

Analysis on Methods to Applying TRIZ to Solve Management Innovation Problems

Ya-qiang ZHANG*, Hong-mei LI

Department of Business Administration, Xingtai University, Xingtai Hebei, China
(tjhbzyq@126.com)

¹ *Abstract* - Being an effective way to technological innovations, basic ideas and methods of TRIZ can be applied to the methods of management innovations. There is difference between technical system and management system, but at the same time management innovations provide more space for the application of TRIZ, management problems having more solving paths and possible solutions. The key point of applying TRIZ in the method of management innovations successfully is to innovate TRIZ methods according to the characteristics of management system. This paper discusses the methodology advantages of applying TRIZ in management innovation, put forward the basic idea of the management specialization of TRIZ to management innovation, as well as the basic work of the management specialization of TRIZ.

Keywords - Conflict, management innovations, management specialization, TRIZ, TRIZ methodology

I. INTRODUCTION

TRIZ is Theory of Inventive Problem Solving, first started by Soviet inventor, the chairman of Inventors Association, Genrich S. Altshuller, from 1946. It puts forward a complete system of theories and methods for inventive problem solving on the basis of studying two million high level patents around the world. It mainly aims at studying the principles and laws that human beings follow during innovation, invention and technical problem solving.

TRIZ provides a set of standardized tools to guide the direction and process of innovation [1, 2], such as Contradiction Matrix, invention Principles, technical evolution rules, Substance-Field analysis, the Innovation Algorithm (ARIZ) [3], and so on. Meanwhile, TRIZ provides a number of methods to overcome thinking inertia to train professionals' innovative thinking [3, 4], such as miniature person model, STC(Size-Time-Cost) operator etc. TRIZ allows humans' innovation activities have the potential to become a systematic process to be learned, trained and operated, and it is now recognized as the most systematic and mature innovation methods theory.

TRIZ have begun to receive academic attention in China, and get a better application in the field of engineering and technology, but less so in the field of management innovation. This paper attempts to explore the idea of using TRIZ for solving management problems.

II. APPLICABILITY OF TRIZ FOR MANAGEMENT INNOVATION

TRIZ regards the core of innovation is to solve conflict. Management innovation problems may be thought of as the elimination of management conflict. According to Ma Qingguo's definition, management is the arrangement made about a system and its consisting components in order to achieve a certain goal [5], before achieving the goal. This definition is quite suitable for the studies of management innovation methods: The "arrangement" is a state, the process of transition from one state to another state is management innovation [6]. Transformation of arrangement may result in conflicts between management elements, people can use TRIZ to define management problems and conflicts, to confirm management innovation direction until using the invention principles and tools to eliminate management conflicts.

However, TRIZ is the summary of the law of inventions in the field of engineering and technology. After all, technology systems and management system is different, the former mainly is about object system, while the latter is more of a system comprised of human and objects, which is becoming more complex because of human involvement. "Human" factor make management study face two difficulties, which are manager's image thinking and management situations [7]. Apart from under specific work environments, the various management elements are also under the influence of mode of thinking of the management body. The key to successfully apply TRIZ to management innovation is to carry out innovation to TRIZ method, combining the features of management object system.

What needs to be pointed out is that "human" factor provides more space for applying TRIZ into management innovation.

Firstly, as a kind of soft technology, management is still a technical system. The main characteristic of soft technology differs from hard technology is that its action target is the operator [8], the action mode of soft technology is limiting the actions and methods between operators and between operator and tools by rules systems, adjusting the way, method or process of operator by regulations and standards. Therefore, the management system is still a technology system, as a technological invention theory, TRIZ's majority outcomes still apply to management innovation.

Moreover, it is more flexible in the aspect of adjusting and regulating human, providing more opportunities for management innovation. From an

¹ This paper is subsidized by the Natural Sciences Fund in Hebei Province (No. G2013202184) and the Science and Technology Research Projects for Colleges and Universities in Hebei Province (No. QN2014322)

analysis of a large number of conflict-solving strategies, Extension theory finds out that objects can be analyzed from different angles [9], in which the concept of object is a much broader. In the aspect of materiality, objects have material part (real part) and non-material part (imaginary part); in the aspect of systematicness, objects have consisting parts and relationships (hard part and soft part); in the aspect of dynamic, objects have revealing part and hidden part; in the aspect of opposition, object have positive part and negative part about certain characteristic. Many innovations take advantage of objects' imaginary part, soft part, hidden part and negative part, which makes some conflict problems that hard to solve to transform. In management system, "human" factor is often reflected as imaginary part, soft part and hidden part of system, the adjustment of human contains more opportunities for innovation, this adjustment is more flexible, and often is no-cost or low-cost, which actually does benefit to system's evolution to IFR(the Ideal Final Result). For example, JIT innovation puts more emphasis on the continuous optimization of human and organizational aspects, such as Kanban, multifunctional workers, visualization, etc.

III. THINKING OF USING TRIZ FOR SOLVING MANAGEMENT PROBLEM

TRIZ is a kind of heuristic methodology, does not aims at each specific problem of users, generalizes specific problems as general problem and provides general solutions through the abstracted standard models. TRIZ offers a range of standard analysis models without technical jargon, such as engineering Parameters, Contradiction Matrix, Substance-Field analysis, ARIZ etc. Then TRIZ compares the general solution with specific problem and transforms to the solution of specific problem, realizes it in practical design and finally getting the practical solution of specific problem. The methodology of TRIZ for problem solving is shown in Fig.1.

A. Advantage of TRIZ Methodology

TRIZ is different from the conventional science and engineering methods, is very practical. Its methodology strengths can also be applied to management systems, is beneficial to solve management problems.

1) TRIZ is the Embodiment of Philosophy Principles

Opposition and unification law, from quantitative change to qualitative change law and negative of negative law, these three laws in Dialectics of Nature as the most common applied law are too macro and uneasy to operate. TRIZ's technological evolution modes and routes are a kind of reveal and summary of these objective laws which is easy to operate, and are also reflected in the other tools of TRIZ system. Actual designers do not need to focus on the internal relations between all evolution principals, simply need select and materialize it. In this way, TRIZ embodies general technology philosophy, also has become a practical design and invention tool.

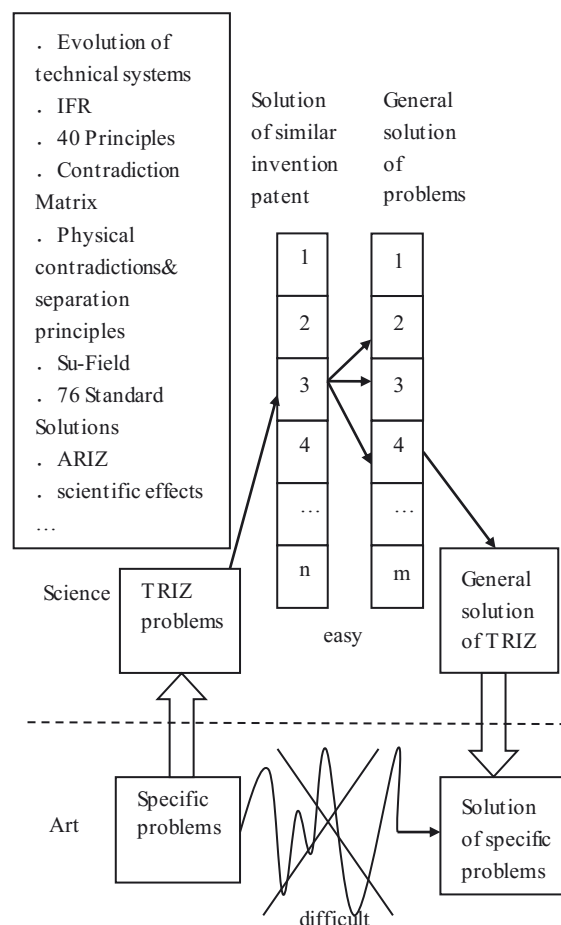


Fig.1. TRIZ methodology

2) TRIZ is a Methodology of Knowledge-based, People-oriented Innovation Problem Solving

The knowledge adopted by TRIZ are abstracted from the world-wide patents, TRIZ's design allows and supports many rounds of repeated use of these abstract knowledge. Based on abstract knowledge, TRIZ provides a set of standardized analysis models, which transform fuzzy original invention problems into simple problem models, and try to avoid using technical terms, so may more widely uses knowledge outside of company, industry, subject for problems solving.

For complex design problems, an inventive principle is not enough, in the selection process of principles, in-depth consideration of problems and experience are needed. In the transformation process from general solution to specific solution, in-depth thinking, ingenuity and experience about problems are also indispensable. Thus, TRIZ is based on tacit knowledge and experience, so is based on human, and TRIZ's application is linked with designers' experience and mature process. As pointed out by Qian Xuesen, quantitative methodology for dealing with complex systems is a combination of scientific theory, experience and expert judgment. This kind of methodology is a semi-empirical and semi-theoretical [10].

3) *TRIZ is a Reverse Search Mechanism of "Target-Approach"*

Different from the positive "condition-result" mode of current science and technology system, at the beginning of problem-solving, TRIZ confirms the direction and position (technological evolution, the Ideal Final Result) to avoid repeating exploration work in other methods, and then explores specific solutions with appropriate principles or laws, improving the efficiency of innovation.

TRIZ has many advantages, which makes the introduction of TRIZ into management system can be directly based on TRIZ's ideas, methods and frameworks. In particular, the stylized analysis tools about innovation problems, such as Substance-Field analysis, ARIZ algorithm, can be directly introduced in the analyzing and solving of management problems, because a thorough analysis of problem often means to solve the problem.

B. Management Specialization of TRIZ

Introducing TRIZ into management systems needs to make adjustments about TRIZ, according to the characteristics of management innovation. There are two possible directions, one is adding, amending the components and tools of TRIZ in view of management system, the other is carrying out necessary simplification to adapt practice in management field.

1) Revise of TRIZ for Management Specialization

TRIZ mainly is the summary of invention knowledge in engineering and technology field, though technical jargons are avoided as much as possible, there is still deep specialized "mark" of engineering and technology. A considerable part of inventive principles and analytical tools are applicable to management problems, but parts of evolution rules and innovation principles need to revise.

Evolution law of technical system is an important basis of TRIZ. Rule of "evolution to micro-level and application of field" need to adapt to the management system, summarizing different energy fields of management. S-curve evolution rule is changing due to human factor in management system. Specific amendments of evolution laws will lead to adjustment of other innovative principle and methods structure.

39 engineering Parameters and 40 Principle should make professional adjustments according to management problems, particularly designing the standard parameters about management system. Reference [11] has made relevant attempts.

Segmentation principle is also proved to have good usability in solving management contradictions. However, what is difficult for management arrangement is the segmentation of system factors, managers stress more on some sort of "art" of "balancing and focusing". This requires the introduction of relevant principles of balance and symmetry, guiding to solve management innovation problems.

2) Simplification of TRIZ for Management Specialization

Relevant surveys show that the use of management tools in enterprise is not optimistic [12]. The complex and complicated process, high demanding of resources, the

limitation of environment and culture conditions is unfavorable to the use and success of traditional management tools. This also reflects the current management theory has wide applicability and constrains of implementation conditions, management disciplines is more like a mysterious jungle, rather than a familiar path. Simple, practical management innovation logic is more practical significant, is conducive to change the "management jungle" situations.

Given the using experience of management tools and techniques, TRIZ should constantly enrich its knowledge base and improve its tool system, at the same time, should carry out necessary simplification about management problems to facilitate the application of management practices. For example, after professional adjustments are made about general engineering Parameters and 40 Principles targeting at management problems, it is about to determine the Parameters and Principles that are more often used, confirm the priority and reorder, form a new simplified management Contradiction Matrix. Administrators can even skip the analysis and applications processes of Contradiction Matrix when solving certain problems, directly consider high priority invention principles, which can increase the efficiency of innovation.

3) Basic Work of Management Specialization of TRIZ

TRIZ in nature is a knowledge base about innovation rules and offers a range of principles and tools which can be easily retrieve by users. This knowledge base is constantly evolving and improving, new knowledge and systems are being added to TRIZ, such as, new symbol system of Substance-Field model, further development of conflict and solving technologies, improvement of ARIZ algorithm, integration of TRIZ, Robust Design and QFD(Quality Function Deployment) [13], simplified TRIZ model [14, 15], and so on. The management specialization of TRIZ is based on TRIZ framework, should also be a process having constant additions and amendments with regard to management innovation rules. It is hard to complete the theory work once for all, not a simply mechanical application of TRIZ in management system. Applying TRIZ to solve management innovation problem needs summarize management theories and management practice experience, refine general management innovation rules, especially summarize new evolution rules, innovation principles, standard solutions or effects about management problems formed by the influence of human factor, as pointed out above, the adjustment about human is more flexible, which provides more solving path and feasible solutions for management innovation.

IV. CONCLUSION

TRIZ, as a summary of invention & innovation rules in engineering and technology field, its fundamental ideas, methodologies and frameworks can be used by management innovation. TRIZ in essence is a knowledge base of rules related to invention and innovation, is also a methodology of solving innovation problems base on

knowledge and human; its application in management innovation problems has more space, is more conducive for managers to use management knowledge and management experience, providing more solving path and feasible solutions for management innovation.

The application of TRIZ to solve management problems needs to target at the characteristics of management system, make professional adjustments to TRIZ, for example, selecting new management Parameters, setting up a management Contradiction Matrix, on this basis, carrying out necessary simplification about Contradiction Matrix and innovative Principles in order to facilitate the use of managers. In addition, TRIZ system about management innovation should also be a acknowledge base with continuous accumulation and enriching.

Problem of Solving” (in Chinese), *Manufacturing Automation*, vol. 24, no. 8, pp. 24-27, 2002.

REFERENCES

- [1] Yang Qingliang, *This Invention was Born - full Contacting with TRIZ* (in Chinese). Beijing: China Machine Press, 2006, pp. 11-24.
- [2] Altshuller G. S., *Creativity as an exact science*. New York: Gordon & Breach Science Publishers, 1984, pp.16-25.
- [3] Altshuller G S., *The Innovation Algorithm*. Worcester: Technical Innovation Center, INC., 1999.
- [4] Altshuller G S., *And Suddenly the Inventor Appeared*. Worcester: Technical Innovation Center, INC., 1996.
- [5] Ma Qingguo, “Several key problems of management science research in China” (in Chinese), *Management World*, no. 8, pp. 105-110, 2002.
- [6] Zhang Dongsheng, Xu Man, and Yuan Yuan, “Study on the method of TRIZ-based management innovations”(in Chinese). *Studies in Science of Science*, vol. 23, no. Suppl., pp. 264-269, 2005.
- [7] Li Huaizu, *Methodology of Management Research (2nd version)* (in Chinese). Xi’an: Xi’an Jiaotong University Press, 2004, pp. 18-30.
- [8] Ma Qingguo, Hu Longji, and Yan Liang, “Redefining the Concept of Soft-technology” (in Chinese), *Science Research Management*, vol. 26, no. 6, pp. 99-105, 2005.
- [9] Chou Cheng, Feng Junwen, and Guo Chunming, “Comparison of TRIZ and Extenics” (in Chinese), *Industrial Technology & Economy*, vol. 26, no.10, pp.105-107, 2005.
- [10] Qian Xuesen, *On Systems Engineering (revised edition)* (in Chinese). Changsha: Hunan Science & Technology Press, 1988, pp. 1-7.
- [11] Tian Xin, Ren Gongchang, “Research about the Conflict of Management System Based on TRIZ” (in Chinese), *Machinery Design & Manufacture*, no. 11, pp. 160-162, 2006.
- [12] Andrew Cox, Chris Lonsdale, Joe Sanderson, and Glyn Watson, *The Right Tools for the Job*. Palgrave Macmillan, 2004.
- [13] Tan Runhua, Wang Qingyu, “TRIZ-TRIZ Engineering, Tools and Development Trend” (in Chinese), *Journal of Machine Design*, no. 7, pp. 7-11, 2001.
- [14] Kalevi Rantanen, and Ellen Domb, *Simplified TRIZ (2nd edition)*. Taylor & Francis Group, 2008.
- [15] Zhou Jiehan, Xiong Guangleng, and Fan Wenhui, “Research and Progress on TRIZ: A theory of Inventive