A survey of the relation between TRIZ and quality

Masoud Pourkiani, Majidreza Dahmardeh Komak, Hossein Shojaee Farahabadi

Islamic Azad university, Kerman Branch, Kerman, Iran

Abstract

Nowadays, creative thinking and considering the attitudes of the employees and experts in various organizational and manufacturing systems are utilized as a strategy to remove the existing problems in organizational decisions and policies. Considering the improvement in organizational decisions and strategies is one of the main concerns of executive managers but creating a logical relation among the innovative strategies and thinking and other systems and strategies used in the organization can make these strategies efficient and strong tools in the organizations. In the present study, the researcher evaluated the relation between innovative thinking and quality management systems.

Keywords: TRIZ, Quality management system

Introduction

Today, one of the development factors of the organizations is investing in innovation field. They use the main factor in keeping the competitive power organization among the competitors and it maintains the proactive feature of the organization and it shows the organization commitment to Excellency.

One of the ways of providing the innovation of the organizations is using the external resources. The organizations first find the innovation resources and after adapting their goals with it or legally, purchasing innovation illegally, industrial spy, attained it and applied in their organization. It seems that creating good environment and facilities and empowerment of human resources of the organization is one of the ways of development innovation in the organization. The theory of inventive problem solving is based on the general rule:

The evolution of all technical systems follows the natural, subjective and objective rules. Based on these rules, during the evolution of technical system, the improvement of each section of the system that is maximum in terms of duty function is in contradiction with other parts of the system. This evolution leads into the improvement of uncompleted section. This process makes the system close to the desirable condition as continuously. Understanding such evolutionary process, predicts the developed process of the technical system.

The aim of creative problem solving is discovery of achieving to creativity. Thus, by the attempt to understand creativity process, hard problems were solved by modern methods. This theory helped the user to organized complex thinking that by providing logic and knowledge basis, system engineering is improved. Although using creative problem solving theory is considered as creativity tool and impose many pressures on the person and organization, its application leads into the solution of process problems in productions (Mansurian, 1989). Shiuand others (2007), Jiangand others (2007) believed that Quality Function Deployment (QFD) is a concept of NPD under the framework of Total Quality Management Effects Analysis (FMEA).

Jafari (2000) stated that quality from the view of total quality management, customer satisfaction and continuous improvement of this level of satisfaction, to achieve this aim, there are various tools and views including QFD, application of Failure Medo and Effects Analysis (FMEA(and benchmark are developed and introduced. One of the views is QFD following the desires of the customer and changing them to manufacturing, substances and design requirements to achieve these requirements in the market.

The driving force of QFD and the desire of the

Corresponding author: Masoud Pourkiani, Islamic Azad university, Kerman Branch, Kerman, Iran. Email: pourkaini@yahoo.com

customer were expressed in the form of concepts and terms, when QFD technique was used in some products, a Paradigm shift from Process Oriented Quality Assurance to Design Oriented Quality Assurance was occurred.

The definition of TRIZ

The term TRIZ[1] is derived of a Russian acronym, the theory of inventive problem solving. This knowledge is called TRIZ all over the world and its reputation is for the reason that its founder was a Russian creativity theorist, Altshuller (1926-1998) (Trinteko *et al*. 2001, p.26). TRIZ is recognized by various descriptive names and titles as organized innovation, invention creativity, methodology of inventive problem solving, inventive solution methodology, creativity and innovation engineering, creativity methodology, creative study of invention, technical creativity, etc (Golestan Hashemi, 2006, p. 12).

This knowledge can be in a wide range of definitions consisting of creative world view or a comprehensive approach to sciences and technology and the other end is about different kinds of inventive problem solving and creativity techniques. One of the prominent scientists in this field, Simon Savranski defined the knowledge as:" humanistic-centered knowledge based on established methodology for inventive problem solving" and some of the theorists presented this definition: "TRIZ is a kind of algorithm approach for inventive solution of technical problems" (Golestan Hashemi, 2006, cited in Savranski, 2000, p. 23).

TRIZ history

TRIZ foundation was based since 1946 by Altshuller based on the results of the study of various inventions. Altshuller investigated more than 20000 patents to find how the inventions are solved as inventive problems (he discovered inventive and creativity problem). Among them, Altshuller reviewed 40000 important inventions or creative and inventive solutions carefully.

Based on the results of analytical creativity study, Altshuller achieved important discoveries and presented the principles of TRIZ as new and valuable science to the world (Golestan Hashemi, 2006). This theory was evolved after being proposed by Altshuller. These stages are shown in table 1.

[1] TRIZ= Teoriya Resheniya Izobretatelskikh Zadatch

The main components of TRIZ

1- Ideality: It means that technical systems are directed to the increase of ideality degree. Ideality or ideal final result is the ratio of the total positive and useful aspects of the system to the total negative and harmful aspects of the system.

2- 4-stage problem solving system

1) Identification of the problem

2) formulation of the problem

3) Discovery previously solved (using 39 engineering parameters)

4) using discovered solutions models (using 40 invention principles)

3- Five levels of problem solving and innovation

1) Personal solutions

2) minor improvement

3) major improvement

4) new concepts

5) fundamental discovery

4- Analysis of substance –field (VEPOL Analysis): By problem analysis, it is divided into two types:

a. familiar problems as standard ones

b. unfamiliar problems as non-standard problems

5- 8 rules of transformation and evolution of technical systems (technology progress rules)

6- 76 standard inventive solutions: The standard problems recognized by VEPOL can be solved by 76 standard inventive solutions.

7- Contradiction matrix: In TRIZ, inventive issue is called contradiction and it means two contradictory positions or contradictory qualities, increasing the quality of one of them reduces the quality of another one and inventive problem solving is the discovery of solution of this contradiction.

8- 40 principles for invention and innovation

9- A set of fundamental scientific effects (Physical, chemical, geometry and biology effects)

10- ARIZ method (inventive problem solving algorithm): ARIZ is an established instruction to identity the non-standard problem solving by the capabilities of all the techniques of creativity. Generally, four main concepts in TRIZ are as:

1- Evolution and transformation of technology systems

2- information record TRIZ

3- standard and non-standard problems

4- ARIZ methodology

Table 1 Historical trend of TRIZ (Litvin, 2005; Petrov 2006; Sidorchuk, 2006).

Year	History
1956-1959	The algorithm included 15 steps and 18 Inventive Principles; a step with "Ideal Final Result" was introduced.
1963	-The term "ARIZ" was introduced, the algorithms being used for problem solving. The algorithm included 18 steps and 7 inventive principles (with 39 sub-principles) (Altshuller, 1963)
	- Altshuller published the first system of the Laws of Technical Systems Evolution.
1964	Altshuller published the first technical rules system of Triz
	The algorithm included 18 steps, 31 inventive principles, and the first version of the Matrix for Resolving Technical Contradictions (16x16 parameters).
1964-1968	-The next version of ARIZ included 25 steps, 35 inventive principles, and the Matrix for Resolving Technical Contradictions (32x32).
	-Developing techniques for Creative Imagination (e.g. Method of Focal Objects,
1971.	ARIZ-71 included 35 steps, 40 inventive principles (with 88 sub-principles), and the Matrix for Resolving Technical Contradictions with 39 parameters
	o Development of a Database of Physical Effects had begun by
	Yuri Gorin, which linked generic technical functions with specific physical effects
1974	Establishing a St. Petersburg School of TRIZ
1975	-A new approach to solving inventive problems was introduced: Su-field Modeling) and the first 5 Inventive Standards which were later extended to 76 Inventive Standards were published by Altshuller.
	- ARIZ-75B included 35 steps, and introduced several new major TRIZ concepts.
1979	Altshuller publishes "Creativity as an Exact Science.
1985	A major step in TRIZ evolution: appearance of ARIZ-85 (Altshuller, 1989). It included 32 steps, and introduced a number of new rules. 76 Inventive Standards were presented(Grasimo, 1988)
1989	The first TRIZ software "Invention Machine™" was released by Invention Machine including 76 Inventive Standards and 40 Triz principles and Physical, Chemical, and Geometric Effects
1990	Russian-language "Journal of TRIZ" is launched
1990-1994	A database of Biological Effects was published by V. Timokhov
1994-1998	The Russian TRIZ Association becomes International TRIZ Association
1998	Altshuller passed awy and TRIZ online journal was launched in 1998.
1997	ARIZ-77 included 31 steps, and introduced the concepts of a physical contradiction at micro-level, a pair of conflicting components, operational time
1997-2004.	-A simplified version of TRIZ, Systematic Inventive Thinking (SIT), European TRIZ Association was established (Caplan, 1999).
	-Altshuller Institute for TRIZ Studies is established in the US
2008	New tools based on previous studies emerge, such as Hybridization, search based on AFD activity ,etc (Litvin, 2005; Petrov, 2006; Sidorchuk, 2006)
	New version of ARIZ and initial proposal for a system of 150 Inventive Standards.

Six Sigma

Six Sigma is the system including a set of continuous improvement tool to focus on the analysis processes and their comparison and allocation of the resources to the processes in need of consideration. The failures in the organizations processes lead into the re-work, waste, costs and extra human resources. Focusing all the attempts on reduction of the failures besides the reduction of re-work, reduces the costs of processes. Six Sigma b defining the measures showing the failures in the process, they compare the function of various processes and help in decision making about the focus of the resources for better function.

Six Sigma methodology is a commercial attitude helping the companies working at global quality level and following the continuous improvement and to achieve the high satisfaction of the customer. The criteria in this methodology relate the organizational strategic values and goals to the needs and expectations of the customers.

The introduction of Quality Function Deployment (QFD)

QFD as an approach in design was proposed by Akao in 1996 in Japan. This approach was applied first in Mitsubishi s kobe ship yard and was used in 1972. Then, it came into USA in 1983 and it is used widely in most of the countries (Abdolbaqi, Raeesi, 2006). QFD can be used as an overall concept that provides a means of translating customer requirements into the appropriate technical requirements for each stage of product development via systematic development of the relations between customer demands and the features of product quality. This process is started with the quality of function components and then it develops to the quality of all the parts and processes (Abdolbaqi, Raeesi, 2006).

QFD is the system translating the customer needs to a suitable product. In other words, that type of the needs of the customer that can be met by product function that can be implemented by quality function. According to the definition of Yoji Akao, the founder of QFD, it is the needs and expectations of the customer to a product being translated into the features of the product. The aim of QFD is fulfilling the demands of the customer that in a tangible object can present customer desirability to him. The history of QFD is briefly shown in Table 2 and Figure 1.

Table 2.The history of QFD (Rezayi et al., 2005).

Year	History
1966	The first attempts to use "quality deployment" concepts by Dr. Akao in Japan.
1972	The introduction of evolved method of QFD in shipyard company of Kube by Akao to design the oil tanks
1978	Holding an independent committee in quality control institution of Japan for more searching in QFD
1980	Deming prize given to Kayaba company by good establishment of QFD method
1983	Publishing the first paper about QFD in north America
1984	Holding the first course (1-day) of QFD in USA. The introduction of the authorities and engineers of Ford company with QFD by Dr. Donald Kelaring
1985	Using QFD in Ford company and parts suppliers
1986	Holding the first course (5-year) of QFD
1987	Publishing the first book of QFD in USA by Bob King
1988	Publishing an important paper on the house of quality
1989	Holding the first seminar of QFD in Northern America
1190	Presenting a software on QFD
1991	Publishing a book on training QFD
1993	The start of the first research institution on QFD in USA
1994	Translation of the book of Dr. Akao and Dr. Mizomi in USA

The elements of QFD

QFD is consisting of two parts leading into deployment in design process and one is quality and the other is function. Quality deployment translates voice of customer to design process (Abdolbaqi, Abdolmajdi, 2006). This is done with the identification of design goals, parts features and product related to customer requirements and leads into Assurance of design and production quality. Function deployment does it in relation with various function sections in the organization related with production design and they do it by design team. The functional experts reduced the problems of the communication between design stages and functions.

To achieve the quality goals and what is called

QFD, various methods are used in QFD. The main tool for implementation of QFD is the house of quality or the elements and there are different methods for the implementation of each element. The method of the house of quality in QFD:

The first matrix of this method is called the house of quality (Fig. 3). The experts of QFD believed that if this matrix is completed totally, the project is finished at the initial stages and based on the importance of this matrix, the following seven sections are as (Radman and Zakerzade, 2005).

a. The customer requirements
b. product features
c. The importance of customer requirements
d. planning matrix
e. The relation between customer requirements and product features
f. Correlation matrix between engineering features
g. The priorities and goals of each of the engineering features

If QFD is used correctly, it can be an effective method to consider the voice of customer in new products and process design (ibid). The benefits of QFD are deployment of team work and participation culture, systematic deployment of documentation and combining all operating needs, reduction of the failures and mistakes, creating the lowest changes in design and defining the weakness and strengths of manufacturing with competitive manufacturing resources (Abdolbaqi and Raeesi, 2006).

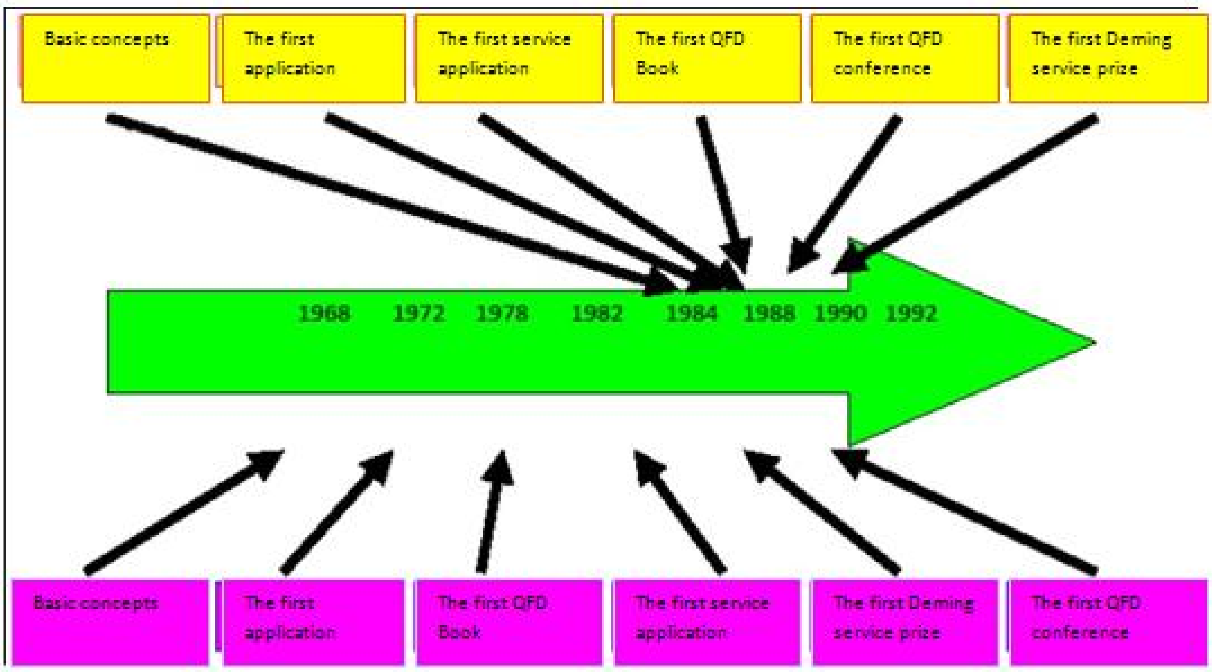

Figure 1.The historical trend of QFD in Japan and Northern America (Abdolbaqi, Raeesi, 2006).

The application of TRIZ and Six Sigma approach

In Six Sigma approach, DMAIC improvement cycle was used . The improvement cycle is the enriched form of Shiuhart improvement cycles (P.D.C.A), (P.D.S.A).

The significance of DMAIC cycle is in its structure. This system defines Six Sigma projects obviously and their results are as standard in daily performance. Six Sigma approach is introducing methodology of the sigma, with three aims (increase market share, strategic cost reduction, grow profit margin. At first the valuable processes of the organization are recognized to achieve the excellent goals and some indices are defined to reduce error in them.

Then, the capability of these processes is evaluated to define the minimum reliability of this process based on the obtained indices and the process is in the path of some sigma. The first point is that the processes should be a basic for further activities of Six Sigma approach, being defined well; the second point is that the collected data are of great value. In this stage, DMAIC cycles as the following stages are used. To make this cycle efficient in each phase, the method of using TRIZ creativity knowledge tools.

Define phase

In this phase, the goal and project scope are defined and the existing information of process and customer, defined indices and their efficiency, and the organization process map and if the true monitoring of the organization is estimated, the weaknesses or strengths are defined. One of the techniques that in this stage can give us a complete definition is Innovation Situation Questionnaire (ISQ), extraction of useful and harmful functions about the ideal design of the problem helping you in this issue. It can be said that for full definition of the problem, it should be investigated well and the problem dimensions should be understood and be evaluated from various views. It is better than historical fields in problem solving and prediction of future should be considered. Considering the resources in TRIZ literature as air, vacuum, energy, etc. The contradictions of the problem (e.g. why reworking is created and why despite our attempt, the customer is not satisfied, etc).

The stages of innovation success questionnaire

1- Collection of the information about the system or product that should be changed, in this stage, useful and harmful functions are determined in the system. The identification of the functions helps us to give the ideal design.

2- Existing resources: Resources in TRIZ literature are said to two substances (even waste) existing in the system or environment and can present function commonly. It is said that some of the resources are nothing, vacuum, bubbles, energy conservation, free time and many physical resources, etc) and in this stage all the resources should be identified.

A list of the resources is time and place resources.

3- Information about the system position, some cases as presenting improvement solutions, elimination of harmful effects, the process creating the problem, the history of the problem and others are identified in this stage.

4- System change, the review of different kinds of useful and harmful changes affecting the systems and the changes you create should be identified in this stage.

5- Some indices to select the ideal plan, some cases as innovation, good technical and economical features and good schedule to achieve this plan can be used in this stage.

6- The history of tested solutions on a problem even at historical creativity can helps us in presenting the ideal plan that should be identified.

Useful and harmful functions

The definition of useful function: Any function leading into the improvement of the system is useful function. The definition of harmful function: Any function avoiding the system improvement is called harmful function. The identification of useful and harmful functions of the system or product gives us a clear future of the system and determines the improvement points or the related barriers. Some of the tools being used in define phase in Six Sigma are:

- project chart (existing condition)
- The analysis of SIPOC beneficiary
- Total return
- The voice of customer
- Customer dependency chart
- Critical To Quality (CTQ) tree
- Cano model

The analytical survey of six-sigma tools gives good information about the current condition of the problem and customer expectations and contradictions but its approach is not from innovation view and it is improving system. Using TRIZ tools and Six Sigma at the same time present inventive solutions, ideal plans and identification and elimination of harmful functions and using free resources (1-8 stage 2) in the system.

Measurement phase

In measurement phase, the aim is that by data collection about the current conditions focus on improvement activities. In this stage, by substance-fields models, and Technical contradictions (as following), valuable information of the problem is obtained. Many problems are solved in case of having accurate definition of these two models:

Substance-Fields model

Two cases are required for formulation, one the problem is used to eliminate the current problem and eliminating two or more technical contradictions, second this problem has not contradiction at first, and improving the problem is required. Fields-substance model is used in the latter, as at first the system is analyzed into some subsystems, then the components of each subsystem is classified as following:

Any system is designed to do some functions. Good function is the system output and substance (S1) is obtained of another substance (S2) or by the aid of some fields (F) as effective (Figure 2).

In case of using this model, if instead of complete system as figure 2 models (two substances and at least one field), we faced an incomplete system or complete but harmful effect, the system is completed by adding some items. One of the features of the model is such that after modeling the problem, 76 standard solutions are used to achieve the improvement and innovation.

Figure 2. Substance-field model

Contradictions analysis model

Contradiction model: The position in which the attempt is made to improve one aspect of problem on another one with negative effect, the contradiction is as technical and physical defined as:

Technical contradiction definition: If improvement in a feature of a product or service loses one or some features, a technical contradiction is created.

If two ideal conditions are different, one feature of the product or service has two different good positions, physical contradiction is created.

After the identification of the contradictions, if the contradiction is technical, by identification of good and bad parameters by contradiction table, various solutions are extracted.

Ideal plan

The definition of ideal system: Ideal system is the one that without any negative function (without existing) creates positive function. One of the important factors in problem solving is the distance between current plan and ideal system (relative). Based on the above relation, if the useful functions are increased, the problem is directed to ideal position. There are six methods to achieve the ideal design in identification of the ideal position of the problem.

1- Elimination of additional functions, as they are eliminated and their activity is given to the main activities.

2- Some of the components are eliminated as possible and their function is given to the resources.

3- Identification of service providing to self and in problem solving, various components are used for giving service to self (doing parallel functions).

4- Changing the components of some parts or total system

5- changing the operation principles

6- using the resources

By six items, we can design an ideal plan. Some of the applied tools in this stage in Six Sigma are as:

1- Data collection plan
2- data collection forms
3- control charts
4- Frequency char ts
5- R&R gauge
6- Parato charts
7- Prioritization matrix
8- FMEA
9- process capability
10- Process sigma
11- Sampling

By viewing the above tools in Six Sigma, it can be said that the above tools had the role of data collection and try to improve it by the experience of the process and they have improvement approach while by using substance-fields models and contradictions and using ideality, some conditions for innovation in a product are increased and after the identification of the contradictions via agreement doesn't cope with contradiction and provide the solutions to escape from it.

Analysis phase

In this stage of Six Sigma, the reasons of problems are analyzed and identified and these reasons are verified and solutions in problem are identified. It can be said that in this phase, the contradictions are identified obviously and if some techniques except TRIZ are used, it is dealt with adaptability and there are no good response in most cases. TRIZ tools by parameters and forty principles in contradictions table give the best proposition to cope with the contradictions and it leads into innovation or new product.

If the problem is determining the system improvement solution, by substance-fields model, the best solutions of a table can be presented. In this table, after formulation of the problem, three different paths are proposed for problem solving:

Prediction of change creation potential, needing improvement, discovery and measurement

If the system changes are defined, we go from the first path of algorithm (prediction of potential of creation of change) to the next stage, in this case depending upon the changes of class 2, 3, 76 standard solutions are used for problem solving.

If the problem needs improvement, depending upon the interaction of negative functions with the problem (it is effective completely, it is not effective completely and it is possible it is effective), algorithm proposes three various paths. If the harmful functions have no effect in the problem, we go to the lack of existence path and solutions of class 1,1 takes us to the solution. If the negative functions are effective completely in the problem, we go from harmful functions path and its solution is using the solutions of class 2 of 76 solutions. Finally, if harmful functions are effective in the problem, using classes 1 or 2 is problem solving.

If the problem needs measurement or discovery (zero state and one direction control) using the solutions of class 4 can be effective in presenting solution. It can be said that field-substance and table and ARIZ algorithm can solve the problems innovatively. By the review of the tools of analyze phase Six Sigma is used:

Data collection plan	Control charts	Causality charts	Brain storming	Dependency chart
Hypotheses test	Frequency chart	Flowchart	Experiments design	Data collection forms
Distribution and classified frequency charts	Sampling	Response level methodology	Regression analysis	Parto chart

It can be said that the above techniques, despite receiving the data from the previous stage, don't present definite solutions to improve with the same speed TRIZ techniques present and they are changed into innovation less. The important factor in TRIZ tools is using human knowledge as by presenting innovation models, required ideas are given to him.

Presenting evolution models

Another tool as effective in analysis phase is using 8 evolution models in problem identification. If by the previous record of the problem, we define the previous evolutionary trend, its future plays an important role in presenting problem ideality. In TRIZ tool box, the following 8 evolution models for progress are introduced as:

- Stage evolution
- evolution for more ideality
- evolution via non-uniform development of the components of system
- evolution for dynamic and control test
- evolution via increasing complexity and then simplification
- evolution via consistent and inconsistent components
- evolution to macro level and increasing the use of fields
- evolution to reduce the human involvement

After presenting an ideal solution, by evolution models, the future of its product is determined.

ARIZ method

ARIZ method called established innovation algorithm helps 1% of the innovation problems with no definite solution and they are called fifth level, these problems after being solved lead into new discovery and invention.

Improvement phase

The aim of this stage of improvement cycle is testing and implementation of solutions (innovation) relates to original reasons and its output is the tested and planned activities to reduce or eliminate the effect of original reasons. In this phase, the data of ISQ, substance-field model, contradictions analysis, predicted evolution models with other techniques related with Six Sigma as brain storming, agreeing, creativity and innovation techniques, tests design and FMEA and hypotheses test for fulfillment of the ideal plans extracted of the previous stages are tested and if there is any problems, they are eliminated. Some of the cases of great importance are registering the results as it leads into invention and an experience to identify and solve other problems.

Control phase

This stage is aimed to control and evaluate the plans, solutions and keep the achievements by process standards and formulating general lines of improvements and in case of true evaluation by some plans, new opportunities are identified and besides registering the innovations from the previous stages, apply the similar cases for other projects by TRIZ parameters and by using TRIZ futuristic models, the project future is estimated.

Using TRIZ in QFD

Using QFD and TRIZA techniques at the same time to present inventive design ideas and helping to eliminate the existing contradictions in the product increases the ability of the team being active about the design and development interestingly.

ARIZ is an algorithm in TRIZ to eliminate the engineering contradictions. ARIZ aim is translating the main problem to some small problems. By some established principles of patent data bank and the existing resources in the system, the problem was solved.

Contradictions: Another main approach in TRIZ is being aware of contradictions and direct focus on them. The identified contradictions in TRIZ are divided into two types:

Engineering contradictions and physical contradictions

Engineering contradictions: Engineering contradictions are defined as the direct contradictions about the parameters and elements of a system. For example, the desire of the customers about the customers. Based on the studies on patent database, Altshuller found that in most important inventions, there are some contradictions and all of them are eliminated and there is no peace. By classification of the contradictions and presented responses in the inventions, there is a point attracting the attention of Altshuller and it was using 40 inventive principles regarding engineering sciences present in most of the contradictions and is mentioned in 40 principles of Triz.

Conclusion

Based on the title of the study, it is attempted to review the relation between creative thinking and quality management systems and there is an interaction between them. The interaction between the indices and the goals of quality management systems as Six Sigma and QFD by creative thinking showed the good relation to eliminate the existing issues in the house of quality and Six Sigma by creative thinking.

Reference

Abdolbaqi, A.M. (2006). The application of QFD technique in determining the physical features of bank branches. Best site.

Abdolbaqi, A.M.(2006). *The application of QFD technique in respecting the client.* The fourth international conference on quality. Tehran.

Bashiri, M., & Kazemzade, R. (2002). *The audit of fulfilling the needs of the customers*, The third international conference of quality. Tehran.

Golestan Hashemi, S. M. (2003). *An introduction of creativity knowledge.* Jihad Daneshgahi publications.

Jafari, D. (2000). QFD in fuzzy space. MA thesis. Industry and Science University of Iran. Tehran.

Jafarzade, M. (2007). *Creativity engineering of TRIZ a catalyst in DMAIC improvement cycle of Six Sigma.* The second international conference on Six Sigma. Tehran.

Kamran, N. (2003). T*he application of the combination of QFD, Triz in designing customer-oriented product in electricity industry.* MA thesis. Amirkabir industrial University. Tehran.

Mansurian, A. (2007). *Creativity engineering (inventive problem solving theory of TRIZ*). Rasa publications. Theran.

Mojtabayi, M. H. (2007). T*he role of Six Sigma and established innovation engineering approach TRIZ and international standards of quality management in development of the organization.* The second international conference of Six Sigma. Tehran.

Adibi, M., Seyedi, P., Seyed, M., Iran.B., & Seyed,

J. (2008). *The study of the requirements of customers in maintenance by QFD, AHP.* The first national conference of TPM. Tehran.

Osuli, S. H., & Kazazi, A. (2004). *Determining the features of bank services (LC service) by matrix of the house of quality, i*nternational conference of industry engineering. Tehran.

Radman, K., & Zakerzade, H. (2005). *The role of QFD in supply chain management.* International conference on supply chain management. Tehran.

Rezayi, K, Hosseini Ashtiani, H., Hushiar, M., & Vaziri, F. (2005). *QFD customer oriented approach to planning and improving product quality.* Tehran. R-V-TOF company publications in Iran. Third edition.

Seyedi, Seyed ,M., & Mostafa Adibi, P. (2007). *The combination of quality control systems in maintenance of total productivity.* Regional conference of research achievements in technical and research fields. Shiraz.

Seyedi, Seyed ,M., Mostafa Adibi, P., & Mait, M. (2007). *QFD in Six Sigma.* The second international conference of Six Sigma. Tehran.

Shahbazi, S. (2007). T*he application of problem solving software and TRIZ in Six Sigma (Application of cps and TRIZ) Software in Six Sigma).* The second international conference of Six Sigma. Tehran.

Shahriari, M. R. (2002). *The review of neural networks in QFD technique*. The third international conference on quality mangers. Tehran.

Tadayon Kazemi, M. (2002). *The design of the product by QFD technique in Foolad Mobarake company.* Third international conference on quality management. Tehran.

Terninko, J. (2007). *TRIZ. Established innovatio*n. Translators: Seyed Mostafa Jafari, Seyed HOssein Osuli, Amir Hossein Fahimi, Reza Mori, Resa publications. Tehran.