future re-use. For example, one could use the 40 Inventive Principles to categorize A3 reports that describe technical solutions, and the Contradictions Matrix to cross-reference them to common trade-offs within a given area of technology.

TRIZ encourages people to seek solutions outside of the traditional functional boundaries. In large organizations, a common TRIZ-based classification scheme could help break down functional and organizational barriers to knowledge-sharing. Once the system of categorization is in place, TRIZ problem analysis techniques can point future teams towards the areas in the knowledge base that may contain relevant reusable knowledge, no matter where in the organization it was generated.

Teams can also use TRIZ to help them reuse the knowledge gained in other companies and even other industries who have already solved similar problems. TRIZ turns the U.S. Patent Database into a collection of accessible solutions which may be adapted to a team's specific problem, creating breakthrough innovations.

How to Learn More

- Visit the TRIZ Journal at www.triz-journal.com for examples and case studies of how TRIZ has been used in industry to fuel innovation.
- Sign up for a workshop or visit a conference presentation. The TRIZ Journal has a calendar of public workshops, and larger companies may offer training through their engineering professional development programs.

References

Katie Barry, Ellen Domb and Michael S. Slocum, "What is TRIZ?" *TRIZ Journal* http://www.triz-journal.com/archives/what_is_triz

Ellen Domb, *Practical Innovation: Applying the Concepts of TRIZ to Accelerate Innovation.* Upland, CA: The PQR Group, 2005.

For Further Reading:

The TRIZ Journal: http://www.triz-journal.com

Kalevi Rantanen and Ellen Domb, *Simplified TRIZ: New Problem Solving Applications for Engineers and Manufacturing Professionals.* CRC Press: 2002 (2nd edition in November, 2007).

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