

40 principles as a problem finder

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1. Introduction

For a problem solving, TRIZ is the very useful tool. It began from 1946 by G.S. Altshuller in Russia. In early stage, it used for technical problems, but expand the using areas to economy, politics, software etc.

It is not rare that one tool is using for many areas. Brain Storming by Alex Osborne and Mind Map by Tony Buzan are using in many areas from education to technical problems. How they are able to use for many areas? It's up to simplicity of that method. They are very simple and easy to learn. So many people easily used it for their problems. But if method is becoming complex, it is hard to apply to other areas. For example, FEA(finite element analysis) can't apply to political or social problems because it designed for specialized complex engineering problems.

Most people already know that TRIZ is not easy and simple methodology. Even though how TRIZ can apply to such a many areas? That's why TRIZ knows the primary source of problems. Thousands of problem solving methods are already made. But only three methods are reaching at the real origin of problems. 'The Art of War'¹⁾ by Sontsu, 'Right 8 way'²⁾ by Holly Budda and 'TRIZ'. 'The Art of War' is used for war problems, but nowadays it used for marketing, politics, business etc. 'Right 8 way' is used for religion, but it is using for medical, psychological problems in Korea. They are different to TRIZ because they have different process and method. But they are similar to TRIZ because they are reaching at the real origin of the problems.

TRIZ is just the problem solving method? During study of TRIZ I realize more than that. Most people use TRIZ for problem solving. But if we use TRIZ in other way, not only for problem solving but for problem finding though it doesn't happen.

2. Level of problem solving

Is problem solving the best strategy? The strategies of problem solving are classified into 4 types. 'Elimination', 'Transfer', 'Solving' and 'Evasion'.³⁾ 'Elimination' means deletion of problem itself, so we don't need to solve it. 'Transfer' means changing the problem from hard to easy or from given to remake. Sometimes solve the remaking problems are more efficient than solve the given problems. 'Solving' means to solve the given problems. 'Evasion' means run away from given problems. 'Let it be' is the keyword of this strategy. There are no royal rules that which strategy is always right. All of these strategies depend on problem types and situation.

But one thing is clear, if we find the problem in advance we can prevent or delete the problems.

In ancient China, there was a famous doctor. His name is 'Hwata'. Legend is still that he cured all of patients except one who never believe him. He got two brothers. They were also doctor. His first brother cures semi-illness. What is semi-illness? That is early warning system of human body for health. Do you think that people get a cold suddenly? It never happens. There may be a lot of early warnings before cold. Such as little headache, feel tired, a slight fever and so on. If you feel like that, you must get a rest, sufficient meal, and deep sleep. Doing that your body returns to healthy state from semi-illness. But if you ignore these informs you going to be real-illness from semi-illness. His first brother cures these kinds of patients. So his name was not famous because most people thought they never got a disease. Why semi-illness comes to people? They are up to behavior of peoples. Greed, Overeat, heavy drink, over sex, insufficient sleep, constipation, diarrhea make people weak. So if you prevent doing these things you never get disease. This calls potential-illness. His second brother cures potential-illness of peoples. Therefore in his village, no patients were there. And peoples never thought he is a doctor. It is not important that story is real or fiction. It defines what is the problem solving. Hwata solved problem, his first brother prevent the problem, second brother delete the root cause of problem. Who is real great doctor? I prefer his second brother.

Problem solving is important. But prevention is more. And elimination is most. Because problem happened once, we have to spend lot of times and materials to solve it.

The problem finding can be possible in advance? If can, what kind of work is defined as a problem? Answer is 40 inventive principles.⁴⁾

3. 40 Inventive principles and problem finding rules

40 Inventive principles are using for solving a technical contradiction as initial stage of the TRIZ. And it still using for many technical problem solving. There are 40 kinds of principles for problem solving. For example, inventive principle 1 'Segmentation' divides the present

situation for problem solving. And Inventive principle 4 'Asymmetry' breaks the balance of the present situation for problem solving.

If we change the viewpoint of these principles, we are able to get the rules of problems finding. Inventive principle 1 'Segmentation' solves the problems by divide. Therefore if something is not divided, that means that is problem. For example, you have one million dollars in cash. It's not safe that money holding in your room. So you deposit all of that in one Bank. Is that a problem or not? It is problem by inventive principle 1. What happened on bankruptcy? You never get nickels from that Bank. So most of rich peoples divide their wealth such as financial budget(ex. Bond, Stock), gold, real estate. Is that a problem or not if you have one job? It is also a problem. If you fired or your company is bankrupted how can you get the money?



Figure 1. Glass bottles



Figure 2. PET bottles

Let we think about inventive principle 15 'Dynamics'. It solves the problem to give them a flexible property. If it is like that, no flexible thing means problem. Look at figure 1. They are glass bottles. Are they problems or not? As you know, Glass bottles are hard and fragile. If you drop one, it breaks into pieces. Look at figure 2. PET bottles are very flexible. Even falling on rocks, it never brakes. So glass bottle is defined as a problem by inventive principle 15

Let we think about inventive principle 29 'Pneumatics and hydraulics'. Figure 3 is normal furnace. It made by steel outside, and refractory bricks inside. The inside temperature of furnace is very high, sometimes higher than 1,200 °C. No steel can resists on that high temperature. So engineer uses refractory bricks inside made by clay or ceramics. Even using refractory bricks, corrosion and contamination of bricks are happened by high temperature. So they have to change it regularly. If we increase the temperature of furnace, it comes to more thermal efficient. But even refractory bricks, it can't resist more than 1,500 °C. Figure 4 is a newly developed furnace. As you can see, the temperature of furnace is reach at 2,000°C. And there are no bricks

inside. Instead, it uses incoming air as a thermal insulation bricks. Incoming airs are changed into tornado on the side of furnace. It prevents the overheating of furnace wall. And heated incoming airs are increasing the combustion temperatures of furnace. And level of the NO_x is lower than 20ppm. It is the same level as low temperature furnace. So new furnace satisfied the rules of inventive principle 29.



Figure 3. Normal Furnace

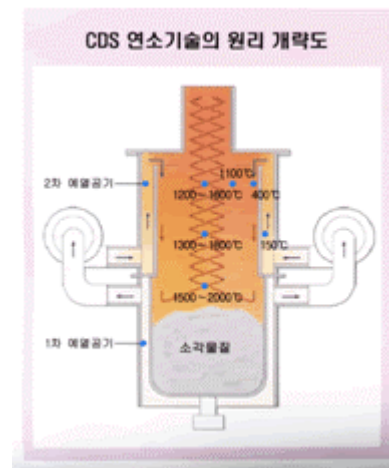


Figure 4. New concept furnace

Like this way we can get the problem finding rules by using the 40 inventive principles. All of rules are summarized in Table 1. Some principles are overlaped, so there are 15 rules for problem finding not 40.

Inventive principle 1. 'Segmentation', 2. 'Taking out', and 3. 'Local quality' are divide the problem for solving. That means undivided things are problem.

Inventive principle 5. 'Merging' and 6. 'Universality' are concentrate the problem for solving. That means segmented things are problem.

Inventive principle 7. 'Nested doll', 17. 'Another dimension', 9. 'Preliminary anti-action', 10. 'Preliminary action' 11. 'Beforehand cushioning' are find the resources(ex. Time, Space, Field) for problem solving. . That means lack of resource is the problem.

The inventive principle 40 is reducing the weight and increasing the strength by using composite materials. So heavy, weak strength are defined as a problem.

Like this way, low efficiency, strict or static, insufficient feedback, insufficient control, insufficient measurement, difference, insufficient strength, harmful, hard to direct handling, different condition, balance and unbalance are rules for problem find.

40 Principles	Method for problem solving	Rule for problem find
1,2,3	Dividing	Undivided
5,6	Undivided	Dividing
7,17,9,10,11	Find Resource	Lack of resource
16,21,27,34,18,27,28, 29,34,35,36,37,38,39	Increase efficiency	Low efficiency
15,29,30,31	Dynamic or flexible	Strict or static
23	Increase feed back	Insufficient feedback
23,25	Increase control	Insufficient control
26,32	Increase measurement	Insufficient measurement
33	Homogeneity	Difference
14,15,29,30,31,40	Increase strength	Insufficient strength
21,22	Remove harmful	Harmful
24,26	Indirect handling	Direct handling
12,13,19,20	Change condition	Different condition
4,8	Asymmetry, Symmetry	Balance, Unbalance
1,8,25,28,29,30,31,40	Decrease weight	Heavy weight

Table 1. 40 principle and rule for problem finding

Low efficiency means present efficiency is low than 100%. If you have a gas cooker please check the label of that. Maybe thermal efficiency of gas cooker is lower than 50%. So we can define that is the problem.

Strict or static means something is strict or static. Remember the glass bottle.

Insufficient feedback means lack of feedback. Compare the cannon ball and missile. Compare the success company and failed company.

Insufficient control means lack of control. Imagine the no steering wheel car.

Insufficient measurement means lack of measuring. Think that you are walking in the dark without lamp. If you can't measure, you can't feedback and control. So that calls problem too.

Difference means different between things. What is the reason for the race problem and War of Religion.

Insufficient strength means weakness. Please search the web what's happening in Tacoma bridge, Mihama nuclear plant, DH Commet the first commercial jet plane. Many problems occurred by weakness.

Harmful doesn't need explain. Environmental pollution, noise, waste, disease, crime are

harmful problems.

Hard to direct handling means you want to do directly but can't. Imagine that you are holding the hot kettle without tools.

Different condition is error of problem choosing. You got the right answer of wrong problem.

Balance and unbalance means current status is balanced or unbalanced. Sometimes balanced thing make problem, but in any situation unbalanced thing make problem too.

If you use 40 principles like this way, you can find the many problems in advance. It makes you more powerful in problem solving.

4. Conclusion

TRIZ is most developed and rational method for problem solving. TRIZ will evolve continuously. And the way of evolving is not only for problem solving but also for problem finding. If we find the problems before a thing takes place, we can prevent or delete it. Therefore we can save lot of money and time for problem solving.

So we have to developing the TRIZ theory for problem finding not just problem solving. 40 inventive principles can apply to finding because it deals the source of problem. And the other method of TRIZ, such as Effects, 76 Standards, System Operator, also can apply to the problem finding. So we have to study more the TRIZ for problem finding.

Reference:

- 1) Sontsu, "Art of war", Taeul 2001
- 2) Chung Heo, "Buddhist scriptures Agama", Tree of wisdom 2004.
- 3) Ikcheol Kim, "On problem", KTA 2002
- 4) Ellen Domb, "40 Inventive Principles With Examples", TRIZ Journal, 1997.7
- 5) Todd Williams, "Reversability of the 40 Principles of Problem Solving", TRIZ Journal, 1998.5
- 6) John Terninko, "40 Inventive Principles with Social Examples", TRIZ Journal, 2001.6
- 7) G. Altshuller, "The Innovation Algorithm", Hyunsil and mirae 2002.