

## TRIZ for the small planet of Earth

### The best component for the best tank

T-34. This symbol is a synonym for the best tank of the Second World War. And now attention, please. The question is which, in your opinion, is the best component of the tank? The most impenetrable, insubmersible, unbreakable, incombustible, and inexpensive?

We have asked this question many times in auditoria of businessmen, teachers, engineers - and received a variety of answers such as a muzzle, armour, caterpillars and even... a tanker! And here is the answer the design engineer of the legendary tank, the engineering genius and inventor Koshkin himself gave to this question, "The best component of the tank is the one which is absent!" That's true! It's a sure thing that it will never break or burn down.

The simpler the more reliable. However, it isn't at all that easy to make the complex simple. Here is a textbook example – history of the 'Russian light'. In the second half of the 19<sup>th</sup> century, streets of European capitals were illuminated by arc lamps – the so-called "Russian light". The principle components of the lamp are two rods between which a bright glow – an arc – occurs upon applying a voltage. (Fig.) The question is what should be done to maintain the same distance between the carbons irrespective of the burn-out of the rod ends? Generations of engineers spared no efforts to solve this problem. A clock-operated device was invented. It brought the rods together as soon as they burnt out. Gear wheels, springs, rockers, a driving mechanism ... All those components needed adjustment, lubrication and repair.

The "Russian light" turned out to be an expensive pleasure. How could it be made reliable and less expensive? The bottleneck is the clock device. But we already know that the best mechanism is the one which is absent. Let us fantasize a little – let carbons adjust the distance between each other themselves, without any clock device... Is it the delirium of deformed imagination?

No, it is a 'lawful' method of strong inventive thinking. This is how engineer Yablochkov solved the problem. He just arranged the carbons in parallel. Now the distance between them is always the same and no complicated mechanism is needed. The solution is simple as all works of

genius. What looked as delirium at first sight turned out to be the Ideal Final Result of the inventive problem.

The ideal final result is the notion of the modern theory of inventive problem solving – TRIZ. And the “Russian light” problem is one of thousands of training problems used to perfect inventive thinking. Those who received good TRIZ education logically come to bright ideas, which initially only fell to the share of “exclusive” geniuses.

### **Short history**

Could have mankind “missed the telephone”? Could have the telephone remained uninvented”? Unlikely. After experiments by Page and Race<sup>1</sup> and taking into account the great interest in electricity and objective necessity in sound transfer over a distance, the birth of the telephone was unavoidable. This is confirmed by the fact that patent applications for the telephone were filed by several independent inventors within a year. The same refers to the invention of the radio and television. And what about invention methods?

Just look. Here is the Memford chart<sup>2</sup> which reflects the growth of the number of significant inventions with time. The deviations from the curve are ascribed to political and economic events, wars..

This chart is an exponential curve. The number of inventions is growing like a snowball, more and more people are getting involved in the invention of the new. Is it enough for giving a thought to how inventions are “produced”? What “mental moves” are made by an inventor? What help does he need?

In the middle of the 40s of the 20th century, various methods started to spring up like mushrooms. The United States turned out to be the “smartest “ in this respect, Western Europe followed them. Brain storming, the method of test questions, morphological analysis, synectics – each of these methods proposed new approaches to the invention activities. But they also had one feature in common - all of them were based on psychology and logic and no one of them pretended to being a scientific theory.

Meantime, a young army engineer and inventor from his school-days Genrih Altshuller was studying the patent collection. He was anxious to understand what strong, beautiful and surprising inventions had in common.

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<sup>1</sup> Because the names were retranslated from Russian, spelling mistakes are possible.

<sup>2</sup> Moles, A. "*Sociodynamics of Culture*". – M: Progress, 1977.

It was just at that time that the notion of the Ideal Final Result emerged. Then, long after, Altshuller understood that it was necessary to reveal and use technology development laws in addition to psychological peculiarities and thinking methods. This is how TRIZ was born.

Was it easy at that time to organize a wide movement in the Soviet Union in the absence of support of the Party and State? “The absence of support” is a very mild evaluation of the situation. A six-year prison sentence but thankfully not a death sentence... Slashing criticism in “Komsomolskaya Pravda” but thankfully not a repeated prison sentence.

However, the movement emerged and stretched the wings – public TRIZ schools were functioning practically in all big cities of the Soviet Union and this means that thousands of people attended seminars conducted by Altshuller or his disciples, tens of books and articles were published, and thousands of technical problems were solved.

At present, TRIZ specialists consult famous companies in the United States, Canada, Western Europe and lecture at the world’s leading universities. You will find Ford and General Motors, Caterpillar and Procter and Gamble, Samsung and Gillette, Kodak and Xerox on the list of their clients.

The movement was a success because it met the objective requirements of the market. And also because Genrih Altshuller was not an “armchair inventor” but a practitioner in a broad sense. He managed to solve the problems of the theory survival in a “hostile environment”, and those were not technical, but social problems.

### **No technical problems any more?**

The planet has become small... Scandinavians protest against the smoke issued from the chimneys of Norilsk Concentrating Mill. Industrial discharge into the water of Danube on the Czechoslovak territory will be a heavy blow to the health of Yugoslavs. The terrorist attack of September, 11 in the United States set armies of many countries in motion. The problems of the Russian oil company “Yukos” excited a keen interest not only in businessmen but also in politicians and military strategists. Everything is interconnected in the present world – technology, medicine, politics, ideology, culture... Just as in a watchwork – touching one of the wheels sets in motion all the other wheels.

All the problems of the modern world are complexes, chains, and knots of contradictions. Imagine that you are an inventor who managed to invent an unburnable bulb having a 100-year service life. Great, isn’t it?

And here is the question. Would it be easy to introduce this invention into practice? Have you thought about those specialists who work at research institutes on improving the bulb efficiency by 5 –10%, write thesis, get money for their work? What kind of report will these specialists write about this invention if they are invited to be experts? Have you ever thought about the number of ‘worldweight’ firms (such as Caterpillar, Philips and the like) to which you shot in the eye? About mounds of useless equipment and thousands of workers who will land on the street level?

This is not official information, but according to some sources, such a bulb has already been invented. Now you understand that we will hardly see it in the near future.

Nowadays, any serious technical invention entails social consequences and, as a result, social problems. Economics, ecology, and defense from terrorism – all these spheres of human activities require solving complexes of inseparable technical and social problems.

### **Complex problems**

Truly, complex problems have always existed. The larger the problem scale, the more aspects are entwined in it. One and the same problems may be understood as technical or biological, military or even advertising. It is not difficult to find examples of such problems in history.

Year 1427. Vietnam. Revolt headed by Le Loi against Chinese invaders. Le Loi advisers understood that in addition to purely military preparation, they needed a Miracle, some predictive sign to encourage peasants in this revolt...

For lack of a real Miracle, they had to create it themselves. They had a prophecy ‘Le Loi will become a king!’ written on a large number of tree leaves. Several hieroglyphs were enough to express that thought. They, however, were written not with China ink, but with... hog-grease. Ants ate the greasy portions of the leaves and the inscription turned out to be incised on the leaves which were disseminated all the country round by wind.

As it was planned, the Vietnamese took the leaves as a predictive sign and started fighting against the invaders with renewed energy... In 1429, Vietnam was liberated<sup>3</sup>.

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<sup>3</sup> From the book by Harro von Senger “*About the Chinese Art to Live and Survive. Famous 36 Stratagems of the Last Three Centuries*”. – M: Progress, Culture, 1995, p. 107.

In the modern world, practically all problems become complex. This is neither good nor bad, it is a fact. Even if a problem can be more or less correctly characterized as technical or scientific, its practical application will require solving problems connected at least with business or management. The inability to solve “post-technical” or “post-scientific” problems nullifies all previous achievements.

The fundamental principles of logistics were formed by the beginning of the seventies<sup>4</sup>. Enterprises started putting them into practice but were immediately confronted by the resistance of middle and even upper managers. Having got used to perform traditional functions of purchasing, carrying, processing, etc., they prevented introduction of new management patterns. The final purpose of the proposed changes was reduction of total expenses. In such a situation, the independence of each individual echelon would be inevitably reduced and no employee wanted to be a cog in a machine<sup>5</sup>.

And vice versa – a well-solved social problem can render a significant assistance to technological advance. A textbook example is the US Law on welded vacuum tubes which incited radio industry to reject bulky devices on electronic tubes and transfer to miniature tubes and transistors.

From the TRIZ standpoint, social and technical problems have much in common as regards their solving. Social problems also have the Ideal Final Result when the problem source ITSELF, using its own efforts solves the problem. For example, there exists an ecological problem – an industrial enterprise spews out its waste products into the river neglecting to provide their effective treatment. To fine such an enterprise, it would be necessary to organize permanent control and a cat-and-mouse game would start. Another way out is to force the enterprise to take water for its needs below the point of polluted water discharge so that this enterprise itself would have to take the polluted water for its needs. Certainly, there are other methods to solve the problem...

One of possible versions was tested in America. The method is simple. Every year, enterprises have to account for discharge of waste products, for example, a factory has discharged so many tons of CO, so many tons of SO, so many tons of freons, etc. Just imagine, what a factory manager feels when signing such a report and sending it to his

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<sup>4</sup> The Soviet Union is meant.

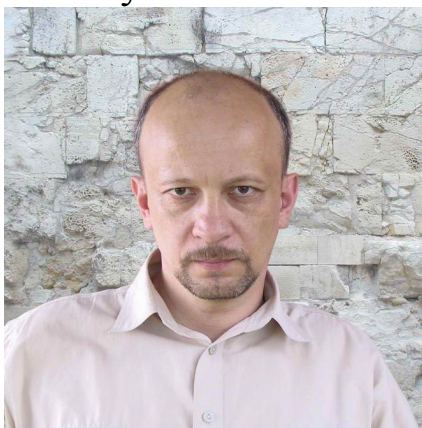
<sup>5</sup> The data are taken from the article by Leonid Borisovich Mirotin, Chairman of the All-Russia Coordination Council on Logistics, site: naukaizn\nauka.relis.ru\01\0007\01007070.

head, especially if this information is going to be published in mass media. Willy-nilly, he will read it again, be horrified and promise to lower these comfortless figures by the next year. Anyhow, such industrial giants as Monsanto and Dupon have publicly announced about their decision to do this<sup>6</sup>.

As distinct from physical and chemical effects used to solve technical problems, the social sphere will need social and psychological effects. Thinking properties, ideological peculiarities, view of life instead of material properties; legislation, mass media influence, organizational structures instead of technical tools.

TRIZ is a young science. It is too early to affirm that this theory has reached the adulthood in its classical form – as a technological discipline. However, it is clear that humankind is much more efficient in technology than in the social sphere. It was easier to launch a satellite to Saturn than to come to an agreement with “planetmates” on peaceful coexistence. This is why it is so important to develop the invention theory and practice in the social sphere. It may become one of the important steps towards the salvation of our small planet.

Anatoly Guin



Sergey Faer



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<sup>6</sup> “Khimia I Zhizn” (Chemistry and Life) Magazine, 1992, No.11.