Utilization of Instruments of Directed Evolution® for Bridging Results of Short and Long Term Forecasting

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Abstract

Methods of traditional technological forecasting (like extrapolation of trends, Delhi method or other methods based on building probabilistic models of evolution of systems’ parameters) typically produce satisfactory short term results. However, traditional forecasting does not provide technical details on how these results can be achieved. At the same time, reliability of forecasting seriously depends on its feasibility, which can seriously affect the realization of the predicted changes. Utilization of patterns of evolution for inventing new generations of products, technologies, processes, businesses, etc. (TRIZ forecasting) produces reliable alternatives for long term prediction, however, incremental changes may be or may not be compatible with changes ensuring effective growth in the long term. In the worst case scenario, local and short term improvement can turn into its opposite later.

Directed Evolution is an extension of TRIZ Forecasting, targeting management of the future of various systems, instead of predicting it. At the same time, different zones of evolution (short, middle and long term) provide a different space for intervention, and therefore, management of evolution. The proposed paper is going to emphasize the importance of middle term zone (the nearest crisis point) and will suggest recommendations for bridging short and long term predictions, ensuring smooth long term growth of the given system.

Introduction

Roots of classical scientific forecasting go back to the 19th century. At that point, it was obvious that to make a good prediction, one should analyze existing trends and extrapolate them into the future. One such prediction involved the estimation of the growth of London’s population, the growing need of horses for people’s transportation, the amount of manure produced by horses, the capacities of cleaning equipment, the expected income and other taxes, the cost of community services, etc. Based on all of the above, confident predictions were made concluding that by the middle of the 20th century, London would be buried under a layer of horse manure three meters high.

Everything had been taken into consideration, however, nobody could expect that by the middle of the 20th century a horse in a city street would become a rare event, and that a future problem would be smoke produced by automobiles. Interestingly, at the time of this forecast, quite an extensive grid of rail roads, trams and subways already existed; even first automobiles were driven to their first testing grounds…
Practically similar predictions (with similar “success”) but much more sophisticated in terms of utilized math became a serious business in the 1950-1960s when scientists encouraged by successes in cybernetics, theory of operations and information theory, started working for industrial companies. Their predictions were based on enormous statistical data and mathematical equations analyzed with the help of powerful computers. The main objective of these efforts was to predict certain changes in certain technological parameters of certain systems without giving too much thought on how these changes could be realized technically [1, 2]. While originating great hopes in the beginning, with time, traditional technological forecasting presented serious flaws inherent to the nature of the applied techniques. For example, extrapolation of existing trends into the future ignored the non-linear nature of systems’ evolution (typical S-curve) in the long run; practically all suggested techniques couldn’t address disruptive technologies and paradigm shifts.

In any event, a successful prediction of the system’s (or system’s parameter) future should answer the following questions:

1. What (is going to happen)?
2. When?
3. How?

Traditional technological forecasting excluded question number 3 (How?) from consideration to avoid being influenced by existing technological means and to keep an open mind. In the first two issues, an educated guess should suffice. Unfortunately, in many cases a guess even with 99% probability is not good enough because the remaining 1% can still happen, negating all previous efforts.

Since the mid-1970s, an entirely new approach called TRIZ Forecasting has been in development. TRIZ forecasting is based on the utilization of pre-determined patterns of technological evolution [3, 4]. Unlike traditional technological forecasting, TRIZ Forecasting (as guided by Patterns of Evolution) offered valid directions (definite “What?”) together with proven standard ways of how they can be realized (definite “How?”). The only issue that was left unanswered was “When?”

To address the remaining issue, the Directed Evolution technology was introduced in the early 1990s. The main feature of Directed Evolution (DE) is its pro-active approach to the evolution of technology. Instead of making a prediction and waiting for it to be confirmed, the DE process uses numerous patterns of evolution for the purpose of identifying possible scenarios, analyzing them, selecting the most promising ones, and then planning and actually performing the process of implementation [5, 6, 7]. While technological forecasting is trying to correctly guess a certain inevitable future via extrapolating past and present into the future, or considering the future as a set of repeating cycles, DE is based on the invention of a desired and feasible future. In other
words, instead of predicting an inevitable future, DE shows ways (often a number of alternatives) in which it can be achieved if certain serious efforts are undertaken.

During the last decade, the authors have been involved in numerous DE projects for systems of various size and type (from large chemical production to rather simple consumer products). Our experience has revealed the following:

- Methods of traditional forecasting typically produce good short term results
- TRIZ forecasting produces valid alternatives for long term prediction

At the same time, possible incremental changes typical for short term forecast may or may not be compatible with changes ensuring effective growth in the long term. In the worst case scenario, local and short term improvements can turn into its opposite later and vice versa. Given the above, the following contradictions seriously impacting the forecasting results have been identified:

- Between local (system) and global (super-system level) results of evolution
- Between short and long term evolution

Altshuller was probably the earliest researcher who found indications of the first contradiction associated with finding high level inventive solutions using Algorithm for Inventive Problem Solving (ARIZ) [8]. Today, there are plenty of examples of this contradiction especially in the evolution of complex systems involving technological, political, social and other aspects. In the given paper we are going to address the second contradiction (between short and long term evolution) in more detail.

Additional problems critically influencing the project output and its success are as follows:

- Lack of correct definition of real “zones of prediction”, that is clear distinction between short, mid and long term forecasting.
- Lack of appropriate distribution of efforts between various types of forecasting; for example, short, mid and long term forecasts require a different degree of detail and different instruments.
- Vague clients’ expectations are most often looking for some kind of “breakthrough” without a transparent definition of what the breakthrough actually is about and what they are going to do with it once they get it.

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1 For example, raising taxes can increase tax revenue at first. Later it causes businesses to move elsewhere reducing revenue. Welfare programs helped many people; however, in the long run it caused serious problems, like broken families and numerous teen pregnancies.

2 In 1980s, Altshuller used to say that while obtaining a solution of the highest Ideality, complexity is forced out from the given operational zone into a super-system. In other words, simplification of the system often means increasing complexity in its super-system.
We have partially considered some of the issues above in our previous publications [9]. In this paper, we would like to add more detail to the ones discussed earlier and address the remaining ones.

**Bridging the results of short, mid- and long term forecasting**

*Non-linear approach to systems’ evolution. Three zones of forecasting*

It is well known in technology [10] and in TRIZ [3] that the evolution of various systems can be illustrated with an S-curve. In the picture below, a typical S-curve suggests three distinguished zones – 1 (childhood), 2 (fast growth) and 3 (maturity). All three zones can be approximated with linear functions and thus are quite predictable; however, transition points between the zones (1-2) and (2-3) bring uncertainty (low predictability) to the system’s evolution, making the overall curve non-linear, with different degrees of predictability along it.

![S-curve and Predictability of Evolution](image)

*Fig. 1*

Another interpretation of non-linear evolution was presented in [8]:
Fig. 2

Similar to the S-curve mentioned earlier, in the picture above, one can see linear zones and non-linear transition points reflecting the fact that the evolution of real systems is associated with a mix of regular, deterministic, and highly predictable events along with events that are random, stochastic, haphazard, difficult-to-predict, etc. As in the case of the S-curve, linear zones represent evolution along highly predictable, logical and stable trajectories (recognizable trends) which end at points of uncertainty (bifurcation or branching points). These points are typically associated with certain crises in the given system evolution. A typical example could be the rise of Ford Motor Company and the disappearance of hundreds of small automotive companies between 1910 and 1920s. Typically, at bifurcation points, evolution can continue in different (alternative) directions and a rather small influence on the system can produce enormous (and often unexpected) results. Like a stone on a top of a hill, it is very hard to predict which way it will start rolling down (360 degrees of possibilities!), however, if one pushes the stone slightly to a certain side of the hill, it will go down exactly where we want it.

Bifurcation points impose fundamental limitations on the accuracy of prediction. Practically accurate forecasting is possible only within linear zones between bifurcation points. At the same time, bifurcation points make an effective control of system evolution incredibly possible with small enough efforts and money.

The most significant outcome of the analysis of the picture above was the possibility to make a clear definition of frequently utilized terms of forecasting (short, mid- and long term) as follows:
Short term – linear zone between past and future bifurcation points. Because of the zone’s linear nature, traditional technological forecasting techniques based on knowledge of experts in the given area, marketing analysis, etc. provide fairly reliable results enabling detailed planning.

Mid-term – zone next to the nearest crisis (bifurcation or branching) point or group of points, capable of substantially changing the course of further evolution. Here the probability of accurate forecasting is much lower, as the selection of the evolutionary direction can depend on many, often unknown, factors.

Long-term – zone located beyond the nearest bifurcation point. Although general evolutionary knowledge (patterns of evolution) is the best to provide long term general vision, specifics will strongly depend on the direction selected at the nearest bifurcation point (mid-term situation). At this point, new generations of the system can emerge which have little to do with the existing system and employ a different operating principle (e.g., laser pointer instead of a wooden stick), beget new and unexpected applications (lasers used in cosmetic procedures), and so on.

**Mid-term forecasting as a bridge between the results of short and long term forecasting**

During the Directed Evolution process we are “compressing” time quickly, exploring potential evolutionary options, from nearest to rather remote ones. As it was mentioned earlier, while there is a sufficient understanding of the logistics and instruments utilized during short and long term forecasting (traditional technological forecasting tools for short and TRIZ forecasting tools for long term), mid-term forecasting can be much more difficult because of multiple factors that can influence the output, especially the results of long term forecasting that can be one of the two variants described below:

1. Long term forecasting looks like a natural expansion of the short term one. It does not expect serious changes in market, utilized technologies and system parameters. This situation is more typical if the forecasting is made for the system in its maturity stage of evolution.

2. Long term forecasting looks critically different from the existing situation; for example expectations of sharp growth of demand and market, significant technology improvement, emergence of mass applications for the given product/technology, etc. This situation is typical for systems in their childhood years or in the beginning of the second stage on the evolutionary S-curve when the given system is about to face a crisis (bifurcation) point (or a number of points).

In the first case, before making final conclusions, one should carefully consider the possibility of at least one of the typical critical events occurring that can disrupt the smooth evolution, and make corrections accordingly:
- Product (or service) becomes a typical commodity; the demand is saturated, fierce competition squeezes out profit for all market players.
- Emergence of cultural shifts reducing demand in the given product, for example, health or ecological concerns, fashion considerations, etc.
- Emergence of disruptive technologies that can simply kill the existing product/technology.

In the second case, reliability of the forecasting will depend on our ability to take a proactive approach and start looking for (or better working on) the following specific conditions (factors) typical for a crisis point:
- Stable mass demand in certain product
- Technological feasibility to build this product in mass fashion.
- Financial and other conditions like availability of investments, social regulations, etc.³

Given the above, the main content of mid-term forecasting is to build the bridge between the results of short and long term forecasting making (see the picture below).

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³ In a certain sense, these conditions are similar to three typical conditions in criminal investigation that look for motive, opportunity and means.
At this point, one should make sure that all necessary and sufficient critical conditions required for smooth transition are thoroughly investigated and/or invented (created), in particular:

- Selection of preferable long term possibility for further evolution
- Identifying critical conditions that should take place to ensure this possibility can be realized.
- Formulation of specific tasks and problems that should be addressed to ensure transition from recent situation to the desirable future, in particular:
  - Building necessary evolutionary resources, including creation of intellectual property, financial foundation, customer base, qualified professionals, etc.
  - Preventing the possibility of an undesired course of events (mistakes, creation or competition, etc.).
- Solving problems and building innovative concepts related to technological, business, marketing, etc. aspects of transition.
- Formation of company strategy at pre-crisis, crisis and after crisis points, including:
  - Measures that will allow “arranging” the crisis at “right time and place” (delay or expedite, if necessary).
  - Measures for crisis management to ensure desired outcome
- Establish a system for monitoring the process of evolution and prompt correction in case of unexpected events (feedbacks, foolproof measures, etc.).

**General logistics of the forecasting and evolution management**

The following sequence of work can be suggested to maximize the results of forecasting:

**Stage 1 – Preliminary study**

Study the given system to identify the nature of its evolution so far. If the system’s recent evolution is linear, identify which portion of the S-curve it belongs to – childhood, fast growth or maturity; it will give one an understanding of the nature of the next bifurcation point (transition to mass production (1-2), search for long-term niche application, or selection of the new S-curve to continue growth (2-3).

**Stage 2 – Short term forecasting**

Conduct short-term forecasting for the given linear zone. At this point, it always makes sense to use real predictions already made and expectations expressed by subject matter experts (engineers, marketing and business people, management, etc.) in the given area. These predictions could be verified utilizing standard verification procedures, for example, Delphi method.
Stage 3 – Long term forecasting

As it was mentioned earlier, it is rather unrealistic to expect accurate predictions beyond the next bifurcation point, not mentioning more remote ones. At the same time, based on the analysis of evolutionary resources and the utilization of general patterns and lines of evolution, both for the given system and especially for its super-systems, including overall evolution of technology and society needs and expectations\(^4\), it is possible to build potential scenarios for further evolution that will serve as lighthouses for the ones maneuvering around the next bifurcation point to ensure continuity of short, mid- and long term predictions. In particular, long term forecasting can help define long term objectives for the given system evolution and allow the commencement of the following preparatory activities:

- Accumulate adequate resources, including:
  - Conduct research in the given area
  - Build structured portfolio of intellectual property
  - Prepare required specialists
  - Acquire strategic resources like purchasing land or other property
- Formation of the brand name, social image, conditioning (creating) potential market, etc.

Stage 4 – Middle term forecasting

Middle term forecasting involves bridging (matching) the results of short and long term predictions. As it was mentioned earlier, this stage includes unveiling and solving various problems, development of innovative concepts (groups of ideas integrated around specific directions and including technological, business, marketing, organizational, etc. elements). Because of importance of bridging, this stage is a key for the entire DE process, as at this point one should find the “track switch” that will place the given business on the right path.

Stage 5 – Building an integrated scenario of desirable evolution

Using the results described earlier, this stage involves building an integrated scenario for further development of the given system from the current to the desired in the future. At this point, detailed plans should be developed.

\(^4\) Any system’s evolution is driven by challenges imposed by its super-system(s) that has certain demands and requirements from the system of higher rank, which the given system is a part of. Because of that, one cannot make a reliable prediction of evolution of a certain system without careful analysis of possible directions taken by its most important super-systems. For large scale systems (or the ones that have the potential to become large) it may require considering the evolution of the entire society which is best represented by the most general patterns of evolution of man-made systems and known trends in evolution of the main social and technological systems capable to influence the evolution of the given system and accumulated in Ideation Bank of Evolutionary Alternatives™. For example, to make a reliable prediction on evolution of metal cutting instruments, one should identify trends in evolution of cutting machines, evolving demand for precision, check the possibility for cutting operations being replaced with alternative methods of treatment, etc.
Stage 6 – Implementation

This stage involves real implementation of the developed scenario, monitoring the given system evolution, including conducting yearly reviews of the situation, comparing it with the plans and taking corrective action if necessary.

Expectations of breakthrough – fantasy and reality

Real inventions versus miracles. Specifics of pilot TRIZ projects

A pilot TRIZ project (the first attempt to apply TRIZ within a company) has multiple issues that have to be addressed to ensure success, which is highly dependent on precise definition and satisfaction of expectations pertaining to the project’s participants and management. At the same time, a client new to TRIZ is not quite sure what to expect. Preliminary presentations explaining powerful TRIZ concepts and success stories are intended to make the potential client excited about the opportunity and go ahead with the TRIZ project; however, this excitement often creates unrealistic expectations of a miracle.

Expectation of a miracle or a breakthrough\(^5\) from a pilot TRIZ project can be a result of overzealous sale or irresponsible publications on the Internet. In any event, it finds a well cultivated psychological ground because expectations of a miracle are deeply embedded in western culture.

For example, everybody knows that Thomas Edison created a miracle inventing an electrical bulb (when a gas company turned off his gas light because of missing payment). At the same time, very few people know that the bulb had been invented by many inventors in different countries in different times; Edison’s contribution was much more serious including the creation of the whole system of electrical lighting, development of an efficient DC generator driven by a steam machine, system of power distribution, cables and wires, bulb socket, isolators, switches and power meters, etc. He also found the best (for his time) material for the bulb filament and developed the technology for mass inexpensive production and more\(^6\)…So which one of these inventions was a breakthrough?

The definition of a breakthrough or a “wow – solution” is quite vague, different people might have something completely different in mind. In general, it could be an intuitive understanding of a solution with the following attributes: a) a paradigm shift, b) obviously and immediately workable, c) implemented with minimal costs (minimal increase in system complexity), d) without producing any side effects. In fact, a combination of b), c) and d) matches Classical TRIZ definition of Ideal Final Result.

\(^5\) We had a project when a client included in the description of criteria of success that the project should produce three “WOWS”.

\(^6\) Rathenau, the founder of AEG company and a prominent electrical engineer and inventor in his own right wrote that Edison’s electrical system was so well thought through that there existed an opinion that it had been utilized for decades in numerous cities.
While being very useful in the process of generating ideas, the concept of IFR becomes quite harmful during the process of transition from ideality to reality, creating unreasonable expectations and hindering a successful implementation of solutions originated with TRIZ.

**Three types of breakthrough**

From the authors’ point of view, it is possible to single out three different types of breakthroughs that can take place within the same project (but not necessarily within the same concept):

1. High level breakthrough (or paradigm shift)
2. “Invisible” breakthrough (that becomes annoyingly obvious after its discovery)
3. Integrated system (concept) breakthrough

**High level breakthrough**

High level breakthrough (HLB) is an idea associated with a paradigm shift, utilization of a brand new approach, effect, means, etc. that people didn’t think about nor thought as possible. Typical sign of this breakthrough is rejection by professionals in the area. Their main argument – it is not going to work and thus it doesn’t make sense even to try. There are numerous examples here – stories associated with inventions of radio, broadcasting, personal computers, Xerox technology, semiconductors, microchips, FedEx, etc.

According to Ideation’s experience, today more often one can hear instead of “it won’t work” something like “it is against our company’s policy” or “our customer won’t accept it”, etc. Interestingly, in most situations this is not an excuse. Typically, HLB while having a potential to bring high profits eventually, would require a lot of effort and money, including expensive and time consuming research, experiments, costly marketing campaigns, etc. Implementation of this type of breakthrough is bearable for advanced and powerful High-Tech companies like IBM, Intel; large universities reaping the benefits of special grants; special start-up companies spun off by large corporations and/or financed by government agencies, etc. In any event, HLB cannot be implemented unless numerous problems at the lower level have been solved (see the picture below).

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7 According to Altshuller’s classification of levels of inventions these are inventions of level 3 to 5.
In this situation, TRIZ role would be (in addition to helping find such breakthroughs):

- Formulate numerous secondary problems that hinder fast implementation and address consequent tasks\(^8\) targeting finding solutions that will maximize the utilization of existing resources, (including knowledge, experience, cultural and other advantages, etc.), or

- Offering partial solutions (for example, allowing the utilization of the breakthrough idea in special cases) in case of strong limitations or resistance, or

- Proving that this breakthrough is premature, more like wishful thinking that cannot be supported by the current level of technology and the efforts should be directed to more realistic alternatives.

Authors’ experience includes a limited number of projects resulting in HLB\(^9\). One of them related to plasma cutters.

*The main problem of plasma cutters is fast wear of a cathode serving as a contact point for high temperature electrical arc (see the picture below). Even utilization of materials with the best thermal resistance (expensive rare earth metals) cannot solve the problem.*

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\(^8\) In fact, finding solutions to all secondary problems is the best way to prove the feasibility of a HLB.

\(^9\) According to Altshuller’s 1960s research, inventions of level 3-5 represent less than 25% of all inventions; our recent estimation result in a number less than 5%.
With the help of TRIZ, a brand new solution has been found (see the picture below). According to this solution, an electrical arc contact point is made movable inside a copper cylinder when winding around it is introduced in the cutter’s body. When the cutter is working, the winding conducts DC, creating a magnet field. The magnet field forces the electrical arc to move along the cylinder’s diameter. In addition, special shapes and DC fluctuations result in the arc contact point also moving up and down the cylinder. Continuous movement of the contact point prevents the electrode’s overheating and consequently, wear; incoming gas absorbs the heat which is beneficial for the main process.
"Invisible" breakthrough

"Invisible" breakthrough represents a situation when a solution looks so primitive and obvious that it creates an impression (usually a wrong one) that it was equally easy to find it. These solutions are typically based on discovering a hidden resource(s) or more often, on finding a new (and usually unexpected) utilization of an existing resource. The main problem here is to recognize that against normal common sense, it is easy to create a complex solution and hard to find a simple one. An individual exposed to TRIZ for the first time often expects sophisticated and complex solutions from a top notch innovation technology, involving IT, lasers, nanotechnology, and other “buzz” names. Instead he/she sees something very simple, something that looks like it was always there and it is a real mystery why nobody noticed it earlier (a month, a year or a decade ago). Often this situation is a disappointment – yes, it worked, but why did we have to use TRIZ for that?

Ideation had quite a few cases like that. In many situations, it’s the simple acknowledgement of how much time and money have been invested in solving this problem to date and how easy it was to find the solution using the right methodology. Further education in TRIZ is also helpful.

In any event, these “invisible” inventions often address problems in existing and often almost obsolete systems; in certain cases they can even boost the new life on the system.
ready to be given up to competitors. When TRIZ was “young”, these inventions represented the majority in all solutions.\textsuperscript{10}

From the authors’ experience, the following problem is a good illustration of the above.

\textit{In 1970s, when weather forecast was much less reliable compared to recent days, unexpected freezing storms could present a grave danger for relatively small fishing boats. Strong and cold wind lifts water from the sea surface and throws it on the boat structures where water is quickly freezing, putting a lot of weight and causing the boat to capsize (see the picture below).}

\begin{figure}[h]
\centering
\includegraphics[width=0.6\textwidth]{Icing_and_Capsizing.png}
\caption{Icing and Capsizing of a Fishing Boat}
\end{figure}

\textit{TRIZ helped to develop a solution based on the utilization of two available resources – water from the ocean (even in winter water several meters below the ocean’s surface has temperatures no less than 39 F or 4C, which is relatively “warm”) that has enough thermal capacity to melt ice, and bilge pumps always present on boats (see the picture below).}

\textsuperscript{10} These solutions were also the most remarkable for TRIZ novices who were suddenly impressed by the fact that they were able to solve a long standing problem that professionals failed to handle. Unfortunately, these professionals were often intimidated by the situation and went out of their way to prove that these solutions wouldn’t work.
Interestingly, during one of the TRIZ seminars conducted by the authors using this solution for explanation of the concept of resources, two participants from the plant producing various glass products and thus utilizing a lot of sand, had realized that the same solution could be utilized to defrost sand frozen during cold winter days using water from the relatively large river next to the plant yard.

**Integrated system (concept) breakthrough**

When the system (and/or problem) is rather mature and multiple attempts have been already made trying to resolve (improve) the situation, it results in the accumulation of numerous ideas, experiments, knowledge, tested variants of design of certain elements, etc. Unfortunately, because none of the previous attempts led to a successful completion of the project, the issue is still unresolved. Moreover, with continuing accumulation of data, incomplete results, etc., the situation is getting worse and worse. In this case, a breakthrough will be a result of a thorough analysis of the situation and the creation of an integrated concept of the next generation of the given system (new evolutionary S-curve). This integrated concept breakthrough will maximize the utilization of available resources (including all previous development and accumulated knowledge of specialists) in addition to the creation of new inventions necessary to provide integration and ensure feasibility and successful implementation of the integrated concept\(^{11}\). Most important is the evaluation of available ideas and concepts and the selection of the ones ready for integration\(^{12}\) that do not waste time and resources for reinvention of what has been already done.

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\(^{11}\) This is exactly the kind of breakthrough made by Edison – the answer on the question posted earlier.

\(^{12}\) These “ready for integration” ideas are not necessarily the best ones while considered separately, but rather the ones with high compatibility.
Typically, integration projects require more efforts than regular problem solving projects and in this regard are closer to Directed Evolution (or Express Directed Evolution) projects.

Sometimes, Subject Matter Experts have a problem with accepting integrated concepts as a breakthrough; TRIZ’s role also is not necessarily transparent. On the surface, the majority of the basics have been known from before (often even tested) and it is hard to recognize the importance of integration and its systemic effect that converted numerous disconnected ideas into an effective working concept. Recently, the number of Ideation projects resulting in integration concept breakthrough is continuously growing. A typical illustration of this type of breakthrough can be Ideation’s forecasting of the evolution of hybrid vehicles completed in the early 2000s.

The concept of the new hybrid vehicle included the following components (see the picture below):

- Hybrid including combustion engine, electrical generator, batteries capable to accumulate electrical power and computerized power control.
- Inexpensive turbines as an engine
- Ethanol with certain amount of water as a fuel for the turbine
- Electrical transmission and motor-wheel system

![Diagram of Systems for Hybridization and Futuristic Hybrid Car](image)
A breakthrough for client’s satisfaction

For a long time, solving a problem with TRIZ meant looking for an ideal solution or the one closest to it. The last 20 years of real practical TRIZ application have shown that one solution cannot satisfy various requirements, especially cover short, mid and long term needs. While short term needs are best covered with low level solutions (small changes to the existing system, less number of surprises and thus faster implementation, etc.), long term solutions should be of a high level to ensure competitive edge and eventually high ROI (the downsize – these solutions require much longer implementation time and apply high risk) [11]. Obviously, we are talking about different solutions here.

Given the above, since the early 1990s we have been developing and enhancing tools capable of providing an array of possible solutions at different levels, focusing on satisfying all terms and needs.

Ideally, a client would be happy if we provided all three types of breakthroughs within the same project – something for now, something for tomorrow and something for the day after tomorrow. In reality, though, not all options can be available. For example, high level breakthroughs depend on the emergence of new scientific knowledge; “invisible” breakthroughs depend on the availability of hidden resources. Fortunately, the third type of breakthrough – an integrated system concept is almost always available through contemporary TRIZ tools utilized for problem solving and Directed Evolution allowing the development of numerous ideas that can be integrated (including the ones that have been known earlier). The only problem here is an educated client.

Conclusions

1. There exist a number of serious contradictions related to forecasting, including contradictions between short and long term, local and global (super-system) results of certain actions. Measures taken “here and now” can take the opposite effect later and in other places.
2. These contradictions can be taken care of via special mid-term forecasting targeting special management during transition (crisis) point(s).
3. The success of TRIZ projects depends on a clear understanding of the breakthrough. One from the three possible types of breakthroughs (integrated concept) can be practically always achieved via the utilization of TRIZ tools developed by Ideation International.

References


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Mr. Zlotin received his MS in electrical engineering from St. Petersburg Polytechnic University, Russia. He has over 30 years of experience in TRIZ and is widely recognized as the leader of the TRIZ community and considered one of the foremost theorists and TRIZ scientists in the world today. He is responsible for the majority of the advances made to the methodology to date. He facilitated solving of thousands of various problems, is the author or co-author of 15 books on TRIZ and several patents and has conducted numerous seminars, workshops, and lectures. He is the Chief scientist and VP at Ideation International Inc.
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