

# Approach to Complete Search of Innovation Concepts and Customization of TRIZ-Tools

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## Abstract

One of the significant advantages of TRIZ application for the industry is the possibility of systematically defining the complete search field for a concrete technical system (TS) or task. This step has to be done at the stage of problem formulating by the analysis of all potential conflicts between the components of the TS. For each conflict a pair of several technical contradictions, ideal final results and physical contradictions on the macro and micro level is to be formulated. Due to this approach a complete search tree with typically more than 100 formal physical problems could be created and solved with the known separation principles. New software - the TriSolver 'Ideas Generator & Manager' supports a computer-aided implementation of the ARIZ-based method and of all TRIZ-principles, standards and checklists including contradiction matrix and effects pointer as well. Due to the open database the TRIZ principles and operators could be customized or extended by the user or combined for special tasks as e.g. cost reduction. This approach has been proven by the large experience with industrial innovation projects.

### Gaining TRIZ knowledge in the industrial companies

A great number of users confirm that the TRIZ (Theory of inventive Problem Solving) is much too extensive to be successfully introduced parallel to the usual business. Systematic support by experts in the field of the TRIZ methods can be very helpful in the starting phase. Firstly, it helps to integrate the TRIZ techniques to the working processes of the company and secondly, it builds up TRIZ competence within the company.

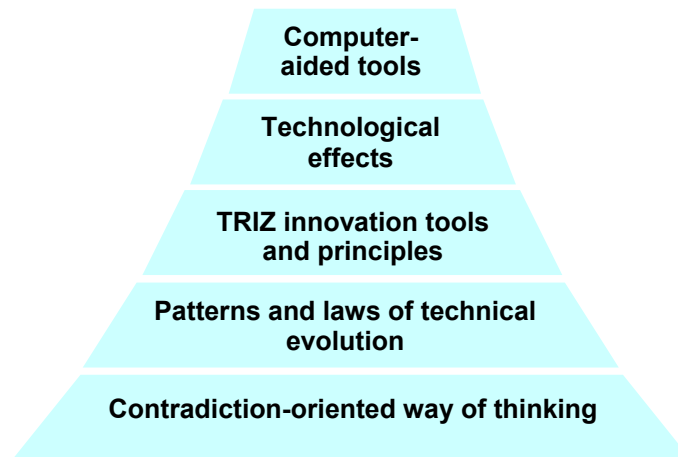
The TRIZ-based computer programs assist the qualified user in solving technical problems and developing ingenious new products with the help of TRIZ-based tools, databases and practical examples. They are often falsely considered to be “invention machines”, however they do not deliver inventions at the click of a mouse button.

Depending on requirements, TRIZ knowledge can be conveyed through practical training or, even more effectively, by conducting pilot projects for resolving actual tasks. The different TRIZ components have to be used according to the complexity of the task (Table 1). In practice, it has been shown that provable results with or without software can only be achieved by users who have knowledge of at least 10-15% of the whole potential of TRIZ, without having to consult a handbook or an electronic thesaurus. According to our experience the customisation of the TRIZ-tools or, in other words, the adaptation of TRIZ knowledge to the needs of companies, is another important factor for a successful implementation of TRIZ in the industry.

Table 1: The most important components of TRIZ

No.	TRIZ – tools, methods	Fields of application
1	40 Inventive Principles for eliminating technical contradictions; System of applications in form of the Contradiction Table.	Simple to moderately difficult tasks, recommended for newcomers to TRIZ.
2	System of 76 Standards for solving technical problems: 5 classes / 76 Standards.	Simple to difficult tasks.
3	Step-by-step techniques or algorithms for inventive problem solving (abbr.: ARIZ). Universal tool for solving all kinds of problems.	Extremely difficult problems, comprehensive search for solutions.
4	Substance-Field analysis of technical systems.	Tools for methods nos. 2 and 3.
5	Separation principles for eliminating physical contradictions.	ARIZ tools (no.3).
6	Methods for analysing system resources.	Tool for nos. 1 to 3.
7	Database of physical, chemical, geometrical and other effects and their technical applications.	TRIZ knowledge base, tools for components nos. 1 to 5.
8	Methods to boost creative thinking and to reduce psychological inertia and to ‘leave beaten tracks’: DTC Operator (dimensions-time-cost), Modelling with “little people” etc.	Psychological support for all TRIZ components.
9	Method of Anticipatory Failure Identification (AFI) in technical systems.	Analysis and prediction of possible sources of failures.
10	Patterns of evolution of technical systems (TS).	Prediction of the development of technical systems, creation of patent fences.

The basic TRIZ knowledge, such as “contradiction-oriented way of thinking” should be widely spread throughout all company levels. The use of special TRIZ tools or software applications should be restricted to a limited number of specialists within the company. It is also advisable to carefully choose how you advance from simple methods to more complex methods and tools: from the bottom to the top of the pyramid as shown in Fig.1.



**Figure 1:** Recommended pyramidal distribution of TRIZ knowledge within a company.

### Comprehensive search of innovation concepts

One of the significant advantages of TRIZ application for the industry is the possibility of the systematic and complete search for technical solutions. Combined with the consideration of the market and customer needs it can help to establish a unique market position. Our approach of comprehensive search for innovation concepts can considerably assist structuring and accelerating of innovation. The approach takes you through the following stages:

1. Uncovering of the hidden wants and needs of your customers through a special process of evaluating customer satisfaction, so you can recognise what you have to do to raise the satisfaction and loyalty of your customers.
2. Simultaneous making of a long-term prediction (10-15 years) of the technical evolution of your products or processes, based up on the latest technology. If required, you can try to get around the patents of your competitors and to strengthen your market position in the medium to long term.
3. After stages 1 and 2, creating of your long-term innovation strategy. You are able to come up with new features for your products or services, which will enthuse your customers. With this knowledge, you can make a large impact on the market with a relatively little effort.
4. Rapid transformation of these features using the inventive and problem solving techniques within TRIZ to a new technical solution with an optimal cost-benefit ratio.
5. Conducting of a comprehensive search for solutions in the most important business areas, also using TRIZ. Your competitors are then left with very little chance of making any major improvements to or out-classing your technical solution within the next 10 years.
6. Protecting of your newly acquired intellectual and technological property with the following measures: patenting of fundamental technologically advanced inventions; creation of so-called patent fences; “dummy patents” and publications to prevent the later patenting of particular information by someone else; technology transfer and extension of new core competency for new products and technology.

7. Subjecting of your new concepts and products to a ‘subversive’ analysis using "anticipatory failure identification" (AFI method). Teething problems with the introduction of new products onto the market can then be practically eradicated.
8. Familiarising of the managerial and specialised staff within your organisation with the TRIZ-based innovation technology, to enable the timesaving and effective solving of all tasks and problems from the initial conceptualisation right up to the launch of the product. This is achieved through, above all, "hands-on" experience.
9. Creation of an enlargeable web-based platform as an idea, information and knowledge management system for the searching, cataloguing and storing of all relevant information and documentation within the organisation.

The problem solving part of the approach for comprehensive search for innovation solutions is based on the proven Inventive Algorithm ARIZ-85, one of the most powerful and universal tools for inventive problem solving (1,2) and implemented in the TriSolver-Software “Idea Generator & Manager” (3) as shown in the Figure 2. The TRIZ structure and the links between the individual methods with regard to different ways of solving technical problems are being considered. Application of this method in numerous industrial innovation projects and training demonstrated a high level of its acceptance and use.

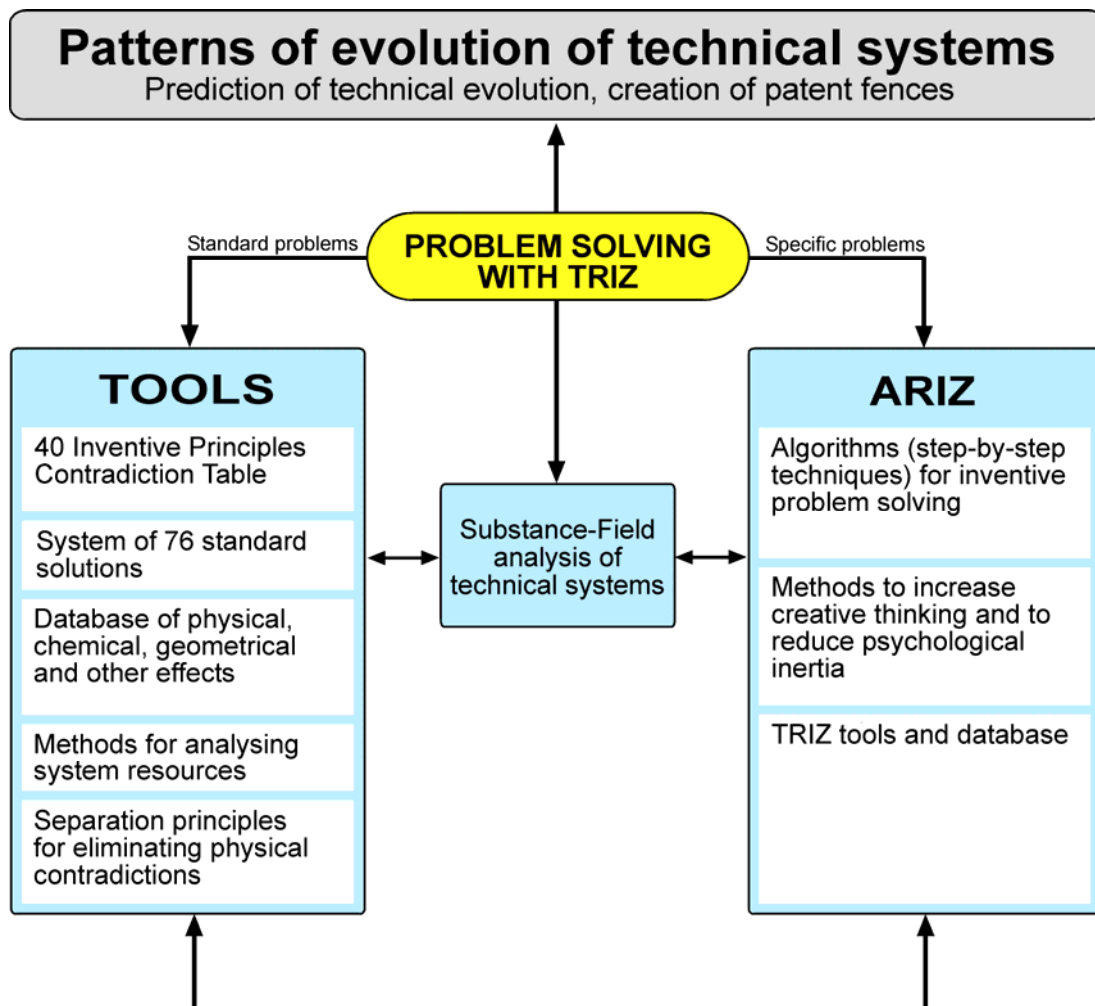


Figure 2: TRIZ structure for solving technical problems

An important role here is played by the first part of the method - Problem Analysis with following elements:

- System components and function analysis
- System resources, existing solution principles and anticipated results
- System levels from the sub- to super-systems and definition of the search field
- Technical conflicts - decomposition of the initial situation to particular problems

As an initial problem situation in technical systems (TS) usually consists of several particular problems or technical conflicts, the conflicting system components or several conflicting pairs (CP) can be identified.

A conflicting pair consists of components of the TS, whose interaction is responsible for causing a negative property or undesired effect. The conflicting pairs represent all relevant interactions and problems within the technical system. The sequence of their analysis, according to their importance and beginning with most important particular problem, should be defined for the further problem solving process. After the analysis of the core CP was initially chosen, all other conflicting pairs are then subsequently analysed for the comprehensive search for solutions.

For each conflicting pair several technical contradictions, ideal final results and physical contradictions on the macro and micro level are to be formulated. Due to this approach, a complete search tree with typically more than 100 formal physical problems could be created and solved with the known tools and separation principles as shown in the Fig. 3. The TriSolver-software supports a multi-path computer-aided application of the method and all TRIZ-principles, standards and checklists including contradiction matrix, effects pointer and main 22 lines of evolution as well.

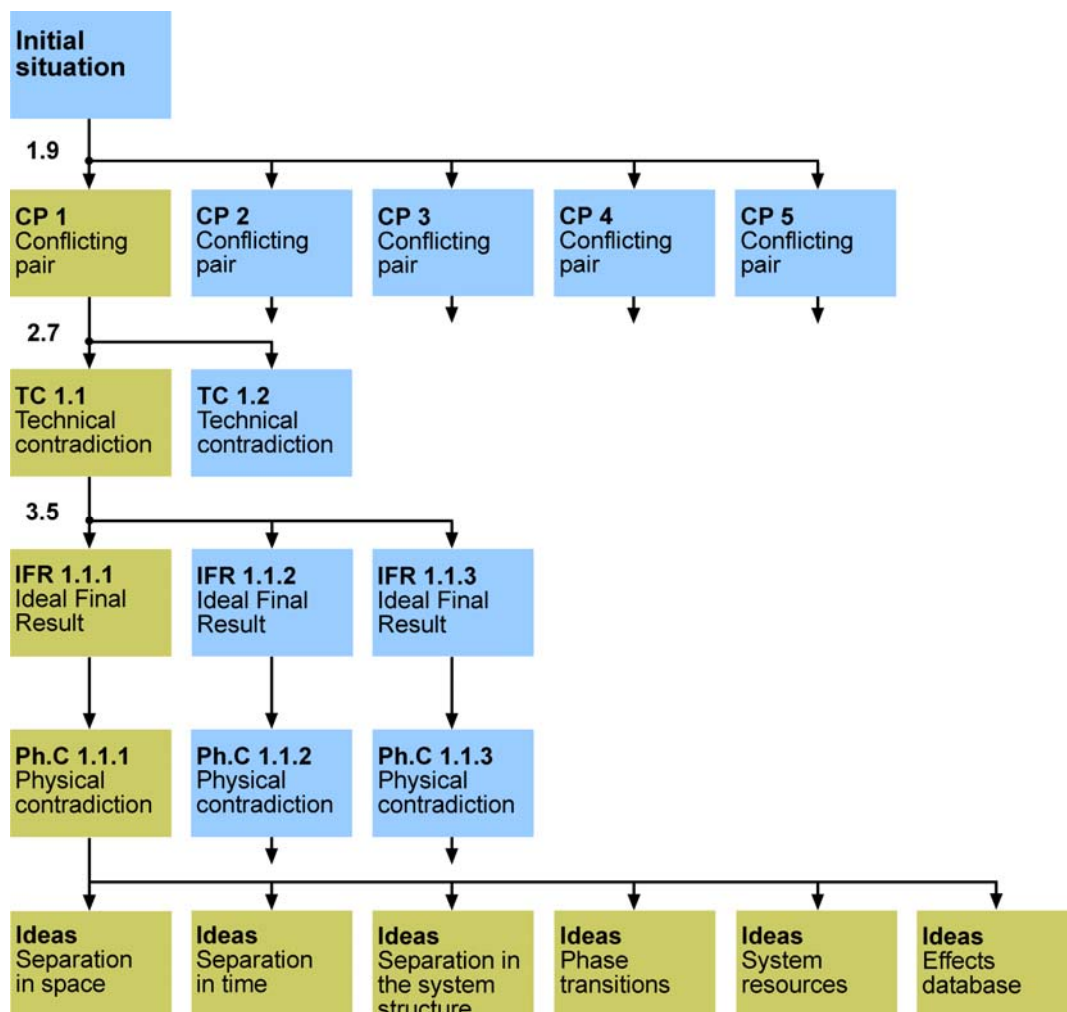


Figure 3: Graph of the comprehensive search for solutions

### Customisation of the TRIZ tools with the TriSolver-software

Designed originally as an internal idea-generating and project-managing tool, the TriSolver 2.0 “Idea Generator & Manager” (3) combines the proven problem solving capabilities of the TRIZ technology, customisable knowledge base approach and an intuitive user interface. The software enables users to generate idea pools, evaluate possible solutions using graphical representation tools, augment and customise the built-in knowledge-base with their own company-specific examples and inventive principles.

The users have the possibility to utilise their individual knowledge and creative expertise to expand and adapt TRIZ modules to the particular requirements of the company, modify or re-group TRIZ-tools to suit particular tasks (e.g. cost reduction), create the list of favourite principles etc. The software also automatically documents every stage in the idea development process, making it easier for the users to explore multi-path solutions (Fig.4).

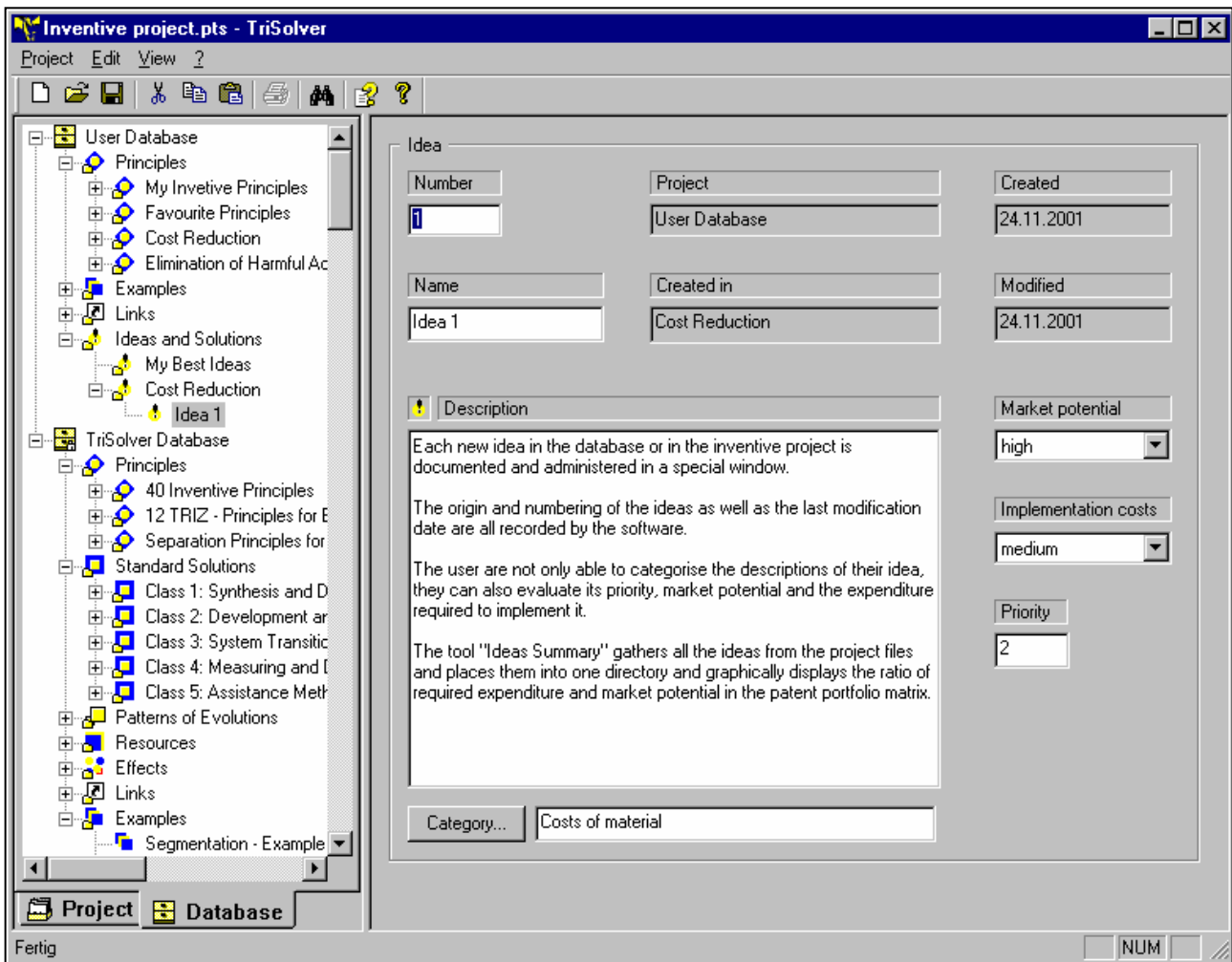


Figure 4: Comprehensive search of solutions with the TriSolver 2.0

## References

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2. V. Petrov, E. Zlotin (1992): Introduction to the Theory of Inventive Problem Solving, Tel-Aviv, 1992; ISBN 965-90087-5-9 (rus).
3. TriSolver® - Idea Generator & Manager, Vers. 2.0, Professional Edition, 2001, [www.trisolver.com](http://www.trisolver.com).

## Appendix:

### Main features of the TriSolver-Software 2.0

#### IDEA GENERATOR

- 40 Inventive Principles
- Contradiction Table with a statistical analysis of the solution principles
- TRIZ Separation Principles
- Inventive Principles for Business and Management
- Systematic inventive process using the ARIZ-based TriSolver method
- Utilisation of system resources
- 76 Standards and Substance-Field Analysis
- Patterns of Evolution of Technical Systems
- Catalogue of applications of physical, chemical and geometrical effects

#### IDEA MANAGER

- Open and clearly structured database architecture including a user database which can be expanded through the addition of new inventive principles, ideas and examples
- Project oriented knowledge and idea management
- Comprehensive documenting of the problem solving and inventive process
- Indexed search in idea pools, projects and databases
- Automatic generation and export of idea pools in various formats
- Idea evaluation and presentation in graphical and tabular form
- Possibility of adding links to external documents stored on PCs and in the Intranet and Internet
- Networking support (optionally)