DEPLOYING INNOVATION AND INVENTIVE THINKING IN ORGANIZATIONS – APPLYING TRIZ TO NON-TECHNICAL FIELDS OF BUSINESS

Paper for Presentation at TRIZCON2005 by Jon Wm. Ezickson, CPA

This paper will initially provide comment on the success and frustrations encountered in introducing and deploying TRIZ and inventive thinking tools to individuals and organizations involved in non-technical functions. The material will elaborate on the following sub-topics:

- Discuss the challenges involved with introducing TRIZ to executive level decision makers. Factors affecting approval, buy-in, resource allocation, and top-level commitment including financial analysis, cost vs. rewards of innovation programs, measuring innovation success. Consideration of the politics of organizations in implementing organization-wide programs, and vital role of innovation in the Six Sigma strategy.

- Review examples detailing how the TRIZ/ARIZ process would be applied to problem solving in various non-technical positions of the organization. Explore the role of innovation in continuous improvement projects and quality management, business processes and cybernetics of business entities.

- Provide examples of how the knowledge of TRIZ concepts can enhance executive decision-making and its usefulness beyond problem solving tasks, such as strategy formulation and business restructuring. Discuss TRIZ application in reaction to disruptive competitive technologies.

- Discuss how other TRIZ versions – ASIT (Advanced Systematic Inventive Thinking, Dr. Roni Horowitz), USIT (Unified Structured Inventive Thinking, Dr. Toru Nakagawa), and UIT (Ultimate Ideal TRIZ, Dr. Rodney King) can be useful in deploying TRIZ knowledge to non-technical personnel in building a culture of innovation within an organization.

- Discuss selected experiences and observations of the presenter in using TRIZ in various small business entities and the impact of fostering a culture of innovation in micro-business units comprised of non-technical personnel.

Since its introduction to western industrialized countries, TRIZ, and its variants, ASIT and USIT have been predominately applied to technical problems involving engineering of tangible products. Geinrich Altshuller's initial discoveries and development of the Theory of Inventive Problem Solving came about by the study of invented objects. Present day state of the art TRIZ as practiced at leading TRIZ organizations emphasize technical applications of systematic innovation by the continued study of patent databases and integration of physics and cybernetic principles.

Recently, many leading TRIZ practitioners have been exploring applications of inventive thinking to other disciplines outside scientific and mechanical fields. This pioneering

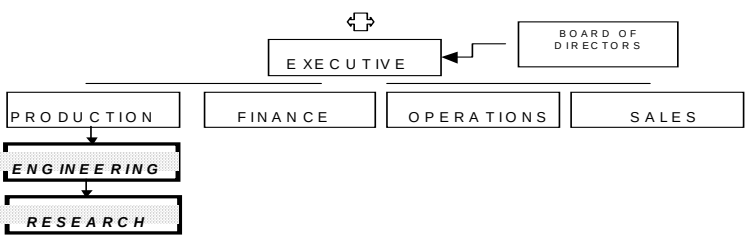
work has lead to the easy conclusion that the TRIZ body of knowledge has significant potential to be the new source of innovation in non-technical applications such as psychology, sociology, and diverse areas of business management functions and positions. As the United States and other developed countries shift towards service based economies, TRIZ and TRIZ alternatives will be important tools for future innovation in these softer science fields. Manufacturing businesses are dependent on non-technical service functions in order to accomplish the corporate mission, and TRIZ has been used in innovating and enhancing operations of such departments. Likewise, service businesses, non-profit organizations, governmental units, and educational institutions are beginning to explore the potential benefits of using TRIZ, ARIZ, ASIT, USIT, UIT, Product Ideation, and Directed Evolution to re-engineer and re-invent systems and processes in organizations.

[A]In his book, Suddenly the Inventor Appeared, Altshuller in some ways expresses a vision of organizations where the inventor is not a single person or position, but where everyone is equipped with the tools of TRIZ to become an organization of innovative individuals, in essence everyone is an inventor. For global companies that have adopted Six-Sigma programs, TRIZ is providing the missing link for quality success by bringing the systematic approach to innovation to the tool-bag. Thus there is a clear and convincing need to further the pioneering work of non-technical TRIZ and introducing it to all levels of all types of organizations. The question remains, how should this be done?

ANALYSIS OF THE CURRENT SYSTEM AND ENVIRONMENT

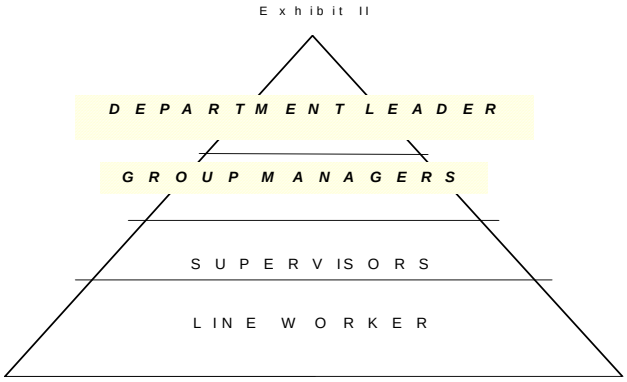
To begin to answer this question, it is worthwhile to clearly understand the current situation – how TRIZ is currently being deployed in organizations. As we noted above, TRIZ application is concentrated in engineering and production for physical products, and within this area the function of research and product development. [B]In a vertical management diagram, we would depict this as a departmental or functional management structure as shown in Exhibit I. This graphic demonstrates the absence of innovation and systematic inventive problem solving in most of the other departments of an organization, from administration to the executive office. In fact, it is rare to meet anyone other than engineers and technicians who have been exposed to TRIZ. Managers, professionals, and executives in fields of accounting, finance, law, operations management, and corporate governors often have no exposure to TRIZ and have never heard of Altshuller.

Exhibit I



In some instances, there is even a disconnect between the research department responsible for innovation, and other productive functions of manufacture, design, and quality control. The second view for analysis of the current environment is a management diagram depicting where TRIZ is being applied in

organizations (notable only engineering and R&D) from a hierarchical approach. Often, personnel below a specific responsibility level are not involved in a great deal of high-level company or consultant based training programs. This is usually due to such factors as high cost in training a large number of workers, higher employee turnover at lower levels, need based on responsibility or authority, and sometimes low academic aptitude. TRIZ training and innovation is generally vested with department leadership. It is infrequent for these department leaders to have access, authority, or time to cross the political and organizational boundaries to introduce TRIZ to other departments of the organization.



This illustration of the concentration of TRIZ in the high level departmental management of engineering functions in organizations is valid for both the qualitative aspect as well as the financial aspect. Ultimately, the budgetary or financial resources and responsibility and accountability for the innovation program and TRIZ training is going to come from the engineering department's budget. This budgetary aspect bears some responsibility for obstructing the more dynamic deployment of TRIZ into other divisions of a global organization.

The analysis of the current situation leads us to interesting observations.

- The concentration of innovation responsibility in one department appears to make the organization lopsided. This condition may possibly undermine innovation. Innovation and TRIZ training in other departments is needed for balance so that the customer perceives inventiveness from all contact with the company.

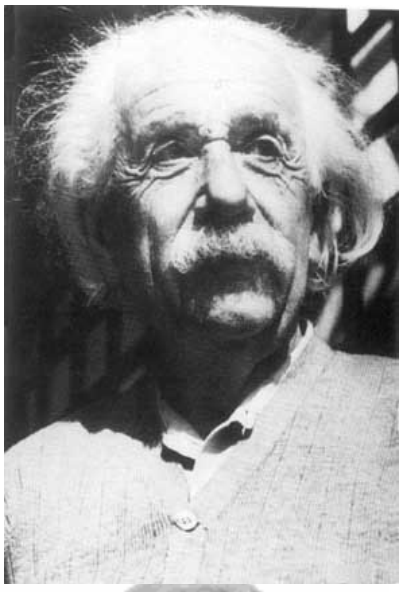
- The concentration might also impede the organization's interaction with internal departments as well as suppliers.

- If the other departments are not using TRIZ or systematic inventive problem solving, they are using something else. These are likely to be methods that are psychologically based, and proven to be inferior to TRIZ. Thus the use of those methods competes with TRIZ to the detriment of the organization's potential for greater success.

GENERAL DEPLOYMENT OBSTACLES

Without a doubt, TRIZ is mysterious, even though TRIZ foundations can be introduced and summarized in a fairly short time. The totality of TRIZ is in reality extensive, and it

takes significant time to absorb the full scope of contradiction resolution, ideality, and underlying science. This aspect scares people from the outset. And rightly so, since Altshuller has been compared to the likes of Albert Einstein and other geniuses. Some people fear the concept of systematic ingenuity as being beyond their comprehension. So in order not to appear "unintelligent" they resist exploring the unknown.



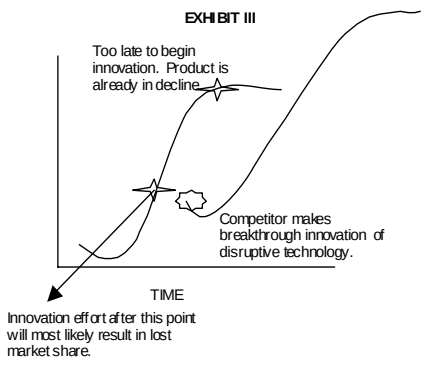
Besides the initial fear, there are also barriers based on skepticism and psychological inertia. In the U.S., the fact that it is from Russia, and not all the available materials have been translated provokes suspicion and produces the reaction of "not invented here". This resistance occurs because of novelty and the perception that TRIZ is a competing tool as opposed to a complimentary tool. The market is already bombarded with a plethora of consultant-based products and programs on quality management that do not specifically address innovation, let alone systematic innovation. Thus there is fear that it will replace vs. enhance other management tools. To some extent this is correct because TRIZ surpasses other psychology based thinking methods. These ego soft spots can be embarrassing to certain personalities, especially with leadership positions where the person in command is supposed to be up to speed on all the latest management techniques. This leads to rationalization on the assertion that TRIZ only applies to technical problem solving. In the U. S., TRIZ is on the cutting-edge, and there are only a few forward-thinking universities that offer any course content on TRIZ in their engineering program, let alone their MBA programs. Since TRIZ is not being taught in business curriculum, non-technical managers justify resistance by the fact that it is not widely recognized. The fact that it is not in prolific use is actually an opportunity to leverage covert competitive advantage.

The truth is, TRIZ is already being applied to business problem solving. TRIZ itself is a very young body of knowledge and is still evolving even in the technical arena where it was born. TRIZ can be a challenge to learn in the technical area where TRIZ evolved. Non-technical TRIZ poses more of a challenge. Technical TRIZ must first be translated to adapt to the more abstract and unpredictable characteristics of business problems. Not everyone agrees on what specific modifications work best to assimilate TRIZ to human behavioral problems. This pioneering work has only recently begun. [C]Jack Hipple of Innovation-TRIZ has been developing integration of TRIZ training with other creativity and personality assessment tools to introduce TRIZ in organization problem solving since the 1999. [D]Darrell Mann in 2004 published "Hands-On Systematic Innovation for

Business and Management", probably the first and most comprehensive textbook available that focuses specifically on non-technical TRIZ. TRIZ masters and experts have published extensively on the subject of non-technical TRIZ, but only in the past 5-8 years. This is evidence of the beginnings of a revolution that hopefully will gain momentum and become prominent in the near future.

SENIOR MANAGEMENT DEPLOYMENT OBSTACLES

Senior executives and company directors as a group have had the least exposure to TRIZ. Executives polled about innovation strategies have consistent responses. "Innovation is the lifeblood of the enterprise". "Innovation is the most important strategic bet a company makes". "Innovation is a top strategic priority". [E]Probably one of the most popular books on innovation being used by senior executives is "The Innovator's Dilemma" by Clayton Christensen. This book presents a historical analysis of how competitors' advances in innovations create disruptive technologies that can lead to failure of the firm. It clearly illustrates S curve behavior theories for products and systems, and there are several business schools that use this text as reference for MBA courses. The drawback to the book is it does not mention TRIZ or Altshuller, and actually presents a "horse already gone from the barn" approach to how management must deal with a competitor's innovation impact on a company's existing products. The price of sluggish innovation is that a competitor can quickly end your product life cycle before a counter innovation breakthrough can be achieved

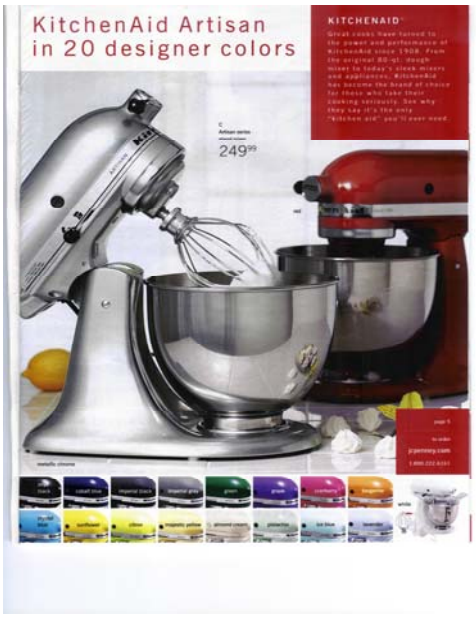


There is plenty of evidence from surveys that show senior management is aware of the need and importance of an innovation program. [F] Boston Consulting Group (BCG) conducted a survey of senior executives that concludes 73% of global companies will increase spending on innovation programs in 2005. Respondents to the survey defined innovation as "creation of new products, services, and processes", or more cliché "turning ideas into profits". Assuming senior management and middle management exposure to TRIZ is limited, some other method to generate innovation and creativity is being used. We cannot assert that companies without TRIZ have no innovation programs, but rather they are relying on psychology-based methods. [G]Altshuller's studies analyzed these methods in detail and his findings are set forth in his writings.

Level I : 1 to 10 trials to reach solution Level II : 10 to 100 trials Level III: 100 to 1,000 trials Level IV : 1,000 to 10,000 trials Level V : 10,000 to 100,000 trials

Altshuller found most methods of brainstorming only reached inventions at Level I and Level II, and that these solutions are achievable using the same mental processes as non-creative or analytical thinking. Additionally, since brainstorming techniques are a form of trial and error, the studies found that the number

of trials to reach a solution at the next level grew exponentially. As shown in the table, reaching a Level III solution theoretically requires up to 1,000 trials. This reflects exactly how companies have been approaching innovation. They rely on the concept that a higher quantity of ideas will produce innovation and creativity. Thus, we have seen



Centers of Excellence in global companies being established in all parts of the world in low cost locations as well as high cost locations. In addition to the outsourcing of low-level tasks, we find outsourcing in engineering to to major cities around the world as well. Companies theorize that the more people and the more types of people that are doing creative thinking will generate more innovative ideas. We can infer from this behavior that management believes at a certain point in time, the personnel in Calcutta will have better ideas than the group in Los Angeles. Without a doubt, there will be a huge quantity of ideas in this strategy, but the evidence predicts these ideas will predominantly be Level I and Level II solutions. It would seem that the only reason significant breakthroughs have been achieved in the past 50 years is that a high numbers of "inventors" are working on the same problems. The number of trials and errors has been spread out across millions of individuals both by internal experiment and sharing of research between companies. Altshuller relates to this as Edison's approach to inventing, "finding the needle in the haysack by examining every straw". This same behavior exists in academia and government research.

The BCG survey also reported that more than half of the executives polled expressed disappointment concerning the financial returns on investment in innovation programs. In turn, disappointment often leads to management shake-ups in the innovation departments as well as disruptions throughout the organization. If the assertion that current practice for innovation strategies is based on idea quantity holds true, then it would follow that the projected increase for 2005 on spending on innovation programs will be spent on inefficient programs, leading to disappointment. Greater investment is likely to feed greater disappointment. The analysis above infers that if TRIZ innovation does produce higher-level solutions, faster, more consistently, and without extensive trial and error, then organizations' investment in innovation has been 1,000 times what it should be. That is to say, up to 1,000 times the cost, personnel, and resources actually needed. The inverse of this hypothesis then is that introduction of TRIZ has the potential to reduce the effort required by the factor of 1/1,000 while increasing idea output in terms of a smaller number of first-class quality ideas. This proposition is bold, however, it coincides with the complaints of senior executives regarding innovation program failures. They often identify rate of idea generation to sales and commercialization, leveraging suppliers for new ideas, and balancing risk, timeframe, and return as recurring complaints.

Senior management has not embraced TRIZ due to its novelty and disappointments with previous contemporary creativity programs. The TRIZ community is in competition with other management consulting firms and methodologies that are more popular in business school curriculum and have brand recognition and acceptance. This competition is fierce in economic downturns and at the bottom of business cycles. Innovation programs and research and development efforts are prone to budgetary cutback by the corporate office. When financial troubles come, the R&D department is an easy target for clandestine reduction, and the axe typically falls on these programs first. The department activities are under the financial analysts radar, and in the executive analysis, innovation and development of future products is a secondary concern to survival. The innovation function is considered deferrable and sometimes expendable. When financial times are good, R&D and innovation spending are among the first areas of investment. The lack of permanence, and erratic funding has been an overall drag innovation programs in organizations, government, and academia. The vacillation in funding combined with wavering between hiring outside consultants and in-house departments, is likewise a hindrance to success. In addition to the R&D department, quality and management training programs that would include creativity and innovation skills for the management departments are also subject to financial winds of fate, and the same irregularity in support.

Another important consideration for a strategy to successful deployment of TRIZ and systematic approaches to innovation in an organization are the psychological factors. [H]An understanding and familiarity with temperament and personality type analysis as provided under a number of brands, (MBTI, Kiersey) is essential in negotiating skills. We can generalize the senior executive's personality and lifestyle and its correlation to obstacles of deployment. Senior executives have consistent tendencies as highly motivated and pragmatic authoritarians who are faced with constant challenges and risks on a global scale. Details are delegated. Therefore in-depth studies of the innovation practices of the engineering department are not high on the list. Executives view their roles as removed from detail and technical operations of the organization and focus on long-term strategy formulation, financial and performance goal setting and achievement, investor relations and shareholder value, and compliance with corporate governance. Gaining recognition that TRIZ is relevant to these responsibilities is a challenge.

These executive personality traits and their environment can sometimes give the impression of complacency or blunt reaction that this is not an executive priority. Often there are characteristic clichéd responses; " that's not the way we do it here; it ain't broke so don't fix it; lets not reinvent the wheel, and keep it simple".

MAKING DEPLOYMENT HAPPEN

In the preceding sections, I have covered the current status of innovation structures from an organization-wide perspective. The assertion is that the approach to innovation in global organizations has conspicuous inefficiencies and shortcomings. TRIZ is noticeably absent from not only the technical programs, but especially from management

training programs where senior executives down the ranks of middle managers have been equipped mainly with psychologically based tools for creativity. In the recent economic recession of 2001, there was a distinct lack of innovation that was a factor in cause of the decline as well as the sluggishness of the recovery. The premise as stated in the introduction is that systematic innovation principles and TRIZ have extensive utility in non-technical functions and its absence is depriving these organizations of potential prosperity and competitiveness. TRIZ presents an opportunity to introduce a revitalization of innovation culture with more permanence in all divisions of an organization.

[IJK]In devising an approach for introducing TRIZ into a company-wide culture, we have the benefits of past experience with quality programs such as ISO9000, TQM, the Deming Management Method, and Six Sigma. These programs were at one time consultant driven and obscure in the corporate world. It was by a combination of market forces, and championing that these management systems rose to prominence. In this analysis, market force is evident in the financial resources devoted to innovation. Championing has been scarce. As with any quality effort, the commitment of top management to see the implementation of the strategy through to its completion is essential. Either as a consultant, or a company executive, an accurate assessment of the organizational hierarchy and the political boundaries and channels must be done first to identify the key decision makers who are going to be the champions that sustain momentum for the realization of the objective

CONTENTS OF A FORMAL BUSINESS PLAN

Executive Summary

Financial Analysis

Benefits, Necessity, Advantages

Implementation Plan

Performance Measurement Metrics

Historical and Present Assessment

Competitor Analysis

Organization, Staffing, Management

Once the champions are known, there must be access. Again, having the political channels identified is important to a plan for being heard and getting a face-to-face meeting. Connections are necessary for feedback as well as forward communication, and should be nurtured as allies for the instances where obstacles or setbacks occur. If you are an inside department leader bringing in an outside consultant, it will be critical to introduce the consultant to this network as well. Like any complex project, it is prudent to have a written plan and timetable in advance. Planning begins with preparaing the executive proposal and follows through the implementation phase. Access is usually limited, and these preliminary steps and advance preparation are crucial to a good first impression.

While the groundwork is being laid for getting access, a proposal document is needed. A familiar format for a presentation to senior executives is a formal written business plan. There are plenty of sources both in book and software form that can help in this process. The business plan should be specific and short, no more than a dozen pages.

[LMN]In the outline for a formal business plan, each element is listed in order of its importance. The first element, the Executive Summary should have a 3 line summary paragraph for each of the detail subjects that follow. The summary should be designed to get the reader's attention and generate a high level of curiosity about the details. If the summary is done poorly, access may be denied.

[O]The second most important element in the plan is the financial analysis. The executive intrinsically knows the underlying conceptual aspects of quality and customer care, and importance of innovation. Regardless of how much can be said about the benefits that TRIZ and systematic innovation training can deliver to management, and its superiority over other creativity methods, the bottom line is the business plan boils down to a request for money. This aspect is known from the beginning, so it makes no sense to defer the financial details to a deeper part of the report. The document is a'Project Funding Request'. Financial performance is the key driver of decision making in the executive office. It is the executive's discretion as to where he directs the financial resources, and he is accountable to the board of directors and shareholders for those decisions.

COST ELEMENTS
Outside Consultants and Training
Personnel time away from daily activity
Training materials
Hard goods – lab equipment, computers
Software – training, reference, database
Facilities – training, product development
Logistics – transportation, lodging, meals

The financial analysis for a project to deploy TRIZ knowledge across a broader scope of company departments has two components, investment and projected rewards. The investment portion is the easier component to assemble, because the underlying data will be objective. Specific costs and outlays can be identified for consulting fees, training materials, hard goods, and personnel time, and the timing of payments can be predicted. The assistance of the finance department in collecting and verifying the cost and investment data in preparation of the budgetary requirements will boost creditability of the analysis.

The more difficult component is projected benefit and financial returns from the investment. This data will be highly subjective and, as with all predictive forecasts, susceptible to inaccuracies since future events rarely coincide with present assumptions. The benefits of TRIZ application in non-technical functions are more qualitative and related to gains in overall efficiency and productivity as well as the creation of new products and services. There will be an up front investment of time and resources to first learn TRIZ. Translating these qualitative aspects of benefits into quantifiable financial result will pose the greater challenge. There is a limited database of comparable success stories and metrics from outside sources that would sustain projection assumptions. Certainly, there is often conflicting data from analyses of the correlation of stock prices to the efforts of quality innovation programs. Additionally, development of financial models to project results will vary by company and need specific tailoring in each case. A complete story of innovation success, from implementation of TRIZ to invention or improvement of a product, to the market acceptance and sales growth, through the

bottom-line to the shareholder dividends exist in case studies. Case studies are useful guides for creating a projection blueprint.

In Benefits, Necessity, and Advantages, the qualitative aspects of TRIZ success can be explained in a narrative form, and augmented with comment on how success of innovation will translate to profits in the short-term. This section will also introduce TRIZ as a thinking tool for tactical and strategic decision-making.

The Implementation Plan section will set forth both in narrative and graphic terms the procedures and timetables for deployment. The two important ingredients of this element are the correlation to the timing of financial outlays for specific time frames, and the targeted points in time when benefits will be realized and subject to quantification and measurement. In developing the implementation plan, a number of methods of deployment should be considered to tailor the program to the needs of the organization from the standpoint of costs, geography, political factors, and culture. The plan may need to be tailored along with the budgetary requirements to accommodate the best timing. Many businesses have slow periods and shutdown time that is ideal for supplementing with training, and periods when the cost outlays might be more comfortably accommodated. Likewise, in a global approach, an organization that finds itself in an extended period of soft markets may be able to outsource functions to save costs, and at the same time deliver training to enrich the management home team.

As the implementation plans are considered, concepts learned from TRIZ are applicable. For instance, periodic action – deployment of TRIZ training in doses. Composite and consolidation – combine TRIZ training program events with other quality and management training seminars. Self-service – deployment of TRIZ training on a self-study basis. Strong oxidation environment and rushing through – conduct TRIZ training in an intense content-rich secluded retreat setting. Mechanical system – delivery of TRIZ materials as book, audiotape, video, computer software, satellite conferencing.

The Performance Measurement Metrics section deals with thinking ahead of time what data needs to be tracked and how. It involves identifying the critical success factors for gauging the level of success and effectiveness of TRIZ programs. The metrics are the quantitative translation of qualitative changes resulting from the application of inventive thinking. The system modifications needs to capture and monitor data related to the instances of TRIZ innovation events, such as number of events, gain in process speed, conversion to new medium, resources conserved and other data that translates to a financial result. Metrics need to identify the characteristics that result in a cost savings or profit increase in a manner that can be subjected to audit. The complimentary set of parameters will be those measurements that track, in either hypothetical or actual terms comparison data that demonstrates the efficacy of TRIZ over alternative methods. The identification of measurement parameters demonstrates willingness to be accountable for the results. This section should coordinate with the presentation of financial projections.

TRIZ Innovation Event
A modification of a product, process, or system resulting from an improvement or problem solution generated through TRIZ tool application.

The final three sections of the business plan are included to provide the executive with additional analysis and information relevant to an assessment of the present situation in the company and in the environment. If available, it should include examples of shortcomings or missed opportunities that might have been averted if a more systematic approach to innovation based on TRIZ had been in place. Likewise, if the data is available, historical and competitive information could include investments and returns on previous innovation efforts by the company, and comparison with costs and benefits of other management training programs that are already in place. Finally, the analysis should incorporate how TRIZ will complement the other management programs and methods in use and fill gaps where they are deficient in spawning creativity and innovation.

INTEGRATION WITH MANAGEMENT AND QUALITY PROGRAMS

Perhaps the most prevalent endorsement of TRIZ can be found in the field of quality control and quality management. Those who are familiar with TRIZ find it an indispensable means for product and system improvement because of its capability to provide quick high-level solutions. Although TRIZ by itself can produce dramatic results, TRIZ used as a enrichment to other tools of quality management, or TRIZ augmented by tools of quality management is all the more potent. TRIZ is not a quality system, but rather, a component of a superior quality system. TRIZ may very well replace a number of weaker creativity tools in use, but there are a number of management tools that are still essential, such as project management techniques, and design of experiments. In fact, many of the tools of quality management developed by Deming, Shewhart, Juran, Crosby, and Fiegenbaum will always have presence in sustaining quality control and continuous improvement in organizations. [PQ]TRIZ is vital in Quality Function Deployment and predicting product or system evolution.

In spite of the endorsement TRIZ has in the quality arena, its use is underutilized in one of the most popular quality programs – Six Sigma. Several TRIZ practitioners have published extensively on the fundamental balancing role TRIZ can play in a 6Σ discipline. Past TRIZCON and ETRIA texts have several articles by the best of TRIZ masters on the integration of TRIZ and 6Σ. Fortunately, a number of TRIZ training organizations and practitioners are finally making inroads to bring TRIZ to Six Sigma. TRIZ is gaining presence in Motorola, where the original architecture of 6Σ was created. This presence is spreading beyond the technical groups to management. Recent Motorola product advertisements actually use TRIZ terminology, such as “form follows function”.

[R]Dr. Jay Desai, CEO of the Institute for Global Competitiveness was the innovation executive responsible for the implementation of Six Sigma at General Electric under the then GE – CEO Jack Welch. Recent press reports have noted that investors are becoming impatient for faster and more dynamic results from organizations that have implemented 6Σ over the past 20 years, and that 6Σ has had some inadequacies that the pundits predict will lead to its eventual downfall. Although a few companies have either passed on 6Σ, or have tried it and moved on, the methodology is still popular and prevalent in some of

the world's most competitive companies, General Electric, Dow Chemical, Motorola, and Caterpillar, just to name a few.

Dr. Desai points out that Six Sigma is a quality methodology, and acknowledges that it does not create innovation. In his own words, "Six Sigma is not a solution for new products or a break-through strategy". In a market environment where investors particularly value revenue growth, 6Σ has not added momentum from innovation and new product development. Six Sigma, as well as ISO 9000, and similar programs were never intended to create innovation because they are quality systems. Companies using 6Σ have reaped billions of dollars in savings over the years, as well as some surprising turnarounds for companies that implemented the program during troubled financial periods. Some companies have rejected 6Σ because the innovation is missing.

The anatomy of 6Σ is that it is a concise set of metrics and procedures designed to drive quality characteristics into control with a goal of 3.4 DPMO (Defects Per Million Opportunities). The foundation is a modified Shewhart Cycle (Plan Do Check Act), which was inappropriately described as a breakthrough strategy, which actually is a statistical approach to process improvement. There are several other useful quality tools used with its kaizen structure, Root Cause, House of Quality, and SPC. TRIZ appears to be the last piece of the puzzle, the missing link, that can propel 6Σ to a more ideal system by adding the missing tools of systematic innovation. By adding TRIZ to the DMAIC process, the search for improvement tasks and solutions becomes more focused on the creative future direction, as opposed to spending on resources improving processes, products, and procedures that may be obsolete and outdated in the first place. The tools of TRIZ compel the 6Σ team to consider the point where the product is on the S curve, and whether the creation of a new product or higher-level improvement solution is required. Otherwise, 6Σ would look at improvement by metrics that attend to the elimination of problem root causes, which might be a pointless exercise. When TRIZ does identify the necessity for new product creation, it provides the tools to direct exactly the features to be improved (targeting solutions, contradiction resolution), and points to the path of evolution the creation should take. Additionally, TRIZ becomes an integral part of the product DFSS, that is to say identifying inventions that allow for defect –free manufacture of the product. The key point is TRIZ accomplishes this in a systematic approach which is conclusive and repeatable. Conclusiveness supported by the patent invention database, and repeatability supported by algorithm.

A SHORT SIX-SIGMA STORY

At a 6Σ seminar, the presenter was boasting how the Six Sigma team used the methodology to reduce the mailing time of paper copies of monthly account statements to customers from 12 days down to 7. At the same time, no one in the organization had addressed implementing on-line access and email delivery of the same documents (Principle of Change System), which could potentially reduce the time to near zero at a fraction of the cost.

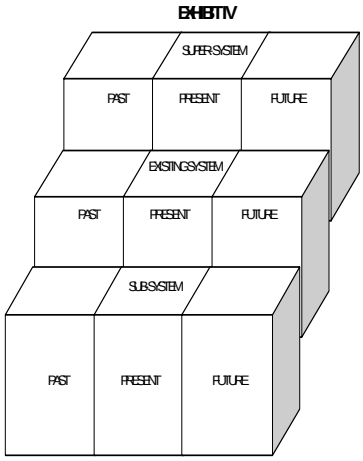
I noted above that a business plan needs a section on performance measurement metrics to provide accountability and assessment of the innovation program results. Here Six Sigma is a perfect complement to TRIZ. Since data characteristics are defined as part of the improvement process, TRIZ can rely to a great extent on the 6Σ system to harvest the

required quantitative data. As shown in the sidebar story, some TRIZ driven innovations can readily provide comparative cost saving data that can be measured by 6Σ statistics. However, since 6Σ emphasis is on quality costs, modifications to the data tracking are needed to provide evidence of the benefit achieved on the revenue and profit elements. In the future, it may require new designs for the accounting systems to track the progress of the new product vs. the old product along its S curve cycle. This need may become more apparent as TRIZ gains popularity and the pace of innovation and product life cycle quickens.

The linking of TRIZ to the Six Sigma program or other quality training system is a practical tactic for deployment. By incorporation of TRIZ (Combining and Homogeneity), the methodology is disseminated within the framework of an existing company-wide program, and the cost is only additive to an existing organizational budget rather than an entity unto itself in an isolated department. There is also the mileage gained in investor relations by demonstrating that action is being taken to address the innovation deficiencies of Six Sigma and enhance returns on an approved long-term investment commitment by the Board of Directors. The linking of measurement metrics to TRIZ innovation projects is critical. Advocates of TRIZ will initially be under scrutiny and management deserves verifiable proof of return on investment. TRIZ advocates will benefit by having success stories recorded to promote further deployment of TRIZ training in the organization. The organization and its shareholders will benefit by increased profitability and value of the company.

OTHER ANTICIPATED USES OF NON-TECHNICAL TRIZ

I have presented a case for the propagation of TRIZ into the administrative and non-technical managerial areas of organizations and a strategy for starting such an effort. This section will deal with some perspectives as to how TRIZ can be applied by the levels of management. TRIZ is a useful personal body of knowledge and can be applied in all aspects of everyday life. However, common sense dictates that TRIZ training for all line-level personnel and immediate supervisors is impractical. The cost exceeds need and potential benefit. Altshuller's work would suggest that anyone and everyone can and should be an inventor, but also concludes that Level I and Level II solutions do not require special creative mental processes. Since this level of personnel is usually faced with only Level I and Level II type problems, they consequently already have the tools necessary to do their jobs. Even in non-technical departments, line-and supervisory personnel have specialized secretarial, clerical, ministerial functions that are also likely to be constrained by having no authority to deviate from an established system.



SOLVING TACTICAL PROBLEMS

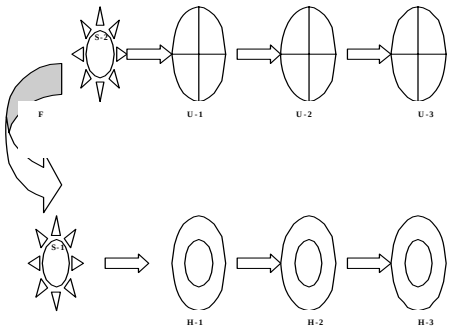
At the middle-management level, we begin to find employees with higher levels of authority and responsibility for system or process maintenance. TRIZ is founded in cybernetic

principles and much of the advanced levels of TRIZ apply explicitly to system analysis and modification. As the level of authority and responsibility increases at each management level, the complexity and magnitude of the system and potential system changes increases accordingly. The conclusion then is that higher dosages of TRIZ training are needed at the higher levels of management. Besides straightforward problem solving, TRIZ equips managers with a new way of system thinking, empowering them to dissect and reconfigure human and physical resources in inventive ways. Thus, the manager can search out a new design using the skill sets, information, and functions of the human side integrating it with the physical facilities in ways that create new value. More than just gaining a cost saving or increasing a capacity, the manager seeks discover new services and functions that can be provided with the existing resources and people by applying TRIZ. To reiterate, these discoveries will emerge at higher inventive levels using TRIZ over alternative methods. In administrative functions TRIZ cybernetic tools can be used to identify fixable and non-fixable problems and resolve them to ideal results for customer satisfaction (internal and external), productivity, efficiency, and performance.

STRATEGY FORMUATION

Unlike middle management where the function is tactical, in the junior executive office, the function switches to more long-term and strategic objectives. The size of information packets increases, the number of network nodes expands, the assignments become more multi-faceted, global, complex, and challenging. Duties are segmented and delegated, but regardless of the increase in size and complexity, it remains a system. In essence, strategic planning is future systems planning, determining what modifications to the inputs, processes, and internal resources are needed to achieve a qualitative change in the output or results. TRIZ provides a number of unique tools that could change the thinking on strategy formulation. S curve, Size-Time-Cost, Su-Field, and Sub-System- Super in past-present-future can give management a more 3 dimensional view of the business macro-models and components that can highlight problems previously concealed and not discovered using other methods, as well as the solid high level solution patterns to correct them.

EXHIBIT V



Darrell Mann, Ellen Domb, and Jack Hipple are three original architects of the use of TRIZ in business management. In addition to their practice experience in technical TRIZ, they have published several books and articles that have furthered the deployment of TRIZ to business and management applications. They have also been active in integrating TRIZ with well-known quality, behavioral science, and organization strategies. Dr. Mann and Dr. Domb have created a working index of the 40 principles in terms of commonly applied business principles. This handy list could be used by the executive in the TRIZ analysis models to review alternative courses of action for system correction in a fairly short period of time. As the practice of business management TRIZ expands, the TRIZ community will develop a working contradiction matrix tool, training executives to search out and reduce or

eliminate trade-off situations and compromises. Senior executives and board members can utilize TRIZ methods when faced with more complex challenges and threats to the organization that involve restructuring or ***reinventing*** the company. By having a broad deployment of TRIZ in the executive office, a new style of communication evolves on the level of inventive principles that provides management with a more in-depth understanding of a restructuring directive and its intended effect.

MERGERS AND ACQUISITIONS

An enormous amount of senior executive energy and resources are devoted to buying and selling companies, divisions, segments, and asset groups. Merger and Acquisition activities are driven by differing factors in a search for competitive advantage. It can be a simple matter that a company has been extremely profitable and needs to find new long-term investments of idle cash and future cash flows. It can be done as a hedge against a scarcity or commoditization of a key company resource. Often, we see merger activity occur in troubled businesses where a more desperate strategy is needed to find synergy with a similarly situated organization. M&A can take many forms, as outright acquisition and full consolidation, partial ownership and control of an independent entity, split-up or spin-off. Some organizations combine efforts through joint venture allowing the partnering companies to retain their identity, autonomy and continuation. Besides being based on TRIZ principles in and of itself (combination, consolidation, extraction, segmentation) the M&A process lends itself to further use of the TRIZ tools. Whatever the motivation is for finding targets for acquisition or disposition, applying the advanced tools of TRIZ could have significant impact on these decisions. As the field of business TRIZ expands, there will be numerous opportunities to apply TRIZ in hindsight to some of the greatest historical merger successes and corporate failures, identifying factors as to why some survived, thrived, or imploded, and how applying TRIZ might have changed the outcome. This effort will add value to the knowledge base, perhaps rounding out the 40 Principles for Business and a contradiction matrix.

MERGERS OF TROUBLED BUSINESSES

There are many merger proposals where two organizations seek to unite to solve their inherent fiscal problems – falling revenues, contracting customer base, increased competition, and personnel resentment. Most of these signs point to a mature business on the decline cycle of the S-curve. Putting together these two entities results in a larger entity with the same problems, on the belief that size alone will add value and create a turn-around. Without an innovation, either internally or as a result of combination, the organization continues down the same path of decline.

M&A is an investment decision based on value, and the executive equipped with tools of TRIZ has a means of gaining a different perspective of some important issues that affect valuation. An executive might analyze a transaction in terms of future cash flows, showing that product or system evolution predictions support or refute the proposed transaction pricing. In terms of synergistics, the executive might evaluate the potency of innovation momentum of the target, and its potential contribution in a combined effort. In terms of M&A logistics, the executive is alert for contradictions, compromises, and trade-offs, where they exist in the negotiations, as well as in the process of future

integration of business systems and cultures. These attributes examined for their contribution to innovation in the new venture can detect whether the price is a bargain or a waste of time. Since the negotiation process is essentially a marketing mission, TRIZ can help the executive identify weaknesses and exaggerations. The ideal target of course would be an entity already proficient in TRIZ that could accelerate TRIZ deployment in the acquirer.

INVESTOR RELATIONS

The tools of quality management are conspicuously absent in the realm of corporate governance, accountability, legal, and financial reporting. In the U. S., quality in these areas is defined by by imposing continually changing and expanding regulation plus an endless onslaught of inspections. The functions in this domain constitute a significant component of the economy, and the resources devoted to coordination are tremendous. Recent events have shown disgraceful results considering the extent of the effort. It is obvious that ethics and honesty cannot be forced into a system by laws, regulation, codes, and inspection. The system has to be designed to achieve the result. In the language of TRIZ, the system by itself would sustain these attributes. In the super-system where executives interact with directors, investors, government, and markets, TRIZ will eventually play a central role in shaping the future designs of these systems. This will happen when those in command realize the extent of waste caused by regulation and inspection, and understand that new efficient systems of oversight and control have to be invented.

Parretto statistics would imply that 90% of the problems of market-wide corporate fraud reside in only 10% of the overall population of organizations. Thus, the extensive regulation and inspection is not really needed for the honest 90%. Nonetheless, executives are confronted with extensive compliance mandates, and employment of TRIZ in meeting these requirements has the usual potential benefits of reduced cost, conservation of resources, and superior results and solutions. TRIZ points to the solutions at Levels III and IV that exist outside the paradigm of management sciences that presumably have never been considered in an environment that relies so heavily on regulation and inspection. Government and markets are impaired by the same factors, and these colleagues must work together with companies on common benefits arising from TRIZ and innovation. The attitude is fundamentally reactionary, so it is doubtful that TRIZ has ever been attempted for solving these problems.

One negative aspect to this logic is that in the past, the 10% fraction of dishonest company executives have used so called “innovative” ideas to conceal fraud and fabricate facades of prosperity. It is unfortunate that TRIZ would be useful to the corrupt. It is reasonable to assume that a faction exists whose goal is to defeat the system for personal gain, and TRIZ knowledge would be assisting them. Remedies to this problem can be found in tools of reverse TRIZ, as well as several untapped quality tools and TRIZ tools that can be used to more effectively and efficiently detect and prevent fraud or manipulation. After all, in the final analysis, it is a system.

ACME CHEMICAL COMPANY

Acme Chemical is a small business that manufactures paints. They have one particular technology in elastomeric coatings that is an advanced product and differentiates Acme in the market. The primary use and customer of the coating is for roofing material. However, the product is mature, and sales growth has been soft. Acme is looking to expand its business, and is considering buying other plants or technologies.

In review of Acme's corporate vision statement, they were focused on making the best quality paint and roofing material for their customers.

As Acme was introduced to TRIZ, we revisited the mission statement and identified Acme as an inventive principle solution provider according to Principle # 30, thin films and membranes. The terms roof and paint disappeared, and the potential customer base was expanded to any one with a problem that pointed to the thin-film solution. We then looked at the company's capabilities in terms of producing the opposite, and integrating other contradiction matrix correlations such as composite thin film - #40.

The expansion of the markets and products for Acme are already producing gains and have a tremendous future capacity. The plans for expansion through acquisition were reconsidered, in light of the possible need for added capacity to produce the new products for the expanded market.

DEFINING CORPORATE MISSION

For years, executives have complained about endless parades of consultants hired in to companies that regurgitate the same material with only a slightly different slant. They often express disappointment that there is nothing "new". TRIZ offers the consulting community and the internal corporate development executives something unique that can be applied and adapted to a number of older concepts and techniques. [S]One example is the Corporate Vision, Mission, or Strategy Statement, which many of us are familiar with.

TRIZ offers a dramatically new point of view in looking at the corporate identity and strategy in terms of the inventive principles and parameters, STC, Su-field, or macro system analysis. Rewriting the vision statement in TRIZ terms can be an eye-opener as to goals, missions, core focus, strategies, opening markets, and finding opportunities. The rewrite of the corporate vision statement leads to identifying the areas where the company can generate productive innovation based on its existing strengths and knowledge base. In redefinition, there is also a closed-world approach in growing the company without adding layers of personnel and determining when full plant capacity is reached before additional facilities are needed. Integration of TRIZ with some of the more traditional consulting techniques leads to the ideal service executive management is looking for – something new, fresh, and potent.

SALES AND MARKETING

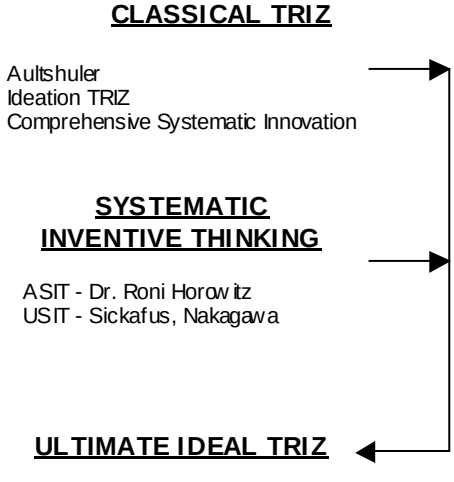
Possibly one key group that has been inadvertently neglected in addressing the deployment of TRIZ to non-technical personnel are the salespeople. The professional salesperson is an exceptional individual, exceedingly extroverted, and sometimes has a natural born talent in addition to expert training. Sales in many organizations is in part a psychological skill. Of course, TRIZ is applicable to psychology and people skills, and there is extensive research on the subject. TRIZ can make a good salesperson great, and a great salesperson stupendous.

Besides providing tools for inventive techniques for the sales process, TRIZ is a very interesting subject. Salespeople love to talk, and need fresh subject matter to get a listener's attention to get to the lead-in for the product or sales pitch. TRIZ has a charisma that differentiates the presenter from the more boring stories about "kids, vacation, my dog ….". By giving the salesperson knowledge as to what a true innovation is and what constitutes real inventive thinking, there is a brilliant synchronization to the introduction of the product and how innovation has been built into it. In turn, the consumer respects novelty, innovation leadership, and intelligence in making a buying decision, thus the TRIZ equipped salesperson possesses a distinctive advantage.

Another key aspect of the deployment of TRIZ to the sales force is that they are the face of the company the customer sees, and the one person who has a first hand look at the customer needs. The customer often will express his approval as well as disappointment in the company's products and service. If the salesperson is adept at the concepts of systematic innovation, he has the means to communicate the shortcomings or desired features of products to design and engineering in a common language of inventive problem solving. Additionally, the salesperson trained in TRIZ may notice deficiencies or improvements for products before the customer, due to an intimate knowledge of the product applications. In the example of Acme Chemical, the training of the sales force in TRIZ immediately caused constructive feedback leading to new product and market research. The functionality of TRIZ in the interaction of sales, management, and engineering cannot be underestimated. Most of the ideas generated were previously unknown before TRIZ was introduced, and the teams would not have gone on these paths otherwise.

OTHER TRIZ BASED METHODS

[TUVWX]In the current universe of TRIZ practice, there are different classifications and branding of TRIZ training and software along with interaction with other quality science, engineering and design, and management consulting methodologies. From the standpoint of a TRIZ practitioner consultant, each adaptation is a practical style. The SIT versions of TRIZ are in many respects the application of TRIZ to TRIZ by consolidation of homogeneous elements. By consolidating the principles, smaller information packets are easier to deal with from the human standpoint and fewer quantities to commit to memory results in simplification. The methods arise from the complaint that classical TRIZ is too large and sophisticated which makes it difficult to convey to large groups in a short time. By simplification, TRIZ knowledge is easier to communicate.



An important feature in considering SIT methods for TRIZ training is that they have demonstrated effectiveness in accomplishing real innovation in terms of meaningful

qualitative change and solutions at high levels of inventiveness. Being based on TRIZ, as the name implies, the methods are systematic and are conclusive and repeatable. There is a risk however that a specific inventive problem may call for the full potentcy of classical TRIZ and ARIZ. These disciplines are viable alternatives to disseminate and deploy TRIZ knowledge to non-technical ranks because of their simplicity. Like TRIZ however, they were originated in mechanical and technical roles and various modifications are desirable to reorient the education toward management and non-technical applications. As with SIT, Ultimate Ideal TRIZ is beneficial in teaching the methods, principles, and tools of TRIZ and ARIZ and is structured for simplicity and use beyond technical problems. The goal in UIT is " resolving the simplicity vs. sophistication contradiction that resides in classical TRIZ" as stated by its developer, Dr. Rodney King.

CONCLUSION

It is widely recognized that TRIZ has important potential in applications to business systems beyond technical and product development purposes. The work of Jack Hipple, Dr. Mann, Dr. Domb, Dr. Horowitz, Dr. Nakagawa, Dr. Sickafus, and Dr. King have pioneered initial translations and implementation, and TRIZ practitioners have a great deal of information to learn in study of their work.

Just as Geinrich Altshuller pioneered the development of technical TRIZ, the community of TRIZ Masters and Experts of the 21st century will be pioneering future application of the Theory of Inventive Problem Solving in all the world's sciences and arts. TRIZ will ultimately overcome the psychological inertia and obstacles currently faced in companies, and management will awaken to a changed world, and a new process of innovation. The old chaotic methods will be retired in favor of the systematic and organized thinking that comes from TRIZ.

REFERENCES

[A] Altshuller, G. S., And Suddenly the Inventor Appeared, Technical Innovation Center, Worcester, Massachussetts, 1996

[B] Sisk, Henry L., Management & Organization 3rd Edition, South-Western Publishing Co., Cincinatti, OH 1977

[C] Hipple, Jack, www.innovation-triz.com, Papers and Presentations

[D] Mann, Darrell, Hands-On Systematic Innovation for Business and Management, Lazaruz Press, Devon, UK, 2004

[E] Christensen, Clayton M., The Innovator's Dilemma – When New Technologies Cause Great Firms to Fail, Harvard Business School Press, Boston, Massachussetts, 1997

[F] Boston Consulting Group, Press Release – December 8, 2004 via NewsEdge Corporation, Boston, Massachusetts

[G] Altshuller, G. S., The Innovation Algorithm, Technical Innovation Center, Worcester, Massachussetts, 1999

[H] Berens, Linda V., Understanding Yourself and Others™ Series, Telos Publications, Huntington Beach, California, 2000

[I] Walton, Mary, The Deming Management Method, Putnam Publishing Group, New York, 1986

[J] Lamprecht, James L., ISO 9000 – Preparing for Registration, ASQC Quality Press, Milwaukee, Wisconsin, 1992

[K] Lucas, James M., The Essential Six Sigma Quality Progress: January 2002

Munro, Roderick A. , Linking Six Sigma With QS 9000, Quality Progress: May 2000, American Society for Quality, Milwaukee, Wisconsin
[L] Carmicjael, Douglas R., Ph.D, CPA et al, Guide to Small Business Consulting Engagements, Practitioners Publishing Company, Fort Worth, Texas, 2004
[M] AICPA Management Consulting Services Division Practice Aid 92-6: Preparing Financial Models, American Institute of Certified Public Accountants, Jersey City, New Jersey, 1992
[N] AICPA Management Consulting Services Division Practice Aid 96-1: Developing Business Plans, American Institute of Certified Public Accountants, Jersey City, New Jersey, 1996
[O] George, Stephen, How To Speak the Language of Senior Management, Quality Progress: May 2003, American Society for Quality, Milwaukee, Wisconsin
[P] Terninko, J., Zusman, A, Zlotin, B., Systematic Innovation – An Introduction to TRIZ, CRC Press LLC,Boca Raton, Florida, 1998
[Q] Slocum, Michael S., et al, Using Axiomatic Design to Integrate Comprehensive QFD and TRIZ in Design for Six Sigma, Proceedings: TRIZCON2004 Sixth Annual Conference of the Altshuller Institute for TRIZ Studies, Altshuller Institute for TRIZ Studies, Seattle, Washington, 2004
[R] Flaherty, Michael, News Release - Six Sigma Is No Longer Enough, Reuters Limited, May, 2004
[S] Hofer, C. W., Schendel, D., Strategy Formulation: Analytical Concepts, West Publishing Company, St. Paul, Minnesota, 1978
[T] Horwitz, Roni, Introduction to ASIT, e-book available at www.start2innovate.com
[U] Sickafus, Ed, Ph.D., Unified Structured Inventive Thinking – An Overview, e-book available at www.u-sit.net, Ntelleck,LLC, Grosse Ile, Michigan, 2001
[V] Nalagawa. T., Kosha, H., Mihara, Y., Usage of USIT Solution Generation Methods: A Simple and Unified System of TRIZ, Proceedings: TRIZCON2003 Fifth Annual Conference of the Altshuller Institute for TRIZ Studies, Altshuller Institute for TRIZ Studies, Philadelphia, Pennsylvania, 2003
[W] Nalagawa. T, Problem Solving Methodology for Innovation: TRIZ/USIT, TRIZ Homepage in Japan, 2004
[X] King, Rodney K., TRIZ for Every Business, Household, and Activity, Proceedings: TRIZCON2003 Fifth Annual Conference of the Altshuller Institute for TRIZ Studies, Altshuller Institute for TRIZ Studies, Philadelphia, Pennsylvania, 2003