

TRIZSoft® development

The organization of TRIZSoft® development

TRIZSoft® belongs to the new class of software systems described earlier, namely, systems that should be first invented, and then and only then, computerized. Hence, the development of TRIZSoft® is being carried out in accordance with the following scenario:

1. Identify and formulate the problem

For example, the following problem arose: how to simplify the description of certain types of business problems using the Problem Formulator.

2. Apply the inventive approach toward resolving this problem

The following idea surfaced: develop ready-made diagrams (i.e., templates) for typical problems.

3. Develop a software prototype; research and improve the prototype

Several prototypes were developed, one of which was considered satisfactory.

4. Introduce the best elements developed in the prototypes into one or more commercial software products

The requirements for the development of templates were formulated; the next version of the software involves specific tools for developing and utilizing these templates.

New TRIZSoft® products, as well as new versions of current TRIZSoft® products, are being developed based on:

- The experience gained in the use of current TRIZSoft® products by both customers and TRIZ specialists
- A determination of the needs of potential customers in solving creative problems
- New achievements in the evolution of TRIZ as a theory

Major directions of development

TRIZSoft® development is based on:

- The redesign of Classical TRIZ in the following directions:
- Applying informational technologies
- Providing systematic work in the area of creativity
- Transferring routine and repetitive operations to the computer
- The development of software “shells” to provide optimum support of TRIZ logic and the structured activity of TRIZ specialists in solving creative problems

TRIZSoft® development is aimed at achieving the following features:

- A technique for effective collection and structuring of information to support creative thinking and reduce psychological inertia.
- A technique for performing a computerized analysis of an innovative situation, and converting the situation description into a set of problems to be solved; in other words, the initial problem should be “sliced” into manageable pieces and transformed into a set of simpler problems.

- A system that “pushes” the user toward a solution by presenting abstract, generalized recommendations for modifying the system, i.e., so-called *Operators*, which show the most prospective directions for solution; a successive, layer-by-layer presentation of hints as the user goes to the “heart” of the problem situation.
- Effective informational funds that support the generation of creative analogies useful for problem solving.
- A system of revealing and utilizing resources, both inside the system and in its environment, in order to more effectively carry out the ideas arrived at by the user.
- A system for evaluating ideas, improving and further developing them; a system of revealing, formulating and resolving secondary problems either resulting from the new concept or interfered in its utilization.

Major elements of TRIZSoft®

The following required elements have been identified¹:

- **Innovation Situation Questionnaire (ISQ):** A system of questions that have been selected and organized in order to support the collection and structuring of information about the problem, and to reveal where there is insufficient knowledge of both the problem and the system where the problem occurred. Support of these activities improves the problem-solving process and reduces psychological inertia; as a result, the probability of success is maximized.
- **Search for Information:** A set of tools that provides the user with an effective way to search for inventive information and recommendations, both internal to the software and via the Internet. This set provides the user with links to the commercial search engine, **MapIt™**, for fast and effective patent searches.
- **Knowledge (Events) Diagram:** A system that graphically presents knowledge to the user in the form of a model of a “knowledge network” or a “knowledge map” that exists in the brains of experts. This Knowledge Diagram allows for the verbalization, formalization and transfer of knowledge with a minimum loss in meaning.
- **Automatic Formulation:** A software algorithm that allows for the transformation of knowledge formalized in the Knowledge Diagram according to the user's needs. For example, the Knowledge Diagram can be transformed into Directions for Innovation for the purpose of simplifying and improving the creative thinking process; these Directions suggest ways to both eliminate harmful effects and improve the system's effectiveness. Other types of knowledge transformation are available as well.
- **System of Recommendations (Operators):** This system provides for the identification and presentation of the recommendations found to be most effective for resolving the particular problem being addressed, together with appropriate supporting information: examples, effects, other knowledge, and hints helpful for problem-solving. When necessary, the user is asked to supply additional information (through menu selections) so that more precise recommendations can be presented.

¹ For a more detailed description of the most important TRIZSoft™ elements, see Appendices 7 & 8.

- **Concept Synthesis:** Provides the user with the ability to integrate separate ideas into a set of Concepts.
- **Evaluation and Improvement of Concepts:** This system helps the user to evaluate Concepts according to the pertinent limitations and constraints, and recommends ways for both further improvement of Concepts according to the Patterns and Lines of Evolution, and for resolving secondary problems, should they arise.
- **Additional TRIZ Tools:** A set of Classical TRIZ tools including a simplified ARIZ, Contradiction Table, etc.
- **Inventive Navigator:** A system that controls the entire problem-solving process and directs it in the most optimal way for the user.
- **Inventors' Screen Saver:** A screen saver that shows the best, most clever, and effective inventions. This screen saver supports the development of the user's creativity levels through familiarization with the best inventions.
- **Protocol:** Helps the user to document the creative process and provide him/her with a report as soon as the problem solving is complete.

General Structure of TRIZSoft®

The separate elements of TRIZSoft® are combined into a unified functional structure called the *Ideation Problem-Solving Process*, which comprises a TRIZ-based step-by-step procedure designed to support the user in identifying available resources and combining them into Concepts for Innovation. This procedure consists of the following steps:

- Step 1. Innovation Situation Questionnaire (ISQ): Identify and document the problem situation
- Step 2. Problem Formulation: Build a functional model of the problem situation and generate problem statements
- Step 3. Prioritize Directions and Generate Ideas
- Step 4. Develop Concepts
- Step 5. Evaluate Results

An abbreviated variant of the Ideation Problem-Solving Process, called the *Express Process*, is designed for the solving of more typical problems.

Some Ideation software products exploit the above structure only partially; for example, in some cases the building of the Knowledge (Events) Diagram and Problem Formulation are replaced with a simplified procedure of identifying the typical problems that relate to the problem faced by the user.

Support for Problem Solving

New ideas, solutions, concepts, etc., may be found in any stage of the problem solver's work; the Ideation Problem-Solving Process supports this in the following ways:

- Filling out the ISQ often helps change the user's point of view, reminding the user of information he/she had not previously linked to this problem. This activity, as well as



structuring the information about the problem, sometimes helps the user to find the solution even in this early stage.

- Consideration of the Directions for Innovation formulated by the software sometimes allows for the revealing of new approaches not previously considered; sometimes these problems are easy to resolve.
- The systematization of known solutions through automatically formulated Directions for Innovation sometimes provides the user with a solution as a combination of known ways not considered before.
- Applying the Operators and examples-analogs for problem solving is the major stage for the revealing of new ideas.
- The improvement of ideas and the solving of secondary problems by applying Operators and Lines of Evolution sometimes prompts new ideas and solutions, as well.

Using TRIZSoft®

Five years of experiments enabled the most effective ways of using TRIZSoft® to be identified, both for individual work and teamwork.

Individual Work

- The step-by-step solving of problems of average to high complexity through the application of the entire Ideation Problem-Solving Process.
- The solving of simple problems through the application of the Express Process.

While working with the software, the user accumulates experience and repeatedly uses his/her own materials (diagrams, ideas, etc.) For example, diagrams made for one problem might be applicable, with some editing, for other problems related to the same system; ideas and solutions that occurred, but were not used in one situation, might be useful for other problems. This means that while working with the software the user creates his/her own "creative library."

TRIZSoft® allows remarks, comments, examples to be added to the software screens by the user, allowing for partial "customization" of the software.

Team Work

TRIZSoft® is most effective if used with teams consisting of at least two experts. This is due to the fact that discussion among team members allows for a more precise description of the problem situation in the Diagram, as well as a better understanding of Directions and recommendations, etc. The Ideation Brainstorming² mode is highly recommended for teamwork.

Assessment of the effectiveness of the TRIZSoft® Support for Problem Solving

² *Ideation brainstorming.* TIRG 1999, Appendix 22.

Generation of concepts

While using TRIZSoft® with the Problem Formulator, the user can regard any problem situation as a combination and interaction of useful and harmful functions. The average problem situation is usually "sliced" into 50 – 100 functions; a complex situation might comprise thousands of functions. In the preliminary formulation mode, the software formulates two to three problems for each function; this means that 100 to 300 problems are formulated when analyzing the average situation.

For each problem, the software suggests between five and twenty Operators, where each is a potential recommendation for resolving the problem situation. As a result, the user obtains several hundreds of recommendations aimed at resolving the problem. We are confident that this represents a practically exhaustive set of concepts; there is no reason to increase this number; to the contrary, the subsequent steps of the problem-solver's work are aimed toward reducing this number by selecting the most effective Directions/ concepts.

Attention: TRIZSoft® completely modifies the traditional approach taken in inventive problem solving; instead of activating a search for variants of solutions, the user's focus is directed to a selection of variants, which is close to "usual" engineering work. It is safe to assume that there are two approaches to improving and evolving systems:

- **Rooster Approach:** *The search for a pearl through trials of variants; this approach is used in many methods of problem-solving, the difference is in the ways the trials are made.*
- **Gold Prospector's Approach:** *Generating many potential directions and concepts, then rejecting some according to specified criteria, as in sluicing the gold ore; this is the TRIZSoft® approach.*

Selecting Directions/concepts

The first step in this selection is made during the process of analyzing the Directions; this selection is aimed at rejecting Directions that are either of little interest for problem-solving or do not meet the goals of the particular project. Usually, from 2/3 to 9/10 of Directions are rejected at this step.

The second step in the selection process is made while working with Operators; this selection is aimed at rejecting those recommendations which either cannot be provided with the necessary resources, or which result in secondary problems that are too complex to be dealt with. Usually, from 1/2 to 9/10 of the remaining recommendations are rejected at this step. As a result, from one to several dozen Directions/concepts remain for resolving the average problem situation.

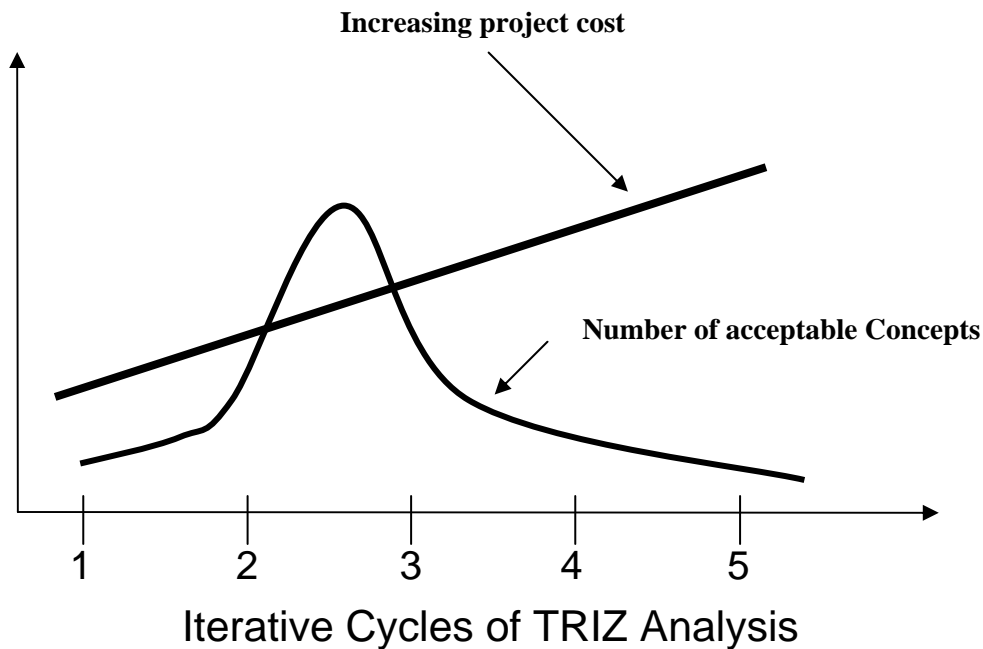
Further Steps

Further steps in the TRIZSoft® user's work are performed in a similar way: the user uses the results of the previous step to conduct a refined analysis of each selected Direction (through a refining of the Directions). Then the user selects the most prospective Refined Directions. This cycle might be repeated several times.



According to our experience, the solutions that are plausible for the customer begin to appear during the first stage of work. For an estimation of both the number of effective ideas that occur at different stages and the potential cost of a project, see Figure 1.





Assessment of Time Consumption of the Problem-Solving Process

Problem solving through the Trial-and-Error method seems like an instant process: there was no solution, then it occurred as a result of circumstance and rare coincidence. However, it can take weeks, months, or even years before the next solution occurs.

Work is the price to be paid when utilizing TRIZSoft®. It typically takes from 5 to 15 minutes to find one solution, whether the solution is plausible or not. However, there is no pause between the occurrence of solutions, and a TRIZ specialist can find about 20 – 50 solutions per working day. For the average problem, the probability is high that a plausible solution will be among the first dozen ideas.

