TRIZ for Non-Technical Problem Solving

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Abstract:

Ursprünglich entwickelte sich TRIZ aus dem Studium von Evolutionstrends oder Strukturen der technologischen Veränderungen, die sich bei Patenten zeigten. Während jener Zeit bezogen sich Patente nur auf technische Dinge und Systeme – nicht für Geschäftsmodelle. Es überraschte daher viele, als man herausfand, dass TRIZ auch für nicht-technische Probleme eine exzellente Problemlösungsmethode ist. TRIZ ist in sehr vielen Gebieten hilfreich: in der Politik, beim Entwickeln und Erbringen von Serviceleistungen, bei der Strukturierung von Organisationen, in sozialen Wohlfahrtssystemen, in zwischenmenschliche Beziehungen und bei der Konfliktbewältigung. Anhand von Fallstudien wird in diesem Beitrag aufgezeigt, wie TRIZ sich bei solchen Problemen einsetzen lässt.

Abstract:

TRIZ developed from the study of trends of evolution, or patterns of changes in technology, as demonstrated in patents, during the decades when patents applied only to technical things and systems, not to business models. It has therefore surprised many people to find that TRIZ is an excellent problem solving methodology for non-technical problems. TRIZ has been very helpful in many areas of politics, service development and delivery, organizational structure, social welfare systems, inter-personal relations, and resolving disputes. Case studies will be used to demonstrate how TRIZ is used for these problems.

1. Introduction

1.1 Background

TRIZ developed from the study of trends of evolution, or patterns of changes in technology, as demonstrated in patents, during the decades when patents applied only to technical things and systems, not to business models. In the early TRIZ publications available in the West, all the examples dealt with technical problem solving, which reinforced the perception that TRIZ is a system for solving technical problems. (1-4)

It has therefore surprised many people, especially those in the non-Russian speaking countries, to find that TRIZ is an excellent problem solving methodology for non-technical problems. Although TRIZ was used frequently for non-technical problem solving during its developmental years, none of those cases were available in accessible publications. Boris Zlotin and his colleagues have written an extensive review of the development of TRIZ in non-technical areas, and the untranslated literature in that area. (5) S. Faer has reviewed the specific applications of TRIZ to the solution of political problems, and its use in many of the former Soviet republics (6)

A contributing problem is that since many of the first users of TRIZ were engineers using TRIZ to solve engineering problems in either production or design, they labeled other applications as *non-technical*. Yet, the problems of finding the best breathing method for a runner (one of Zlotin's examples) or the best way to advertise a candidate who has no money to buy advertising (one of Faer's examples) are both technical problems, in the world of the sports coach and in the world of the campaign manager. So, some of the perception that there are two categories of TRIZ, technical and non-technical, depend on the views of the practioners.

1.2 Current Situation

Many TRIZ consultants and practioners in Europe, North America, and Asia have reproduced the history of the use of TRIZ in „non-technical" areas, without knowing it. Typically, they used TRIZ first in engineering or technological applications, then started using the same methods to solve the business problems that occurred in the same organizations that used TRIZ for engineering problems. Their success with TRIZ in these areas led to the application of TRIZ in all areas of problem solving. (7-12)

2. Using TRIZ Tools, Techniques, and Methodology

Short examples of the use of several key TRIZ tools, techniques, and methods illustrate the similarities between technical and non-technical use of TRIZ, and suggest that we may not need to make that distinction in the future.

2.1. Ideality

Regardless of whether the equation form of the definition of ideality is used, or the „itself" form is used, the concept of ideality and the search for the ideal final result is one of the core methods of TRIZ. The equation method is

Ideal Final Result = lim (Ideality) and Ideality = Σ Benefits / (Σ Costs + Σ Harm)

and the „Itself" method is to state that „The problem solves itself." Or „the system itself solves the problems." (13, 14, 15)

In a recent TRIZ workshop, most of the participants were Design for Six Sigma Black Belts, which makes them project managers for projects to create new products and services. They complained that entering the data into their project management system takes too much time (harm) although having up-to-date data in the system is very useful (benefit.) The ideal final result can be formulated from several points of view:

- The data enters itself
- The data is always correct
- The system updates itself
- Every team member always has correct data

The first form led directly to a solution. Since all the activities of the team members on a development project (interviewing customers, travel to visit customers, recording the data from the customer visits, scheduling meetings, conducting meetings to analyze data, the analysis, QFD matrices constructed from the analysis, design documents, etc.) were handled through the company computer network, changing the way the data were labeled („meta-tags") made it possible to accumulate the data directly into the project management system. Now, the Black Belt only has to enter data when the plans are changed, making considerable time available for the creative work of planning and leading the project.

This example reinforces the main point—is this a ***non-technical*** problem in project management, or a ***technical*** problem in information technology? The concept that was suggested by the Ideal Final Result is impervious to the definition.

2.2. Functional Analysis (Su-Field Analysis) and the 76 Standard Solutions

Three equivalent methods are used for pictorial analysis of problem situations. Two sets of language for functional (Subject-Action-Object) analysis and the classical Substance-Field model are shown in Figure 1. (16)

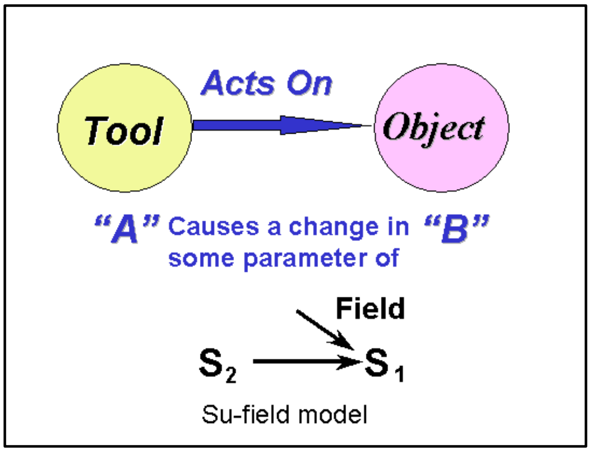

Figure 1. Three equivalent ways of describing a system in TRIZ.

All three methods are equivalent in guiding the problem solver to appropriate solutions. In many cases, examining the initial system to see if any of the five elements of a system are missing can be the key to solving the problems. See figure 2 for an illustration of the five elements.

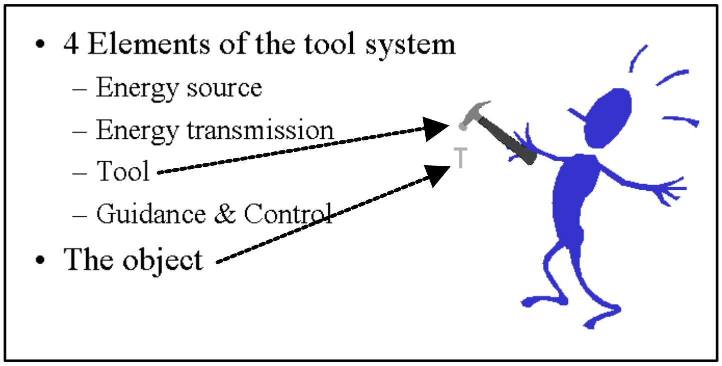

Figure 2. In the case of the hammer and the nail, the hammer is the tool, the nail is the object, the source of the energy is the person's muscle power, the transmission is the person's hand gripping the hammer, and the guidance and control is the person's eye-brain-hand coordination. The parameter of the nail that changes is the position.

In a business example of the use of the five elements, a typical TRIZ example might suggest that if hammering with human power is not fast enough, one should switch to pneumatic power. This might be offered as an example for a business problem in which a courier deliver service does not deliver messages fast enough. The table, shown in Figure 3, can be used to quickly determine which of the 5 elements should be changed to solve the business problem, based on the example from the technical problem.

Creating Analogies in TRIZ

Element	Example Starting	Example Improved	My Problem Starting	My Problem Improved
Object acted on	Nail	nail	Message	
Object Acting (tool)	Metal hammer head	Metal hammer head (minor changes	Company	
Source of Energy	Person's muscle power	Air pressure storage mechanism	Courier vehicle's power system	
Transmission of Energy	Person's hand holding hammer	Walls and cylinder in piston	Message is in the vehicle, carried along	
Guidance and Control	Person's eye and brain	Person's eye and brain	courier	

The energy source is the element of the system that changed the most.

Figure 3. In this example, the technical model, speeding up hammering by switching from human power to pneumatic power, is used by analogy. The business problem of speeding up courier delivery will be solved by changing the source of energy for delivery of the document from a vehicle to some other source (such as electromagnetic energy for an e-mail or a fax delivery of the document.)

This is the equivalent of the use of the 76 Standard Solutions with Substance-Field modeling. (17). See Figure 4.

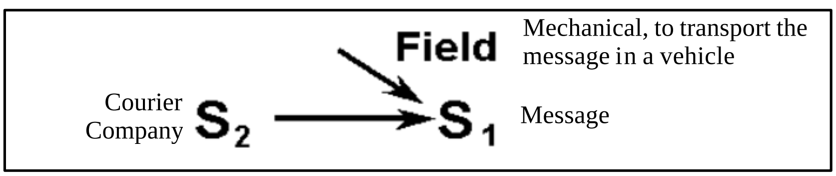

Figure 4. Su-Field model for the case described in Fig. 3. Since the function is too slow, 5.1.1.2 and 5.2.2 both suggest the replacement of the vehicle (source of the mechanical field) by a field available in the environment (such as the electromagnetic field of the e-mail system or the telecommunications system.)

2.3. Contradictions

Controversy has raged for several months (18, 19) about the proper terminology for contradictions, or conflicts, in many areas of problem solving. Both classical and new terms will be used here.

- The classical terms are used to avoid confusing people who are already familiar with them
- The new terms are used because they are natural language for problem solvers, and they help beginners recognize the nature of the contradictions that they are dealing with quickly, without introducing a new language as a barrier to learning TRIZ.

2.3.1. Physical or Inherent Contradictions and Separation Principles

The paradigm for the inherent contradiction is

I want X and I want anti-X **and exaggerations of that statement.**

Classical TRIZ examples include

- I want this system to be heavy and I want it to be light which, when exaggerated, becomes I want this system to be massive and I want it to have zero mass.
- I want this object to be present and I want it to be absent.
- I want this to be cold and to be hot.
- I want my airplane to have landing gear hanging down and I don't want my airplane to have landing gear hanging down.

Non-technical examples of the inherent (or physical) contradiction abound.

- I want my boss to be at the meeting. I don't want my boss to be at the meeting.
- I want to know everything my 17 year old child is doing. I don't want to know everything my child is doing.
- I want all my employees to be thoroughly trained for their jobs and I don't want them away from their work to attend classes. (Fitting this to the paradigm makes it into the statement „I want training and I don't want training.")
- I want all project management data always up to date, but it takes too long to enter the data. (Fitting this to the paradigm, and exaggerating it, creates the statement, „I want the data updated and I don't want the data updated")

The separation principles (anywhere between 4 and 11, depending on your reference source) are used to resolve the inherent contradictions. In addition to converting the problem to the form of the paradigm, it is helpful to ask „why" for each part of the statement. If I know that I want my boss to be at the meeting because she will make quick decisions so I can proceed, and that I don't want my boss to be at the meeting because she inhibits discussion by other members of the group, I can quickly decide to use the principle of separation in time and arrange the schedule to have her there for the decision making part, but not for the discussions about application which require consensus and frank exchange of views. Likewise, separation in time solves the airplane problem: have landing gear down when taxiing, taking off, and landing, but don't have them hanging down when climbing or cruising.

In many non-technical situations, particularly those involving human relationships, the statement of the inherent contradiction suggests solutions directly, and the separation principles enhance the understanding of the solutions.

2.3.2. Technical or Tradeoff Contradictions and the 40 Principles

The classical TRIZ (and systems engineering) paradigm of the tradeoff or technical contradiction is

When X gets better, Y gets worse

Both classical and non-technical examples abound:

- Strength of a structure gets better, but weight gets worse.
- Speed of a process increases, but productivity in a process gets worse (if the increasing speed causes an increase in defects.)
- The amount of weight in in a boat increases, but the freeboard decreases.
- The flexibility of a financial system increases, but the control of the system gets worse.
- Employee empowerment (fast decision making) improves, but standardization gets worse.

Two approaches are emerging for the application of the 40 principles to the resolution of business and other non-technical tradeoff problems:

1. Use the Contradiction Matrix if the parameters are a direct fit for the situation. Use all 40 principles if the parameters are not a direct fit. Frequently, problem solvers use all

40 anyhow, since there is a 50% probability that the best principle for any particular problem is not one of the ones indicated by the matrix for a specific class of problems. (20) There is some argument about whether the most creative solutions are developed from examples of the principles from outside one's area of expertise or those from within one's area. My observation has been that the greatest stimulus comes from those outside one's area, but that most people need to see some from within their own area to get started. (7, 10, 21, and 22 have versions of the 40 principles for general business situations, social situations, quality management, and school administration, respectively.)

2. New versions of the Contradiction Matrix and the 40 principles, based on studies of business cases and business texts, are now being developed (23) Other TRIZ software which uses the inventive principles (24) as well as the patterns of innovation for business situations has been available for some time.

2.4. DTC (Distance-Time-Cost) Operator

The DTC operator (25) is a problem analysis tool that is extremely useful for technical and non-technical problem solving. In its basic form, it is a series of questions, as follows:

- Dimensions: If all centimeters in this problem were 100 km, would the basic nature of the problem change? If all cm in this problem were microns, would the basic nature of the problem change?
- Time: If all seconds in this problem were days, would the basic nature of the problem change? If all seconds in this problem were microseconds, would the basic nature of the problem change?
- Cost: If all dollars were a thousand dollars, would the basic nature of the problem change? If every dollar were a tenth of a penny, would the basic nature of the problem change?

Clearly, the DTC operator is very closely related to the System Operator (or 9 Windows) method, in that it gets the problem solver thinking about the fundamental nature of the problem.

Jayne Majors reports (26) that the DTC operator, combined with the Ideality concept, has been successful in giving her as a counselor and divorcing parents as clients insights that have developed solutions to previously intractable child custody cases.

3. Conclusions

Although the fundamental TRIZ research was based on the study of engineering and technology problems, TRIZ methods, tools, and techniques are very useful for developing creative, inventive solutions to problems in business, human relations, and many areas commonly viewed as *non-technical*. Because the equivalent of the patent database does not exist in this area, it will take some time for the research to reach the level of that on technical problems. The research is taking the form of accumulation of case studies in a variety of areas that require creativity. As the examples presented here show, most practioners are proceeding to use TRIZ in non-technical areas because it is effective, and are not waiting for research or proof.

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