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USING TRIZ IN BUSINESS

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Abstract

The article is devoted to the use of TRIZ tools for solving business problems.

Keywords: TRIZ, business, ARIZ logic, system approach, S-curve, product, company, market, investment

Аннотация

Статья посвящена вопросу использования инструментов ТРИЗ для решения бизнес задач.

Ключевые слова: ТРИЗ, бизнес, логика АРИЗ, системный подход, S -образная кривая, продукт, компания, рынок, инвестиции.

1. Introduction

The article describes the author's experience in using TRIZ tools for solving business tasks.

1.1. TRIZ tools

TRIZ tools for solving business problems, from the experience of the author:

1. Laws of System Development
2. Logic for Solving Non-standard Problems (ARIZ Logic)
3. Universal Inventive Principles for resolving contradictions
4. Systems Approach:
   - *Functional Analysis*
   - *Cause-Effect Approach*
   - *Anticipatory Failure Determination (AFD)*
5. Resources

- **Consider TRIZ tools**
  - ARIZ Logic

In this article we will consider:

- ARIZ Logic.

1.2. Области бизнеса Business areas

Области бизнеса, в которых автор использовал ТРИЗ:

- Business-to-Business (B2B);
- Limited budget;
- Product supply;
- Risk reduction:
- The Stock Market Game;
- Competition.

Details on the ARIZ logic can be found in [1], [2]

2. Using ARIZ Logic

2.1. Brief information about the ARIZ logic

2.1.1. General concepts

The general concepts for various technical strategies are created to meet the needs of a person. The needs grow much faster than opportunities to solve, which is a source of technological progress.
Design of new objects most often involves improvement of system or other technical parameters of system.
Complex inventive problems (unknown types) require non-trivial approach since an improvement of one parameter of the system leads to an unacceptable deterioration of another parameter. These appear as contradictions.
Contradiction - simultaneous interaction of opposite, mutually exclusive parties and trends of objects and phenomena in an internal unit, providing a source of self-motion and evolution of the objective world and knowledge.
Contradiction - it is one of the basic concepts of TRIZ. The most complete contradiction is discussed in the Algorithm of Inventive Problem Solving (ARIZ).
Solution to problems in ARIZ is a sequence of identification and resolution of contradictions, its causes, generated contradiction data, and removal using Knowledge Base. So, defined cause and effect interactions are in essence - identification of Technical and Physical Contradictions.
There are three types of contradictions which are considered in ARIZ:

- Administrative Contradiction (AC)
- Technical Contradiction (TC)
- Physical Contradiction (PC)

2.2.2. Administrative Contradiction

Administrative Contradiction (AC) - contradiction between need and ability to satisfy.
It is easy enough to identify. It is often assigned by administration or customer and is formulated as: "It is necessary to execute but results unknown", "It is necessary to improve or need to eliminate a defect but it is not known how", "There is a reject in the product manufacturing but cause is unknown", etc. This is the most superficial contradiction.

Problem 1. Bus
Conditions of problem
The bus must carry a lot of passengers. How to do it?
This is a typical Administrative Contradiction (AC).

2.2.3. Technical Contradiction

Technical Contradiction (TC) - contradiction between specific parts, quality, or parameters of system.
TC arises when improvement of one part (quality or parameter) of the system results in an unacceptable deterioration of another.
It presents itself as a result of intensifying the Administrative Contradiction (AC). Actually, one AC usually has several TC.
As a rule, improving one feature of an object, dramatically worsens others. Usually, it results in a search for a compromise, that is, to sacrifice something.
Technical Contradiction arises from the disproportionate development of various system components (parameters). When there are significant quantitative changes in one component (parameters) of the system and a sharp "lagging" of other components, it results in a situation where quantitative changes on one parameter of the system are in contradiction with others.
We continue consideration of the bus problem.

Problem 1. Bus (continued)

Analysis of problem

In order to carry a lot of passengers, bus should be roomy i.e. large size. However, big bus is difficult to maneuver.
Thus, it is possible to formulate Technical Contradiction (TC).
TC: Contradiction between bus capacity and maneuverability.

2.2.4. Physical Contradiction

Physical Contradictions (PC) - presentation of diametrically opposed features (e.g. physical) in a certain component of a technical system.
This is necessary to determine the causes of Technical Contradiction i.e. further intensification of contradiction. Amplification (intensification) of contradiction can proceed to an even greater degree to expose root cause of contradiction.
For someone who is new to ARIZ, PC formulation sounds strange and even impossible - some component of the TS must be located in two mutually exclusive states simultaneously: cold and hot, moving and stationary, long and short, flexible and rigid, conductive and non-conductive, present and absent, etc.

Problem 1. Bus (continued)

Analysis of problem

Formulate Physical Contradiction (PC) for given problem.
PC: Bus must be large to accommodate many passengers and small to be maneuverable.
More precisely, these requirements are not for the entire bus, but only to the interior cabin.
It should be stressed again that in contrast to Technical Contradiction which belongs to the entire system, Physical Contradiction only relates to a specific part of it.
Thus, the three types of contradictions form a chain: Administrative Contradiction (AC) - Technical Contradiction (TC) - Physical Contradiction (PC), defines the cause and effect relationships in the technical system under investigation (1).

AC → TC → PC (1)

2.2.5. Methods of resolving Physical Contradiction

The method of resolving Physical Contradiction (PC) can be considered as a means of resolving contradicting properties:

- In space
- In time
- In structure, in particular, phase changes e.g. state of aggregation
- On condition

2.2.6. Ideal Final Result (IFR)

Solutions of mathematical problems and "intelligence" related problems often use "by contradiction" method. The essence of the method consists of the fact that to solve a problem start with the end. Define the final result - the answer. Once this is understood, "pave" the road to the beginning, i.e. solve the problem.
It is tempting to make and solve technical problems in the same way. But how do you know the answer?
Indeed, solution of technical problems is not known, but it is possible to go further ... present the ideal of the developed device - ideal device - Ideal Final Result (IFR).
IFR - a beacon, to be pursued in problem solving. Proximity of solution to ideal determines level and quality of solutions.
IFR - a solution that we would like to see in dreams, performed by fantastic creatures, or means (magic wand). For example, a road that exists only where it contacts the wheels of vehicles.
IFR - result of the process of increasing degree of ideality.

Main properties of **IFR:**

1. Improve harmful parameter, without worsening good
2. Improve parameters without complicating system
3. Improve parameters without causing harmful effects
4. Improve parameters at the right time
5. Improve parameters in the right place
6. All activities must be carried out independently

2.2.7. Path to solution ideas

Identification of Physical Contradictions in solving technical problems requires a specific search pattern, which is only possible with knowledge of the answer. The answer is of course not known in a real technical problem.
The focus on the solution can be achieved through the laws of technical system evolution and above all, based on the law of increasing degree of ideality of technical system.
In ARIZ, this law manifests itself by focusing on the ideal result - Ideal Final Result (IFR).
The basic concepts of ARIZ: IFR, administrative (AC), technical (TC), and physical (PC) contradictions - we can easily present the exact wording of the technical problem for each stage.
Finally, the main sequence of solutions to problems on ARIZ can be presented as follows:

AC → TC → IFR → PC → SOLUTION (2)

Problem is precisely worded when formulated in AC, TC, IFR, PC according to the above sequence (2).
We continue the analysis of bus problem.

Problem 1. Bus (continued)

Analysis of problem

Recall Technical Contradiction (TC).
TC: Contradiction between capacity of bus and maneuverability.
Formulate IFR for problem.
IFR: Bus must be spacious and maneuverable.
Recall Physical Contradiction (PC).
PC: Bus must be big to accommodate many passengers and small to be maneuverable.

Solution of problem

Resolve PC by separating opposite properties:
In structure.
The bus must be made dynamic - flexible, for example, like a snake. This bus will be roomy and very maneuverable. Although such buses have not been created, there is a partial solution - connect two or more buses using flexible connection - "accordion".
In space.
Bus is put on bus - double decker bus. A 5-story bus was built in London. It was used for the first time in the 2012 Olympics. It has a height of 17.68m.
In structure and space.
There are two-story buses and trolley buses, connected by accordion.
In time.
Use small buses, but need to know how many are needed for a certain duration (satisfy on condition).
By condition.
There is a project on expanding bus which depends on number of passengers i.e. small or big.

2.2.8. Logic of ARIZ

The logic of solutions to problems by ARIZ shows the interactions of components in the main sequence (6.4) described previously.
Administrative Contradiction (AC) is formulated in the form of a new requirement “A” for positive effect (PE), or as anti-B for undesirable effect (UE) which must be eliminated. It is schematically depicted in this way:

AC (PE): A or AC (UE): anti-B
or alternatively: AC (PE): B or AC (UE): anti-A

Administrative Contradiction - it is only one requirement (good or bad).
Technical Contradiction (TC) reveals two contradictory requirements of the system. Let these requirements be letters "A" and "B". The Technical Contradiction can be expressed as the need to improve parameters, satisfying requirements of "A", which leads to an unacceptable deterioration of the parameters that satisfy requirement of "B" (expressed as requirement anti-B). An undesirable effect is the requirement of "B". On the contrary - improvement of "B" at the expense of deterioration of “A” (appearance of "anti-A").

The formula of the **ideal final result** (**IFR**) should aim to eliminate the harmful effect (**anti-B**), while preserving the positive requirement "**A,**" that is:

TC: A - anti-B

Unlike Administrative Contradiction, Technical Contradiction has two requirements that contradict each other.

The formulation of Ideal Final Result (IFR) must be aimed at eliminating undesirable effect (anti-B) while maintaining a positive requirement (positive effect) "A", i.e.

IFR: A, B

Physical Contradiction (PC) is determined by identifying contradictory properties of "P" and "anti-P" (e.g. physical), which must have a system component that does not meet IFR requirements. It is necessary to determine how the property of component "C" meets the requirement of "B" i.e. to eliminate an undesirable effect. Simultaneously, the same component must have the contradictory property (anti-P) to maintain a positive effect “A”. Thus, the component must have property of "C" in order to meet demand of "B" (denoted as P → B), and property of "anti-C" in order to preserve the requirement of “A” (denoted as anti-P → A).

PC: P → B, anti-P → A

Further intensification of contradiction is achieved by identifying deeper properties of “P_1”, which are necessary for the creation (preservation) of previously identified properties of “P”.

$$\mathbf{P_1 \rightarrow P}$$

In some cases, when solving complicated inventive problems, it is necessary to identify even deeper cause and effect relationships in the system. Thus, it is necessary to identify more underlying properties P_1, P_2, ... P_n. The following properties as numbered define the cause of the previous properties, which is necessary to satisfy the quality.

$$\mathbf{P_2 \rightarrow P_1}$$
$$\mathbf{P_2 \rightarrow P_2}$$
$$\mathbf{\ldots\ \ldots\ \ldots}$$
$$\mathbf{P_n \rightarrow P_{n-1}}$$

In such cases, identify several aggravated Physical Contradictions (PC_1, PC_2, PC_3 ... PC_n). It can be represented as a diagram:

$$\begin{array}{llll}
\mathbf{PC_1:} & \mathbf{P_1 \longrightarrow P;} & \mathbf{anti\text{-}P_1 \longrightarrow anti\text{-}P.} \\
\mathbf{PC_2:} & \mathbf{P_2 \longrightarrow P_1;} & \mathbf{anti\text{-}P_2 \longrightarrow anti\text{-}P_1.} \\
\mathbf{PC_3:} & \mathbf{P_3 \longrightarrow P_2;} & \mathbf{anti\text{-}P_3 \longrightarrow anti\text{-}P_2.} \\
\cdots & \cdots & \cdots \\
\mathbf{PC_n:} & \mathbf{P_n \longrightarrow P_{n-1};} & \mathbf{anti\text{-}P_n \longrightarrow anti\text{-}P_{n-1}.}
\end{array}$$

Solution of problem (S) consists of solving the Physical Contradiction, for example, by separating the contradictory properties of P ... P_n.

S: P | anti-P

P_1 | anti-P_1

……

P_n | anti-P_n

where vertical bar shows separation of properties.
The logical diagram for solutions to problems of ARIZ is shown fully in Figure 1.

AC: anti-B

↓

TC: anti-B – A

↓

IFR: A, B

↓

PC: P → B anti-P → A

↓

S: P | anti-P

Figure 1. Logic of ARIZ

Legend:
AC - Administrative Contradiction
TC - Technical Contradiction
PC - Physical Contradiction
IFR - Ideal Final Result
S – Solution
A, B - Quality or system parameters
P - Required properties of system
| - Separation sign for contradictory properties

A more developed form of ARIZ logic with the possibility of identifying the underlying properties is shown in Figure 2.

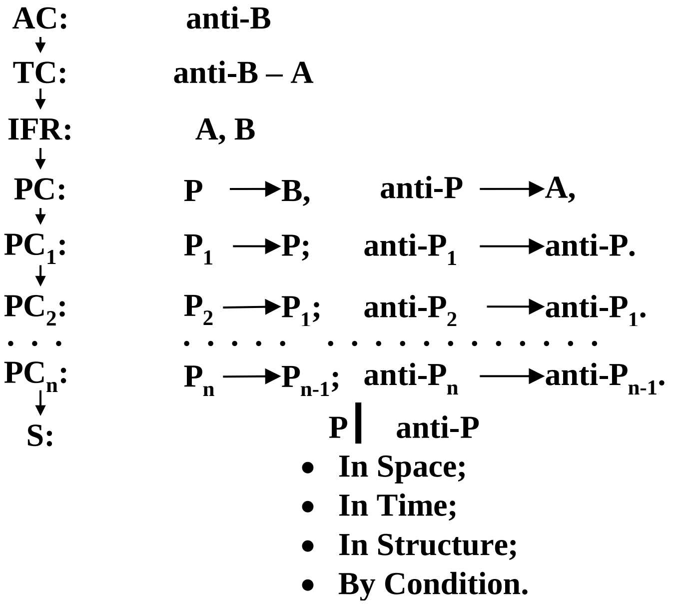

Figure 2. Logic of ARIZ

Legend:
AC - Administrative Contradiction
TC - Technical Contradiction
PC - Physical Contradiction
IFR - Ideal Final Result
S – Solution
A, B - Quality or system parameters
P, P_1 - P_n - Required properties of system
| - Separation sign for contradictory properties

Chain mail invented. It consists of several rings joined together. Each ring is rigid but flexible altogether. Furthermore, there is no metal in the middle of the metal ring, so the weight is significantly reduced.
Note that the cornerstone ("highlight") of the methodology is a result of usage of TC, IFR, PC.

$$\textbf{TC} \longrightarrow \textbf{IFR} \longrightarrow \textbf{PC} \longrightarrow \textbf{SOLUTION} \qquad (3)$$

2.2. Examples of using ARIZ logic in business

Problem 2. Implementation of projects

Problem statement

Not all projects are implemented in the market.
Sometimes you have to give up potential projects, i. e. lose the additional revenue or increase costs (time for project preparation). The use of additional resources has its limits, and then the project becomes unprofitable.
What do we need to do so that the projects, on which the seller works, have been sold by 100%?

Analysis of the problem

The abovementioned problem is an inventive situation.

"5 why" method

*1. WHY is **the implementation of projects low**?*
*Because of **poor sales technique**:*

- *The customer's (decision-maker's) demand is selected not as accurately as possible or incorrectly;*
- *The decision-maker is selected by mistake;*
- *There is no clear understanding of the decision-making chain, or informal decision-making chain;*
- *No sales strategy available (it includes all of the abovementioned items);*

*2. WHY is **sales technique poor**?*
*Because you have **little time** to prepare the project due to a large number of "urgent" tasks;*
*3. Why do you **have many urgent tasks**?*
Because of poor planning of all tasks and those tasks that may lead to a sale (in short term perspective).

Analysis of the problem
ARIZ Logic

Administrative contradiction (AC): **anti-B**
Slow implementation of projects (less than 50%), i. e. low revenue.
Bad parameter "**anti-B**" – **low revenue**.

Technical contradiction (TC): anti-B – A
TC: To get **big revenue** (**A**) you need to use huge resources for preparation which makes the project **more expensive** and **increases the time** for its implementation – the sale (**anti-B**).

Ideal final result (IFR): A – B
IFR: **The growth of total revenue** (**A**) without time increase for the project implementation and **without increasing its cost price** (**B**).

Physical contradiction (PC): P → A; anti-P→ B
PC: To get **big revenue** (**A**) it is necessary ***to spend large resources*** (**P**) which makes the project more expensive and increases the time for its implementation (sale), ***and it is not necessary to spend resources*** (**anti-P**) **to reduce project cost price** and **time for its implementation**
We ***spend resources*** – we do not spend resources (in this case, the resources are system engineers)

Solution
<u>Resolution</u>: P │ anti-P

Resolution of conflicting properties:
in time

- Resources are spent in advance, before receiving the order.
- Solutions are prepared for typical orders

in space

- It is possible to use virtual resources

by condition

- At the time of order receipt the solution is prepared from standard solutions, possibly a slight refinement – the adaptation

in structure

- The majority of problems are common problems,
- You can create a database with ready-made solutions,
- An engineer will take a ready-made solution and not waste his time

Problem 3. Limited budget

Problem statement

The customer has a certain amount of budget and a demand.
This demand is addressed with the solution, which was developed jointly with the customer.
Technical solution is being sold by the partner who does not want to give a discount, explaining it with the desire to have a bigger profit.
Partner cannot be changed, since it is chosen by the top manager of the customer "from political standpoint".
This analysis was carried out by our engineers, who are not familiar with TRIZ

Analysis of the problem

Administrative contradiction (AC): anti-B
Missed part profit of the partner.
Bad parameter "**anti-B**" – **missed part** of the profit.

Technical contradiction (TC): anti-B – A
TC: **Simple** (**A**) project and **missed part** of the profit (**anti-B**).

Ideal final result (IFR): A – B
IFR: **Simple** (**A**) project and **full** profit of the partner (**B**).

Physical contradiction (PC): P → A; anti-P→ B
PC: To implement **simple** (**A**) project the customer should provide the ***simple technical task*** (**P**) but to get **full project** (**B**) The customer should provide ***complex technical task*** (**anti-P**).
Physical contradiction 1 (PC_1): P_1 → p; анти-P_1→ анти-P
PC_1: To implement ***simple technical task*** (**P**), the customer can have ***small budget*** (**P_1**), but to implement ***complex technical task*** (**anti-P**) the customer should have ***lager budget*** (**anti-P_1**).

Solution

Resolution: P │ anti-P

Resolution of conflicting properties:

in time

- Use the OPEX model.
- Partner delivers a complete solution but makes payment for some specific period of time or complete solution is delivered at workable parts that extend the functionality

in space

- To reduce technical task with the same budget

by condition

- To combine multiple projects into one with reduced costs of the partner.
- The larger is volume, the bigger discount you can get for the product.

in structure

- The structure of technical task is modular.
- Each module can be done separately.
- One module complements the other

We used the solution combined in time and by hypothesis, at the same time fulfilling the partner's wish and our sales.

Problem 3. IT security

Problem statement

IT security project.
The customer wants to receive IT security solution (ITS) from external and internal threats during the event in 2017.
To implement the project the customer must mount the equipment at his site.
The supplier is a telecommunication company that wants to sponsor the customer in IT security for 2016, and as part of sponsorship the supplier wants to mount the equipment at his site to provide ITS services to its customers (the company of large business).
The dilemma is that the equipment should be located at the same time on two different sites – both at the customer's and at the supplier's locations with unchanged budget.

Analysis of the problem

Administrative contradiction (AC): A
When mounting IT security equipment at the site of the supplier the customer is not protected from external and internal threats.
Good parameter "**A**" **– small** profit. **Protection of the customer and supplier (full protection)** against external and internal threats.

Technical contradiction (TC): A – anti-B
TC: To protect both **the customer and the supplier** (**full protection**) from external and internal threats (**A**) you should mount equipment at the site of the supplier and the customer which **increases the cost of equipment** (**anti-B**), the budget deteriorates. **A - full protection. Anti-B – price (budget)**

Ideal final result (IFR): A – B
IFR: Full protection (**A**) with **unchanged budget** (**B**).

Physical contradiction (PC): P → A; anti-P→ B
PC: ***The additional budget*** (**P**) is necessary to get **full protection** (**A**) of the supplier and the customer, and **the additional budget is not necessary** to leave it **unchanged** (**B**).

Solution

<u>Resolution</u>: P│anti-P

Resolution of conflicting properties:
in time

- The customer spends its budget for the part of the ITS (e.g., for protection from internal threats) in 2017 and mounts this solution at his site; the supplier plans the budget for 2018 and offers protection from external threats to the customer and uses the same solution to provide ITS services to its other customers (i.e. IT equipment is located at two sites, but is separated in time).

in space

- The supplier uses cloud technology to protect himself and the customer. One set of equipment

by condition

- The supplier buys solution consisting of two hardware platforms. One platform is mounted at the supplier's, another – at the customer's location (reliability of the solution is suffering a little).

in structure

- See in space.

4. Conclusion

This article shows the author's experience in using one of the TRIZ tools in solving business problems.

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