

Framework for solving Global problems-A case study using TRIZ

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Introduction

TRIZ was originally derived from the analysis of patents related to technical problems and therefore early applications were associated with engineering problems. Over the years, the TRIZ Inventive Principles have been modified to solve Business and Social Problems. The aim of this paper is to recognize today's most important global problems, the framework needed to solve these problems and how TRIZ principles can be applied to actually solve these issues.

Today's global Problems

Following are some of the major issues faced by humanity today:

- **Environmental problems:**

Pollution (Ozone layer hole, Greenhouse effect, Global warming and Thermal Pollution, Pesticides, Arsenic contamination, Acid rain, Sound, water, air & Chemical Pollution),
Natural disasters (earthquake, flood etc.) etc.

- **Social and Economic problems:**

Population Explosion, Poverty, unemployment, unfair economic (monopoly and unfair competition) sexual (women issues, Flesh Trading etc.) and racial differences, war, Terrorism, Corruption, Law & Order problem, Low Conviction Rate, Child labor, illiteracy etc.

- **Health problems:**

AIDS, Cancer, Heart & Brain Disorders, Smoking, Obesity, alcoholism, SAD etc.

Framework needed for solving these issues

Governmental, Corporate social responsibility groups and thousands of NGOs are working on these problems. Billions have been spent and is being allocated for future use in tackling these problems. But the problem solving approaches to these issues may not be the best way to proceed. This is because of the fact that these problems are the result of the natural contradictions present in our social, economic and political systems and primarily we have tried to solve these by compromising on contradicting factors of interest. In short the solutions we have suggested are not innovative enough to account for the conflicting interests.

TRIZ is a methodology which helps us to create innovative solutions by eliminating contradictions and maximizing the utilization of resources already present in the system. Hence, the application of TRIZ in solving these global problems has immense possibilities. In this paper we will try to showcase the application of TRIZ principles to solve one of these problems.

Before we proceed to actually solving these problems let's first propose the framework needed to solve these issues. We will account for all the inherent features present in any complex system and try to incorporate those in our practical solutions.

- Think win-win. If somebody has to suffer on a permanent basis, the solution is not going to work. For example, if we stop using plastic bags without giving other options to plastic traders they will not allow us to do it. So we should try to create better alternatives to plastic bags (maybe biodegradable plastics) rather than making protest demonstrations to stop plastic usage.
- It should be a SMART (Specific, Measurable, Achievable, Realistic, Time-Bound) solution. The accounting should be on an actual financial results basis (only the actual results that we are achieving) and not on a projected basis. This is important because using the present accounting system we sometimes don't consider the actual figures and showcase the brightest picture. We should be honest in accounting our progress.
- It should be a capitalistic solution (not an impractical socialist solution). People working with the solution should have a tangible gain from it (expect no charity out of it). I believe it to be the most stable and honorable way of working.
- It should be a worst condition design (golden rule for Engineering Design).
- It should be market-driven decentralized solution. The framework should be such that there is no scope of hypocrisy and corruption.
- The framework should be based on Negative Feedback Control System. This is the most natural way for checks & balances in a system.
- Unfortunately, we cannot neglect the effect of chaos from the system. So our design must account for it.
- We should plan for a sustainable end result. For example, in pollution problems we should not only look to minimize the pollution because this is not a sustainable solution. Our aim will be to have a pollution-free world and we will try to figure out how we can attain that status on a sustainable basis. For achieving that we have to figure out some ways to reverse the effects of pollution rather than trying to minimizing it.

Using TRIZ to solve a serious global problem: Environmental Pollution

Environmental Pollution is a serious problem faced by the world today. Unplanned excessive use of natural resources like carbon based fuels, deforestation, imbalances in ecosystem, and extreme industrial pollution are considered to be the prime causes of environmental pollution besides the natural sources of pollution (natural radioactivity in mines, greenhouse gases in hot water streams etc.). We have already faced grave concerns of global warming, ozone depletion, sea level increase and other major catastrophic trends in global weather change.

Let us use some TRIZ tools to model plausible solutions for these diverse problems. We will discuss the application of some of the main philosophies of TRIZ and some of the Innovative Principles offered by TRIZ.

Ideal Final Result (IFR)

The Ideal Final Result should be a sustainable pollution free world where we will have normal flow of resource cycles (carbon cycle etc.) and processes. The global macro parameters should have an acceptable steady state values (like steady world temperature, ecological balances etc.).

Proper usage of available resources

This has to be achieved with the proper utilization of resources already present in the system.

No external elements should be entered into the system to solve this.

For example, phytoplankton present in the sea water can be used as a wonderful resource for curbing greenhouse gases, UV rays and acid rain and at the same time forming useful clouds for proper rain.

Two research scientists (Georgia Tech's School of Earth and Atmospheric Sciences and NASA) suggested this wonderful way of solving environmental problem.

When dust storms pass over industrialized areas, they pick up sulfur dioxide, an acidic trace gas emitted from industrial facilities and power plants. As the dust storms move out over the ocean, the sulfur dioxide they carry lowers the pH (a measure of acidity and alkalinity) level of dust and transforms iron into a soluble form. This conversion is important because dissolved iron is a necessary micronutrient for phytoplankton - tiny aquatic plants that serve as food for fish and other marine organisms, and also reduce carbon dioxide levels in Earth's atmosphere via photosynthesis. Phytoplanktons carry out almost half of the Earth's photosynthesis even though they represent less than 1 percent of the planet's biomass. Another recent study funded by NASA's Earth Science Department shows that the tiny sea plants release high quantities of cloud-forming compounds on days when the sun's harmful ultraviolet rays are especially strong. The compounds evaporate into the air through a series of chemical processes that result in especially reflective clouds. This, in turn, prevents the radiation from effecting the phytoplankton.

These two examples emphasize how present resources within the system can solve age old problems.^{1, 2, 3}

Use of Established Innovative methods

Another philosophy of TRIZ is to reuse the already established innovative solutions and customize them according to the needs.

We will use some of the established TRIZ innovative solutions to solve different environmental pollution problem.

Creating new kind of industries

Waste management, reusing waste resources, renewable energy power sources, and carbon accounting⁴ are the new age industries. The following TRIZ principles can be shown to be use in this case: Principle 13. 'The other way round', Principle 22. "Blessing in disguise" or "Turn Lemons into Lemonade", Principle 23. 'Feedback'.

These will help to reverse the adverse effects of environmental pollution on a sustainable basis.

Waste management is going to become a major industry tomorrow. The separation of hazardous material (Principle 1. 'Segmentation'), reusing them for future products (Principle 2. 'Taking out') is coming in a big way. Electronic waste(www.ecycle.org) and nuclear radioactive waste management is becoming new business for future.

Environment management organizations are working on tree plantation, irrigation, terracing, and soil and water conservation (Principle 9. 'Preliminary anti-action'). These programs are for poor unemployed people who work for food. Primarily they are backed by World Food Program of United Nations (www.wfp.org).

Electronic society for less paper and energy use

Telecommunication is helping us minimize commuting. Working from home and virtual telephonic meetings are becoming common practices in the industry. People go to the workplace if and only if some physical activity is needed by them in the workplace. In this way a lot of fuel and energy resources can be saved. TRIZ Principle 28. 'Substitution for mechanical means' and Principle 2. 'Taking out' can be applied in this case.

Paper books are made from trees. A lot of 'green world' is being sacrificed for the 'literary world'. We can instead use electronic books (Principle 27. Use cheap Replacement Events) for our educational purpose.

Genetic Engineering

Genetic Engineering has immense potential in improving agricultural productivity. Most of the funding related to biological research is invested in this field due to its business opportunity. Genetic Engineering can be considered to be an application of TRIZ Principle 40. 'Composite materials' and Principle 35. 'Parameter changes'.

At the same time we should be very careful before using genetically modified foods. Risk mitigation of genetically modified foods by extensive testing is necessary (Principle 9. 'Preliminary anti-action').

Nanotechnology: Making new smart systems

Nanotechnology is a modern material science technology where smart systems are made by manipulating materials at the nano level. TRIZ principle 7. "Nested doll" can be used in this case. Using nano materials we can create very small but useful objects and thus minimize energy use.

Conclusion

One important thing to notice here is that many of the proposed solutions can potentially be reached by TRIZ analysis. The effectiveness of TRIZ analysis is that we reach to the solution much faster because of the systematic innovation methods rather than the trial-and-error method. We believe the proper implementation of these proposed solutions can be extremely effective in solving the pollution problem.

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