



## Personal Report of The Sixth TRIZ Symposium in Japan, 2010

Held by the Japan TRIZ Society, NPO,  
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### Part H. Applications to Soft & Non-technical Areas

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Mar. 30, 2011; Updated: Apr. 23, 2011

[Posted on Apr. 14, 2011; Updated: Apr. 30, 2011]

For going to Japanese pages, press  buttons. Japanese translation of this page is not scheduled.

#### Editor's Note (Toru Nakagawa, Apr. 13, 2011)

This page is Part H of my Personal Report of Japan TRIZ Symposium 2010. Please see the [Parent page](#)  for the overall description of the Symposium and the general introduction of the Personal Report. I am thankful to the Authors for their permitting me to cite their slides here for introduction. [Click here for the PDF file of this page of Personal Report.](#)  (21 pages, 1.2 MB)

The following table shows the presentations which are included in this part.

Code	Author(s)	Affiliation	Title of presentation	Agenda	Review	Posting of individual paper
J107	<b>Yojiro Fukushima,</b> Toru Shonai	--, Hitachi	How to use TRIZ in software and IT problem solving	2nd day AM L-4 RB	 (Apr. 14, 2011) 	JTS Official site   (Dec. 1, 2010)
J13	<b>Satoshi Hasegawa,</b> Shoichi Tsuge, Tateki Oka	Konica Minolta Business Technologies, Inc	Expansion of USIT Operators' Matrix to Software Technical Domain	3rd day PM P-B1	 (Apr. 14, 2011) 	
J04	<b>Takuo Maeda</b>	Takumi System Architects, Ltd	Japan-oriented Creative Monozukuri (manufacturing and production) with TRIZ	1st day PM O-3 RA	 (Apr. 14, 2011) 	
J10	<b>Ikuo Yoshizawa,</b> Kimihiko Hasegawa, Akira Sato, Shigeru Kuno, Yasuo Moriya, Takuo Maeda,  Teruyuki Kamimura, Fumiko Kikuchi, Osamu Ikeda, Hisataka Izawa	[Business & Management TRIZ Application Sub-Team, Japan TRIZ Society]: The SANNO Institute of Management, Ideation Japan Inc. Keio University, NKN Consulting Co., Ltd., Fujitsu Advanced Technologies, Ltd., Takumi System Architects, Ltd., Willfort International Patent Attorneys.	An Application of TRIZ Way of Thinking and Its Tools to Develop a New Business Model	2nd day PM P-A2	 (Apr. 14, 2011) 	

		Pioneer Corporation, Sony Corporation				
J05	Atsuko Ishida	Hitachi Consulting Co., Ltd.	Evaluation of Methods for Creativity by Applying the TRIZ-based Business Idea Database to Business Problem Solving	3rd day PM O-18 RA	 (Apr. 14, 2011) 	
J07	Hideto Sanjou, Yukie Hanaoka	DOCOMO Systems, Inc., Wisdom, Inc.	A Practical-type Approach Applying TRIZ to the Mind Field – Toward the Establishment of a TRIZ Mind Training –	2nd day PM O-14 RA	 (Apr. 14; Apr. 30, 2011) 	
J16	Yukie Hanaoka, Hideto Sanjou	Wisdom, Inc., DOCOMO Systems, Inc.	Practice of Creative Thinking through TRIZ Mind Cards – Everywhere with Essence of TRIZ –	3rd day PM P-B2	 (Apr. 14; Apr. 30, 2011) 	JTS Official site   (Dec. 1, 2010)
J06	Toshio Takahara	–	The Ideal of TRIZ TRIZ as the Way of Life? Part 2	2nd day AM O-10 RB	 (Apr. 14, 2011) 	

## Part H. Applications to Soft & Non-technical Areas

Yojiro Fukushima ( ) and Toru Shonai (Hitachi) [J107, L-4] gave a 'Special Interest Lecture', i.e., an invited lecture on "How to Use TRIZ in Software and IT Problem Solving". The lecture was given in Japanese for 80 minutes (including Q&A) showing 20 slides in Japanese. I am quoting the Authors' Abstract here.

We hope that TRIZ can be used effectively in software and IT fields because TRIZ is said to be useful for the creativity reinforcement in general. However, when software and IT engineers actually tried to use TRIZ in their own problem solving, it does not go well sometimes and some beginners hesitate to use any more. Because TRIZ is based on the basic study of many actual inventions in many fields, it seems that it is applicable even to these fields. But, TRIZ shows no detailed algorithms for idea creation at all. It shows only directions in which deep consideration should be made to get their ideas. Because TRIZ cannot replace our creative thinking, application results depend greatly on those who apply. After a lot of experience of TRIZ application in the fields, some understood a basic part of TRIZ is to apply as it is and efforts have to be made to tailor TRIZ tools to use them in software and IT fields smoothly.

In this lecture, we will explain the methods for lowering the wall that software/IT engineers face when they apply TRIZ to their own problems. For instance, the replacement of the characteristic parameter terms in the contradiction table by terms in their fields, extended concepts of the invention principles, case studies of the invention principles in software and IT field, and application example of evolution patterns in the fields and so on. The TRIZ tools that are not limited to fields such as physics, chemistries, and machines, for instance, function diagram, operators, attribute analysis, SLP and so on can be applicable in software and IT fields as they are originally.

[\*\*\* Since the English translation of the slides is not ready yet, I am going to skip the introduction to this lecture for a while.]

Satoshi Hasegawa, Shoichi Tsuge, Tateki Oka (Konica Minolta Business Technologies, Inc) [J13, P-B1] gave a Poster presentation with the title of "Expansion of USIT Operators' Matrix to Software Technical Domain". The Authors' Abstract is quoted here:

We originally arranged USIT operators as a table (USIT operator matrix) and applied it to technology development and products development stages to promote efficiency of the development. In addition, we

extracted frequently-used USIT operators from the application patent investigation of the electrophotograph technical domain and planned promotion of efficiency in generating ideas in combination with the USIT operator matrix. Furthermore, we extracted frequently-used USIT operators from the application patent investigation of the software technical domain and arranged the USIT operator matrix to generate ideas effectively in the software technical domain.

[\*\*\* This Poster presentation has 16 slides in Japanese but essentially no slides (except the title slide and the Abstract slide) in English. Thus I will introduce this presentation only briefly.] The Authors have been introducing and applying USIT actively in their company since 2004. USIT has a system of solution generation methods called the USIT Operators, being composed of 5 groups, 32 sub-operators. The Authors arranged them in a tabular form, called 'USIT Operator Matrix', as shown in the slide (below) (translated into English by Nakagawa). Three groups of USIT Operators, which are operated onto Objects, Attributes, and Functions, are arranged in the three columns. The Operators are also classified as shown in the rows. This Matrix form helps us to understand the Operator system better, the Authors say.

USIT Operator Matrix			
Satoshi Hasegawa et al. (Konica Minota BT) (2010)			
Operation	Onto Objects	Onto Attributes	Onto Functions
Eliminate	(1a) Eliminate	(2a) Deactivate a harmful attribute	
Increase	(1b) Multiply into 2, 3, ..., ∞		
Divide	(1c) Divide into 1/2, 1/3, ..., 1/∞	(2d) -- vary in space	(3b) Divide the compound Functions and assign them separately
		(2e) -- vary in time	(3e) Vary the Function in space, use space-related Functions (3f) Vary the Function in time.
Unify	(1d) Unify		(3c) Unify multiple Functions
Substitute			(3a) Reassign to a different Object
Introduce	(1e) Introduce or modify	(2b) Activate a useful attribute	(3d) Introduce a new Function
	(1f) Introduce from the Environment.	(2g) Attributes at the micro level	(3g) Detection/measurement Function.
		(2d) Introduce a spatial attribute --- (2e) Introduce a temporal attribute ---	(3h) Introduce --- adapting/coordination/control
Replace	(1g) From solid to powder/liquid/gas	(2f) Change the phase or the inner-structure	(3i) With a different physical principle
Enhance/ Suppress		(2c) Enhance a useful or suppress a harmful attribute	(3h) --- Enhance adapting/coordination/control
		(2h) Properties of the system as a whole	

Note: '---' means a part of the operator separated and placed elsewhere.

The Authors analyzed about 600 patents (containing their company's 200) in the field of electrophotograph technology to evaluate the essence of the solutions in terms of these USIT Operators. Thus they have found that the top 10 sub-operators most frequently used are the ones shown in the yellow cells of the matrix. They are the operations of Division, Introduction, and Enhancing/Suppressing. The Authors use the matrix so as to generate ideas with the enforcement by the USIT sub-operators by turn in this matrix.

The Authors further analyzed about 100 patents (of their own) in the field of mechanical-control software technology in a similar manner. They have found the (2b) (2c) and (3h) sub-operators are often used in these fields, similarly to the previous study in the electrophotograph technology. In this particular software field they have noticed that rephrasing of USIT terms is useful: i.e., object --> system; attribute --> required property; and function --> control.

[Takuo Maeda \(Takumi System Architects, Ltd\)](#) [J04, O-3] gave an Oral Presentation with the title of "[Japan-oriented Creative Monozukuri \(manufacturing and production\) with TRIZ](#)".

[\*\*\* This is an intensive and bird-view presentation on the future directions of Japanese industry, especially software industry, with a keen sense of crisis. The Author is a software architect/engineer, having worked much in the field of application systems and embedded software, and became interested in TRIZ/USIT as a possible tool for solving critical difficulties in the software industry. He refers to a number of references in Japanese and some in English. I am going to introduce his presentation to you in some detail.]

Before quoting Author's (rather long) Abstract, I will show you his Agenda of presentation first, in the slide (right). Section 1 (Motivation/Question) and Section 3 (Utilizing TRIZ) are most important for us to understand his points.

With this Agenda in mind, let's read the paragraphs (1) and (2) of the Author's Abstract having 4 paragraphs.

**Agenda:**

- 1. Motivation**
  - Questions on Japanese Strong Monozukuri
- 2. Another example on the questions**
- 3. Utilize TRIZ to make Monozukuri stronger**

**Abstract (1):** Industries, such as automobiles, digital electronic appliances, mother machines, have been producing the highest quality products in the world and having the symbolic status of the strong Japan through "**monozukuri**". Monozukuri itself just means to make something, that is, to manufacture and produce goods. Today "monozukuri" has a broader meaning including development, production, procurement, service and recycle of products in high qualities. Monozukuri has been created and improved by hardworking efforts for many years to get the global competitiveness. The efforts are very sophisticated based on the Japanese tradition to produce very fine products. In the modern industries including automobile manufacturing, these efforts are sometimes called "**suriawase**", have done through lots of engineers cross companies sitting together. This style of effort is intangible, especially by foreigners. However, it seems to have been the key of the strong monozukuri.

**Abstract (2):** Now, growing needs of globally single market and ecological requirements are major drivers for new products. For example, electrical automobile is a typical emerging product to the near future. It requires less suriawase efforts because it is designed based on the **modular architecture**, integrates less number of parts which are procured openly and globally. Typical suriawase efforts will be less than now, resulting Japanese products might become weaker rapidly.

The basic reference the Author cites is the book written by Prof. Kenichiro Senoh (2009), shown in slide (below-left); its title means "Japanese manufactures have advantages with technologies, but are losing businesses". This book is popular in Japanese business; Toshimitsu Kataoka also referred this in his lecture of the present Symposium. The book pointed out the existence of structural problem in the business management of Japanese industries. The second references Prof. Takahiro Fujimoto's book (2004), see slide (below-right). The book discusses on basic types of monozukuri architecture. Japanese industries had the strength in the style of closed and integral (or Suriawase) architecture, but the industries in the world are shifting their weights toward the Modular architecture and the open procurement.

**Japanese manufacturers have advantages with technologies, but are losing businesses.**

the title means

Kenichiro Senoh, Diamond, 2009

**We believe Japanese monozukuri is very strong, but ....**

Basic types of monozukuri architecture are:

		Integral (Suriawase)	Modular
Closed Open (Industry standards)	Closed and Integral	automobile autobicycle electronic appliances game software , etc.	main frame machineries Lego etc.
	Open and Modular		PC, Software for PC Internet Bicycle Financial products, etc.

source: 「日本のものづくり哲学」 Takahiro Fujimoto, Nihon Keizai Shinbunsha, 2004, p.132

技術力で勝る日本が、なぜ事業で負けるのか

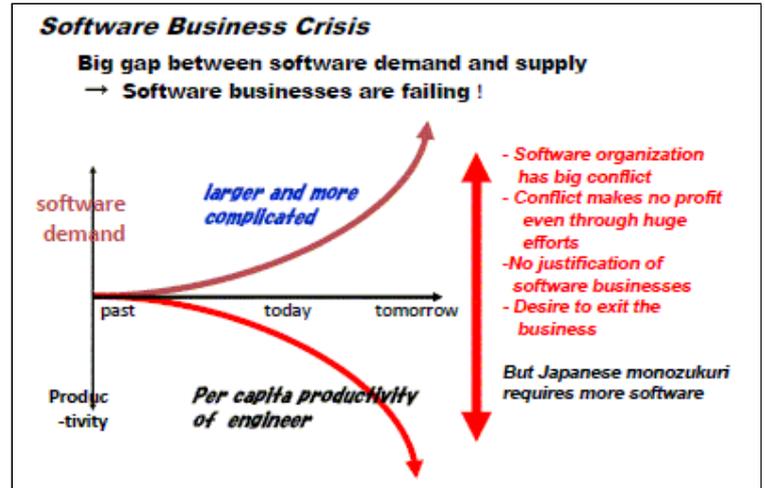
Electronic vehicle:  
 • parts will decrease drastically  
 • Integral efforts will not be needed

Then the Author goes on to discuss about the crisis of Japanese monozukuri especially in the software field. Let's read the paragraph (3) of Author's Abstract.

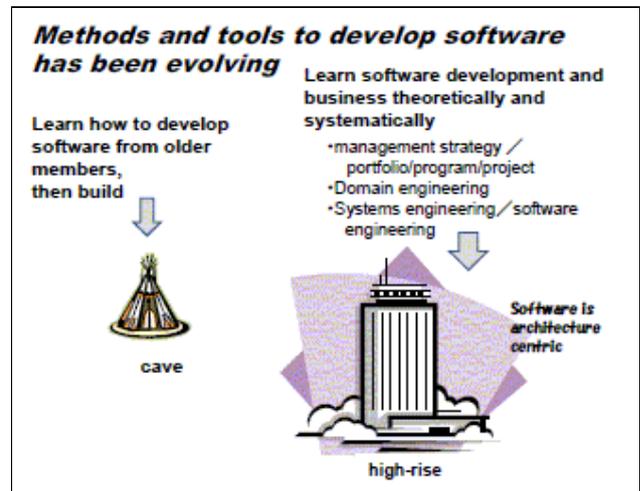
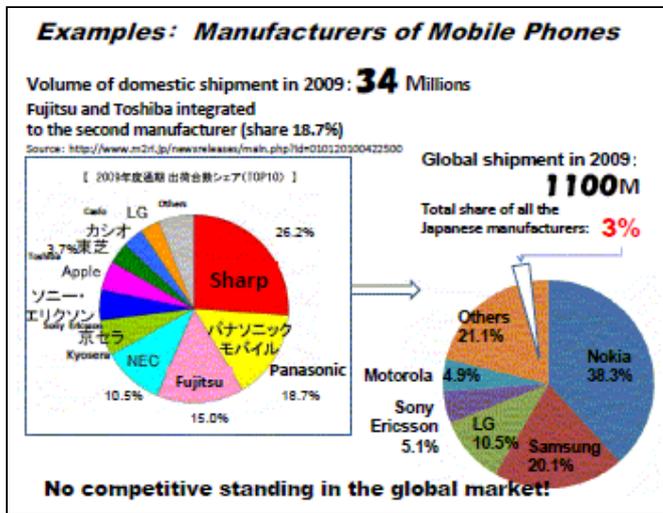
**Abstract (3):** Additionally, products with **embedded software** have the critical problem. Because new products require more software to add new features with it, then embedded software will become large-scaled and very complicated. More software engineers are required because of less productivity of software development and additional efforts, then software supply falls into negative spiral, never coming up to the surface. Modern software development requires very structured approach with strategically reused software components based on modular architecture under the globally shared

process on the network, which seems to be a virtually-configured logical software factory. Japanese software used to be delivered derivatively through generations from an original source code. It would become more difficult in case of delivering more large-scale software products.

The situation of software business crisis (especially in Japan) is demonstrated in the slide (right). Demands for software is increasing much, and the software are demanded to be ever larger and more complicated. This is a natural trend requested by monozukuri in global as well as in Japan. On the other hand, when the engineer's technology is not improved drastically, the productivity of engineer gets reduced counter proportionally with the size and complexity of the software. Such a big gap between software demand and supply is going to fail the software business in Japan, the Author points out.



As an example, the Author shows the case of mobile phone business (slide (below-left)). In Japan, a number of companies are competing for making intelligent mobile phones in the market of 34 millions of domestic shipment. Whereas, the global shipment in the same year (2009) is 1100 Millions and the total share of all the Japanese manufacturers is only 3%. Software has a nature that it requests essentially no cost in reproduction. Thus a company having 10-times larger share can sell its software-intensive products much cheaper because the software development cost for each user may count only 1/10. This causes a severe situation on Japanese manufacturers. Another problem is the methods and tools to develop such software (see slide (below-right)). The approach shown in the left part is typical in Japanese companies. But the methods and tools for developing software have been evolved much in the world. By learning software development and business theoretically and systematically, software has been built well, in some global leader companies, even for larger and more complicated requirements, the Author says.

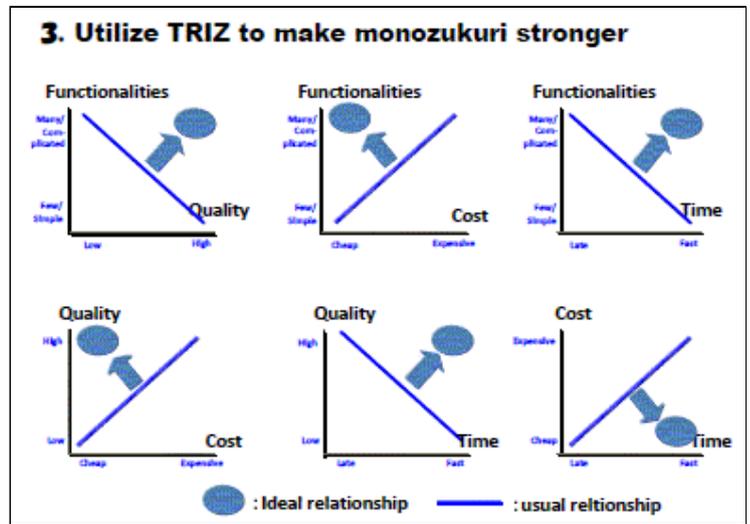


On the basis of realizing these crises in Japanese monozukuri, the Author now wants to discuss on the directions we should proceed. Let's read the paragraph (4) of his Abstract:

**Abstract (4):** These issues are very critical to Japanese monozukuri. They should be resolved urgently with the bird-eyed and monozukuri strategically reconstructed to produce very qualified products with embedded software through redesigned products and processes. **Requirements for the future monozukuri** need to be redefined in global perspectives, including product and software engineering process, shared and collaborative resources with globally and highly qualified people and network, and visible, easier and productive suriawase of technical and management process. Japanese intangible skills to have produced very qualified products will be built into the newly defined tangible processes to make products competitive. TRIZ tools, such as, evolution trends, contradiction matrix, and others, will be used for creating new products and accelerating processes creatively.

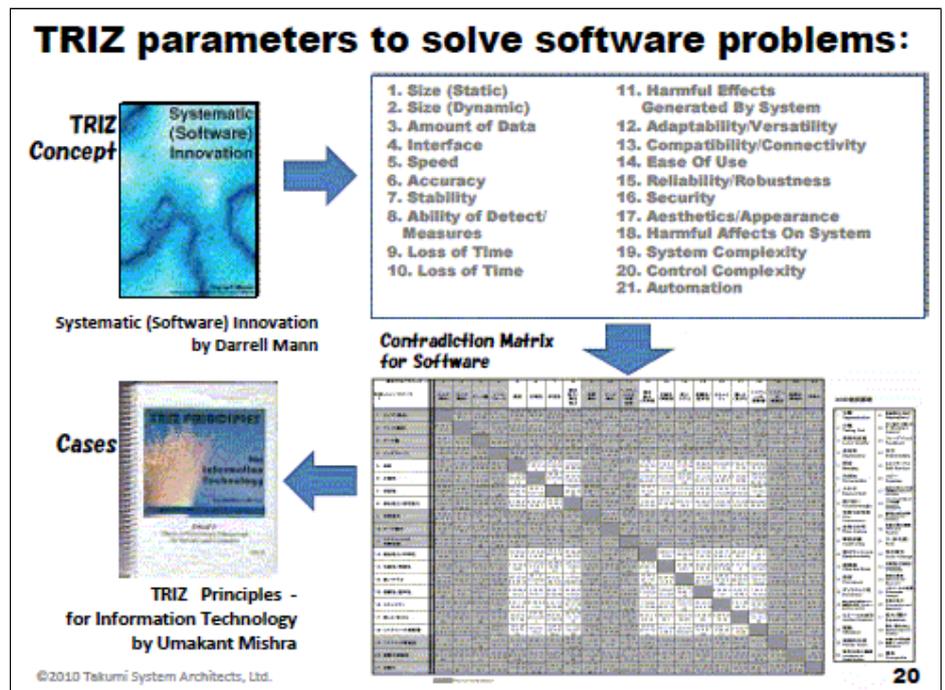
Now the Author discusses how to use TRIZ for making monozukuri stronger. The Author shows his basic

understanding of TRIZ in the slide (right). The graphs show 2 dimensional parameter space of possible solutions. Usual relationship between the two parameters is shown by a blue line; essentially proportional in some cases, while essentially inversely proportional in other cases. Ordinary solution is to try to find an optimal point on the blue line. Whereas, TRIZ suggests us the regions of Ideal relationship as show by blue ovals in the graphs. TRIZ also has a number of methods which can guide us to find such solutions.



More specifically, the Author recommends us two TRIZ textbooks applicable to solve software (or IT) problems. TRIZ concepts can be learned in Darrell Mann's textbook. It has customized TRIZ concepts, e.g. contradiction matrix and its parameters, for software development. The Author also recommends Umakant Mishra's textbook for learning the usage of TRIZ 40 Principles with more-than- 1200 cases of examples.

[\*\*\* Japanese translation of Mishra's book is almost done by Toru Nakagawa, Takuo Maeda, et al., while that of Mann's book is only at the starting position by Takuo Maeda et al.]



Even though the Author knows the advantage of applying TRIZ to technical problems for obtaining much improved solutions, he poses a big question as shown in the slide (below-left). This question reflects the discussion posed by Prof. Kenichiro Senoh, i.e., "Japanese manufactures have advantages with technologies, but are losing businesses". Thus the Author wants to go further to find the route for Japanese (software-intensive) industries to win in the business as well.

So, in the slide (below), he reconsider the factors for stronger monozukuri. This slide shows the Author's scope nicely. With the four groups of factors, the Author wants to build a new, re-constructed model for stronger monozukuri.

### Big Question:

What TRIZ (Theory of inventive problems solving) seeks is:

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To solve problems and realize products/services to be ahead from competitors

However, even if we take a lead in specific technologies, we are losing businesses.

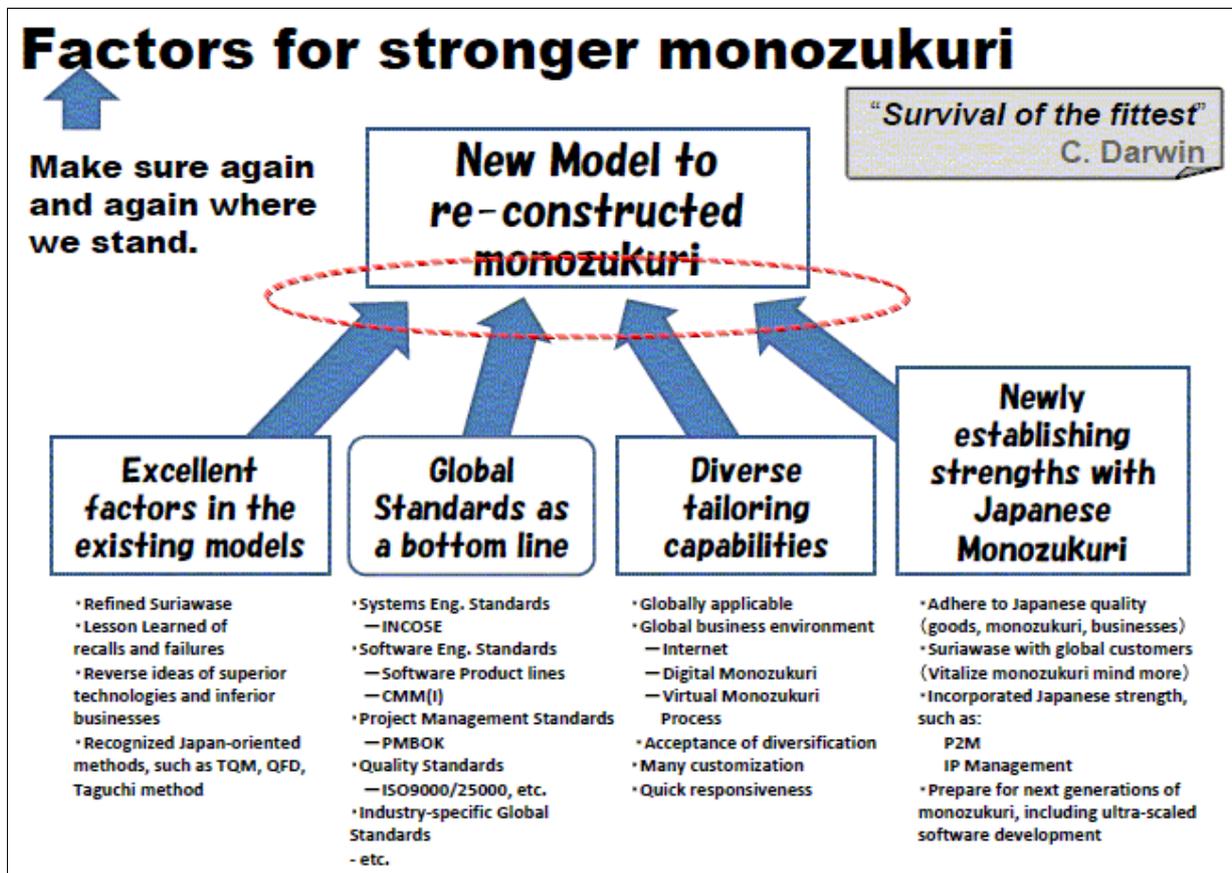
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We should be aware that leading of technologies is not enough.

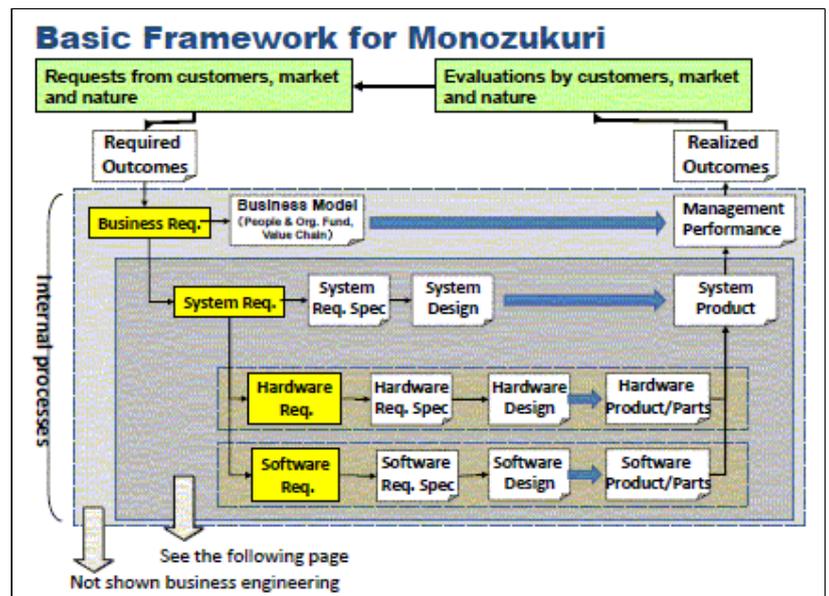
*Why?*

*It is not enough to make efforts to take advantages of TRIZ?*

*Or, TRIZ could not solve complicated problems mixed technologies and businesses?*

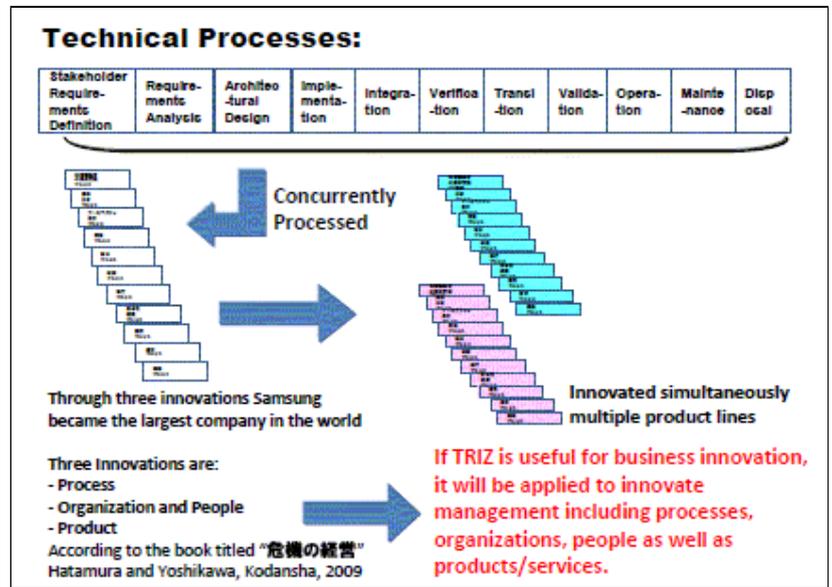


In the slide (right) the Author shows the basic framework of monozukuri. This framework seems to be an extension of the framework of building software/IT system. Inner-most of the three layer framework is either software or hardware monozukuri. Requests from customers (and market and nature) drive the SW/HW requirements, and the latter is converted into requirement specifications, and designs, and then products or parts. The realized products/parts are evaluated by customers. There are two more levels of hierarchy. The system containing the SW and HW inside is similarly requested, developed, realized, and evaluated. The business is the outer-most layer of this framework, and is operated essentially in the same way of cycle.



The slide (right) shows the technical processes, which are positioned as an aspect of realization of SW, HW, or system. At the top the stages of lifecycle are shown in a linear sequence. Processing concurrently, and processing multiple product lines simultaneously are the examples of process innovation. Such process innovation can be suggested with TRIZ.

The Author further mentions the possibility of applying TRIZ to business innovation, i.e., for innovating management including processes, organizations, people as well as products/services.



The general trend in software engineering has been modularization. On the basis of such trend, however, 'Suriawase' (i.e., integration) approach should be necessary, the Author says with reference to a report shown in the slide (right). The report was prepared by a research project of 'Project Management Association of Japan, NPO', in which the Author worked as one of the project members. It discusses on the development of embedded software which has come necessary for nearly all types of advanced industrial products and services.

The two slides (below) describe the views of 'Suriawase-oriented approach' of software development. It is important to distinguish positive suriawase from negative ones. Objectives driven suriawase and specific-issue focused suriawase are positive, while problem-focused suriawase is negative, the report says. In this sense, suriawase should be done actively and positively in the technical and management processes, the Author says. You may also note 'Senoh's Innovation Principles' are quoted in these slides. Senoh wrote 7 Innovation Principles in his book (2009).

**Suriawase approach should be applied to make software**

Software is essential parts of monozukuri today and tomorrow

The title is "Research report on the infrastructure of project management for embedded software development through suriawase approach"

source:  
[http://www.jmf.or.jp/japanes\\_e/houkokusho/kensaku/2010/21hyojuin\\_04.html](http://www.jmf.or.jp/japanes_e/houkokusho/kensaku/2010/21hyojuin_04.html)

#### Views on Suriawase-oriented software development (1/2)

**Importance of Suriawase**  
In order to keep sustaining business growth, it is required to take a lead through suriawase efforts

**Suriawase Processes**

- Suriawases in technical processes**  
To develop systems requirements, requirements analysis, architecture design, hardware and software design, implementations (among processes / inside of process)
- Suriawases in management processes**  
Suriawase with business policy and plan, at the kick-off stage, planning stage, production and maintenance stage and others.

技術力で勝る日本がなぜ事業で負けるのか

「Through pushing to improve existing models, an innovation will never happen.」  
(Senoh's Innovation Principle 1)

「Innovation drives out existing model and makes its effectiveness nothing.」  
(Senoh's Innovation Principle 2)

source: Chapter 1 of the research report shown at the page 7

#### Views on Suriawase-oriented software development (2/2)

**Two types of Suriawase**

**Positive Suriawase**

- Objectives-driven, such as Direct the future, Establish Objectives, Solve Issues
- Specific-issue-focused, such as Designs, Operations, Improvement

**Negative Suriawase**

- Problem-focused, such as Problem-solving, Eliminating not-accomplished issues, Correct errors (Keep control)

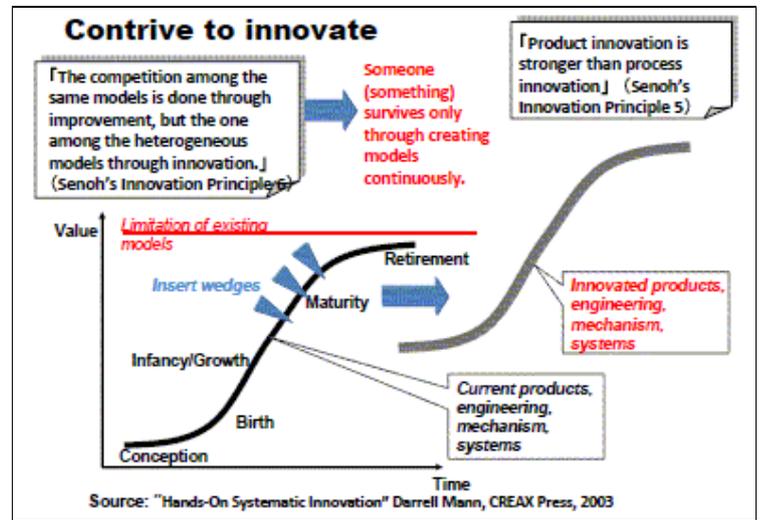
技術力で勝る日本がなぜ事業で負けるのか

「Innovation on higher model has always a competitive advantage」  
(Senoh's Innovation Principle 3)

source: Chapter 1 of the research report shown at the page 7

The slide (right) shows the relationship of S-curves of two products (or engineering, mechanism, systems, models, etc.). This relationship is quite familiar among TRIZ community, but the Author's comments on the innovation, especially the quotes of Senoh's Innovation Principles, are appropriate as the summary here.

Now the Author describes his own approach for contributing to possible future innovations. He wants to build a new, innovative model for achieving innovations in the software-intensive monozukuri.



In the slide (right), the Author reflects himself "What and How I should contribute?". He thought that concentration in core competence is important in his own portfolio. Thus his conclusion is "Make TRIZ more practical" (especially for software-intensive technology/businesses) and "Share and utilize practical information on TRIZ".

**My environment required to innovate very often**

*Dilemma of Innovation: We don't want to take the risks of the Innovation, but do want to take a lead. How?*

- Concentration in Core Competence
- Resource Management
- Portfolio Management

→ **Make TRIZ more practical**  
→ **Share and utilize practical information on TRIZ**

The following two slides (below) describes the Author's recent work. The Author, who previously wrote several books for SE's (System Engineers) mostly on project management, has been preparing two 'Workbooks'. The first one is "Practical Workbook to Create Ideas for New Software and IT Products Guided by USIT" (or 'USIT Workbook', see Japan TRIZ Symposium 2009 ). The second one is "Workbook to Innovate Business and Technology (WIBT)". It is a workbook for a user to write about his/her own thoughts along the line of guidance, whose list of contents is shown in the slide (below-left). The guideline refers to various documents and knowledge bases as shown in the slide (below-left).

**Engineers apply TRIZ concepts and tools daily**

↓

**Make them and monozukuri stronger**

TRIZ Symposium 2009

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**§ 1 Define the specific opportunity**

- Look at potentials
- Locate opportunities
- Select and define specific opportunities

**§ 2 Define the specific value**

- Assure customers' and businesses' values
- Create business models
- Make successful scenario

**§ 3 Evaluate the specific value**

- Assure competitiveness
- Establish innovated business strategy
- Define exit strategy

**§ 4 Realize the specific value**

- Synchronize with comprehensive management strategy
- Take the leadership to realize agreed values
- Get management involved

**Innovation Process (Standards)**

↻

**Outcomes**

↻

**Databases of Innovation Factors and Parts**

- Systems Eng.
- Software Eng.
- Business Eng. and Models
- Problems
- Requirements
- Management Schemes
- Training Schemes
- Strategic Options
- Cases of Failure

↻

**External Info.**

- Market
- Competitors

**WIBT (Workbook to Innovate Business and Technology)**

**V1.0**

[\*\*\* We can learn a lot from this presentation. I wish to post the whole presentation slides both in Japanese and in English in this Web site "TRIZ Home Page in Japan" in near future. ]

Ikuo Yoshizawa (The SANNO Institute of Management), Kimihiko Hasegawa (Ideation Japan Inc. ), Akira Sato (Keio University), Shigeru Kuno (NKN Consulting Co.), Yasuo Moriya (Fujitsu Advanced Technologies), Takuo Maeda (Takumi System Architects), Teruyuki Kamimura (Willfort International Patent Attorneys), Fumiko Kikuchi (Pioneer Corp.), Osamu Ikeda (NIKON Corp.), Hisataka Izawa (Sony Corp.) [Business & Management TRIZ Application Sub-Team, Japan TRIZ Society] [J10, P-A2] gave a Poster presentation with the title of "An Application of TRIZ Way of Thinking and Its Tools to Develop a New Business Model." As shown above this is a presentation of the results of a Study Group of Japan TRIZ Society. About ten people have come from different companies and meet and discuss together every month since 2008. They reported their activities at Japan TRIZ Symposium 2008 and 2009. Their Abstract is quoted here first: {\*\*\* Emphasizing with bold face fonts is made by Nakagawa.]

Most of reported TRIZ applications are for solving technological problems. One of the challenges for TRIZ to be deployed in much wider scale is to prove its capability to help solve business and management problems.

The B & M Application Sub-Team of the Japan TRIZ Society was organized two years ago to address this challenge. We plan to study methods how to apply TRIZ to tackle business and management problems through analysis of real life cases. We intend to make up the guidance for TRIZ application for the purpose. The present report is about our effort up to the present time and some of its results. The subject we choose is “**TRIZ application for developing a new model of business** that brings in the best economic performance for a given product.”

We divided the process of our study into the following 5 phases:

1. Selection of the target. (A product or a field of business)
2. Understanding the present situation (Interviews and analysis of available information)
3. Drawing a scheme for developing a new business model.
4. Developing a business model based on the scheme.
5. Presentation of the model and the evaluation. (Presentation to subject matter experts and interviews)

We choose as our first target “**the Large-Screen Television System**”. This report focuses on the above-mentioned **phase 3** in the course of our study and clarifies a basic scheme of developing a new business model. This report also provides the results of our research for identifying the components of the new business model for “the Large-Screen Television System,” which we have developed using the above-mentioned basic scheme and based on the result of our previously-conducted study at phases 1 and 2.

The content of the report in fiscal year 2010 makes four of the examination phases a nucleus, locates a new business model in the time axis, and reports on the result of review of the concept construction of a short-term, mid/long-term business model. In addition, it reports on the evaluation result in which the concept of a short-term business model is made a nucleus and the content is presented to the large-scale vision entrepreneurs.

[\*\*\* Their 16 Poster slides in Japanese have rich contents, but only 4 of them are translated into English for the Poster Introduction Session.]

In the slide (right), is shown the target system chosen for the case study in the group's activities. "A Large -Screen Television System" was chosen as a sample case. In the upper part of the slide (right), they describe the functions of the system in the current stage. The Group want to think of some new business models taking advantage of this type of product (and its future versions) in the short term (1-2 years), mid term (3-5 years), and long term (10 years) future.

For developing such business models, they are going to use the 5-phase procedure, as described in the Abstract and in the bottom half of the slide (right). This presentation focus on the Phase 3 of the procedure [Phases 1 and 2 are reported in the previous Symposia, while Phases 4 and 5 are not carried out yet.]

In the slide (right) they show four possible patterns of approaches to the development of new business models. First 3 patterns belong to 'Function-Oriented Approach', where the ideality of the existing (Main Useful) functions is to be increased, in the sense of TRIZ. Pattern 4 belongs to Semantically, Revolutionary Approach and try to shift to an alternative system by redefining the basic useful functions.

The bottom half of the slide (right) shows the basic process in the wider scope, including the generation of business concept, planning the business, and implementing the business. The scope of the Group's study is 'Concept generation'

**"A Large-Screen Television System"**

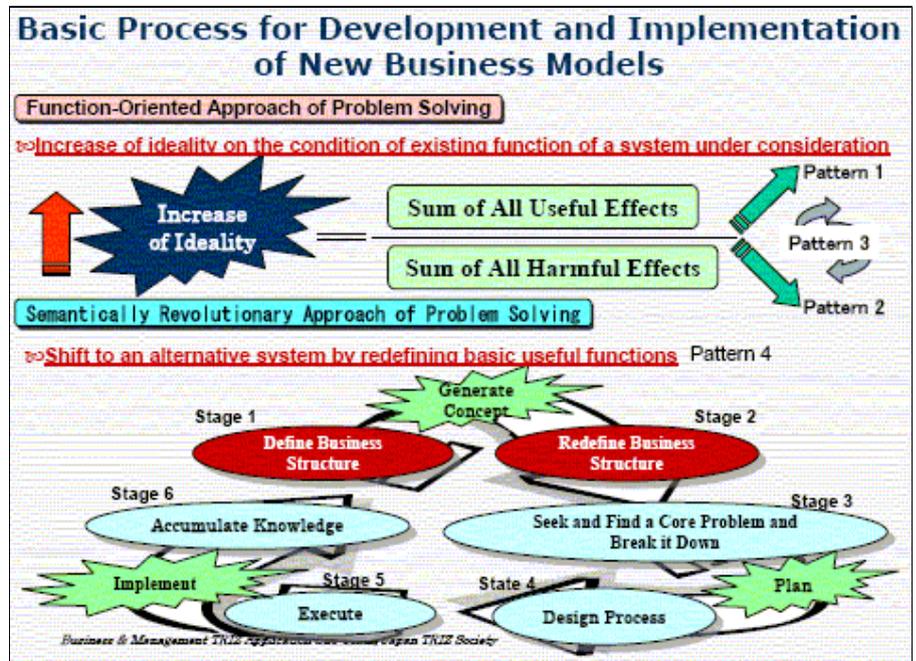
- It provides passengers with various kinds of information, around a large terminal station.
- Currently, it functions as
  - a local landmark
  - a sending office of public information
  - a sending office of local information
  - as an emergency communication tool
  - as an entertainment tool

[SENDAIKAI] (2005.4.1~20)

We apply TRIZ to developing a new business model taking advantage of a large-screen television system, based on next five phases.

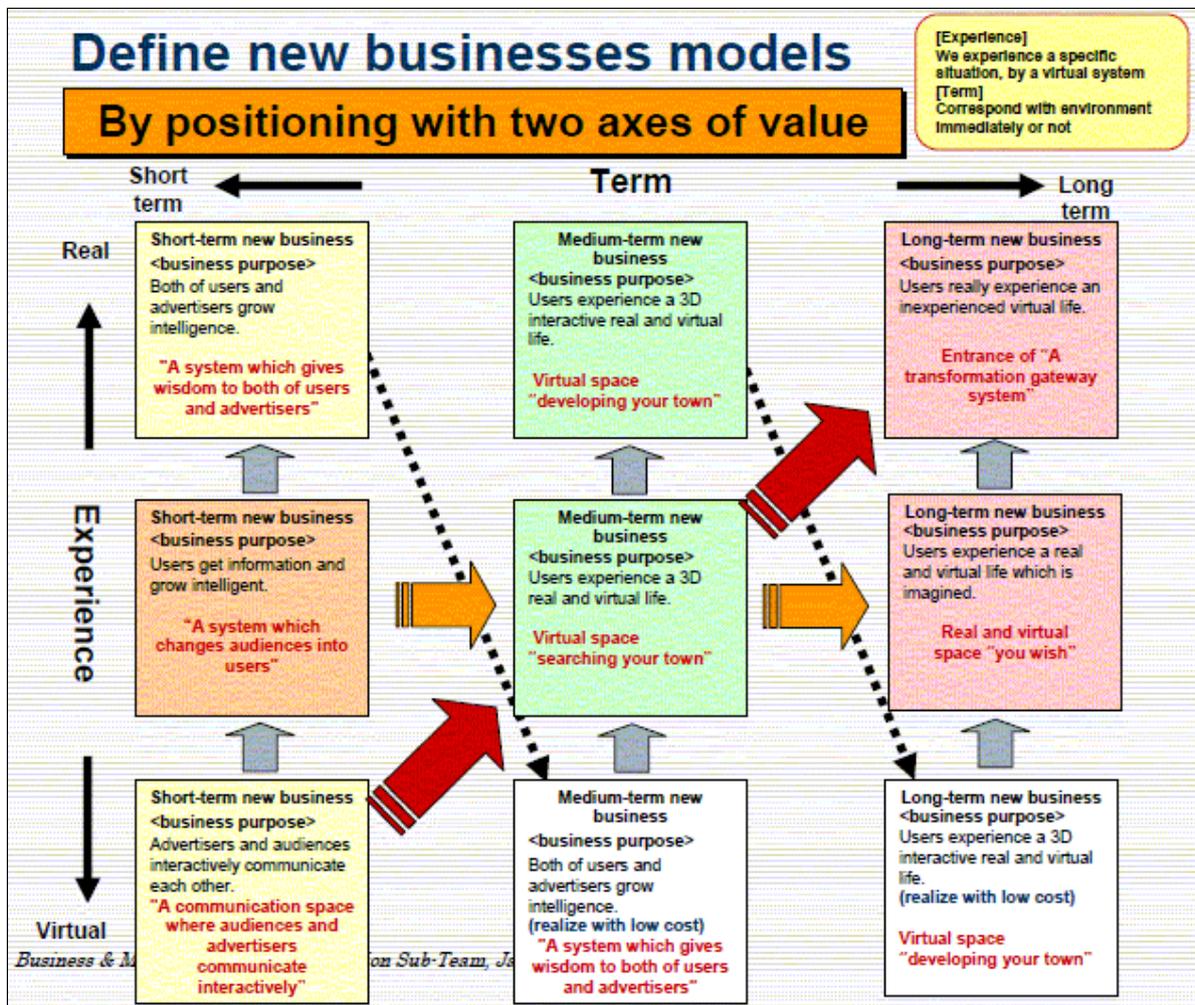
1. Selection of a target product or a business area.
2. Fact finding of a target product or a business area by hearing and information analysis.
3. Developing a scheme of new business models.
4. Developing a business model based on the scheme.
5. Introducing a new business model and evaluating it by hearing to its business provider.

only, which need two processes, i.e. Define (in Stage 1) and Re-define (in Stage 2) the Business Structure.



In Stage 1, the Authors have reviewed the functions of the system, draw a comprehensive diagram of relationships among various stakeholders/customers around the 'Large-Screen TV Operation Business', and figured out potentials of evolution in various (business) aspects. Next in Stage 2 Pattern 1, they have re-evaluated the business and think of the ideals from the standpoints of their customers. In Pattern 2, they further examined the ideals as the business and related them to the step-by-step extension of business concepts.

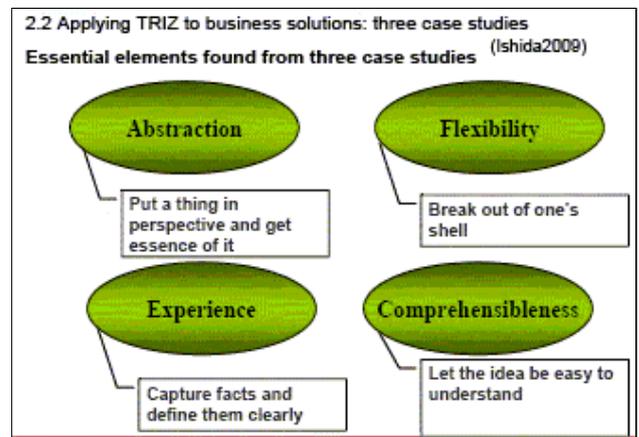
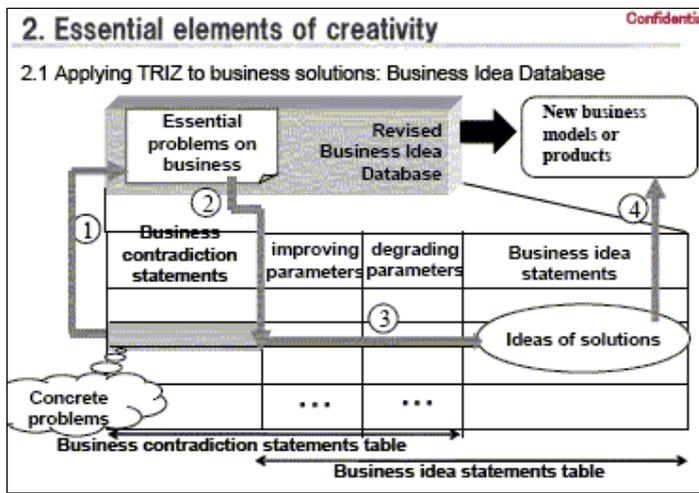
The slide (below) is a result of such an examination (in Stage 2, Pattern 2). In the 9 boxes, various images of business models are written in terms of "Business purpose" and also "System's main function". Such business models are positioned in a two dimensional space of "Virtual/Real Experience" and "Short/Long Term". The choice of "Virtual/Real Experience" seems to be specific to the present case, where the current contents shown by the Large-Screen TV system are 'virtual' in the sense not directly connected to each user (viewer) while the future contents are expected to be 'real', i.e. directly connected to the user's demands and experiences in reality. The horizontal axis is represented as 'Short/Long Term' in this English slide, but as 'Degree of Real-time' in the Japanese slide. The two axes are overlapping with each other, you may think. The box shown at the top-left is the same as the one at the bottom-center; probably because the Authors assume the progress in the future makes a currently-advanced system into a common system in the future. The arrows among the boxes show the directions of advancement. Scenario of business models are shown (in Japanese slides) for the 3 cases which are connected in red block arrows.



Atsuko Ishida (Hitachi Consulting Co.) [J05, O-18] gave an Oral presentation with the title of "Evaluation of Methods for Creativity by Applying the TRIZ-based Business Idea Database to Business Problem Solving". The Author's Abstract is quoted here:

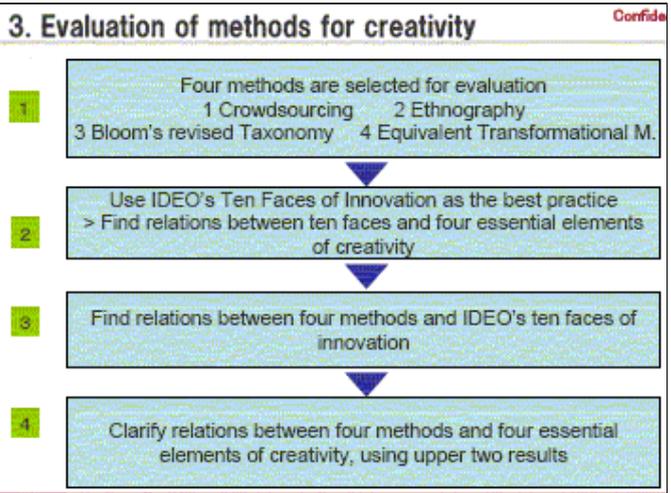
Methods and tools which support improving creativity and innovation are compared and evaluated. View points for evaluation are four essential elements for creativity which were got by applying the TRIZ-based Business Idea Database to three business problems. These are 'Abstraction', 'Flexibility', 'Experience' and 'Comprehensibility'. Firstly, IDEO's Ten Faces of Innovation is studied as the best practice. With the result four methods for creativity are evaluated. The first one is "Crowd sourcing" which is useful for 'Abstraction', 'Flexibility' and 'Experience'. The second one is "Ethnography" which is useful for 'Experience' and 'Comprehensibility'. The third one is "Bloom's taxonomy revised in 2001" which is useful for 'Abstraction', 'Flexibility' and 'Experience'. The last one is "the Equivalent Transformational thinking method" which is useful for 'Abstraction', 'Flexibility' and 'Experience'. In addition, how to improve 'Comprehensibility' which is not noticed is proposed.

The Author built a Business Idea Database in 2003 to be used with TRIZ Contradiction Matrix (see slide (below-left)). She revised it and applied it to 3 cases of business problems (2008). They were: Making training courses for employees, Moving offices for effective business, and Employment under depression. Through these cases the Author found that there are four essential elements for creative problem solving (see slide (below-right)). They are Experience, Abstraction, Flexibility, and Comprehensibility.



The intention and procedure of the present study is shown in the slide (right). The Author wants to evaluate some creativity methods.

- (1) The Author selected four methods and described them briefly. They are:
- (a) Crowd sourcing (slide (below-left)),
  - (b) Ethnography (slide (below-right)),
  - (c) Bloom's revised taxonomy (slide (below-bottom-left)), and
  - (d) Equivalent Transformational Method by Kikuya Ichikawa (slide (below-bottom-right)).

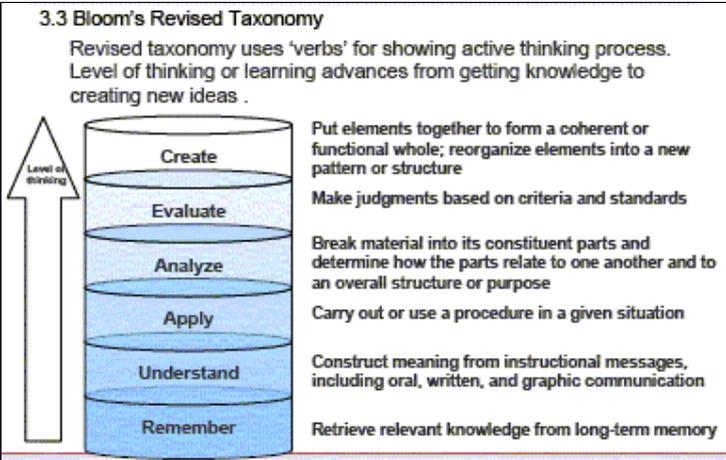


### 3.1 Crowdsourcing

- > Crowdsourcing is new business way which companies offer jobs to outsiders all over the world.
- > For example, the most popular crowdsourcing service 'Innocentive' calls seekers who want to accelerate technologies/ products development and solvers who want to provide own knowledge and experience. It also collects challenging themes and promotes solving them.
- > Crowdsourcing is widely notices because there has been big gaps between products' development cycles and technologies development cycles.

### 3.2 Ethnography: Observation of real lives

- > Ethnography is a discipline for analyzing active patterns of cultures and understanding them. Now a days, it is used for marketing.
- > Ethnographical method includes living with users and putting researchers in users' place to observe and recognize users' implicit attitudes.
- > Ethnography is widely noticed because users want to get not only high quality products but valuable experience,



### (1) What is the Equivalent Transformational Method? (Ichikawa1977)

- > The Equivalent Transformational (ET) thinking was developed by Kikuya Ichikawa. It's one of creative engineering methodologies.
- > It's based on a kind of analogy of shapes and characteristics in various fields.
- > Objects are abstracted through a specific viewpoint beforehand then compared each other. If two abstracted objects are analogous they are treated as 'equivalent'. Example: Electric discharge and a tree. Trails of flying are images abstracted from an electric discharge. Branches are images abstracted from a tree.

As an intermediary for evaluation, the Author used IDEO's Ten Faces of Innovation (slide (right)). The roles of ten faces are described in the table, and are

also interpreted in terms of the Author's four elements for creativity.

The four methods (a)-(d) were evaluated first in terms of these Ten faces, and then are summarized in the table (slide (below-right)) in terms of the four elements.

### 3.4 IDEO's Ten Faces of Innovation

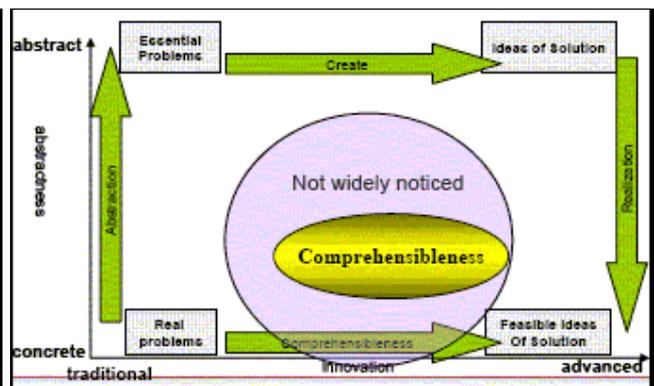
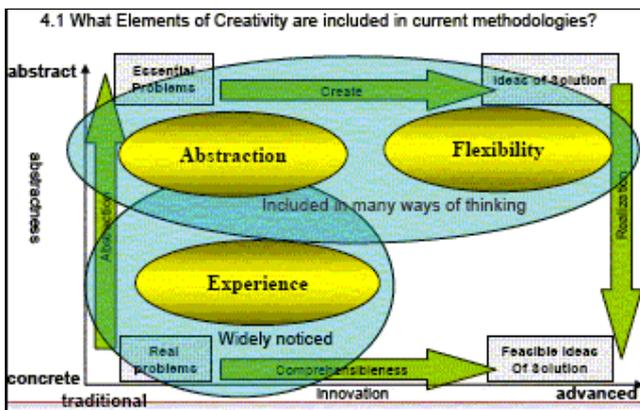
Ten faces	roles	(1) abstraction		(3) experience	
		(2) flexibility	(4) comprehensiveness	(3)	(4)
Anthropologist	Observe and capture facts			○	
Experimenter	Show effects by prototyping	○		○	○
Cross-Pollinator	Research other domains, find new facts and include them	○	○		
Hurdler	Overcome difficulties				
Collaborator	Collaborate various elements and create new solutions	○	○		
Director	Take creativity out from various people		○		
Experience Architect	Design experience strongly related to clients' implicit needs			○	○
Set Designer	Make innovative environment		○	○	
Caregiver	Give special care to client of a service		○		
Storyteller	Raise morale of inside and win popularity of outside with persuasive talk				○

The Author observes in this table: the elements Abstraction, Flexibility, and Experience are covered by most of the (selected) creativity methods, whereas Comprehensiveness is not covered well by the (selected) creativity methods except Ethnography.

These observations are illustrated in the slides (below-left and below-right).

### 3.6 Four Methodologies and Essential elements of Creativity

	abstraction	flexibility	experience	comprehensiveness
Crowdsourcing	Cross-Pollinator Collaborator	Cross-Pollinator Collaborator Director Set Designer	Set Designer	
Ethnography			Anthropologist	Storyteller
Bloom's taxonomy	Collaborator	Collaborator	Anthropologist	
Equivalent Transformational thinking	Cross-Pollinator	Cross-Pollinator	Anthropologist	



The slide (right) may be regarded as the Author's conclusion of the present study. The Author concludes that the methodologies for creative problem solving need 'Comprehensiveness'. Its meaning is described in text in the slide (right) and is illustrated in two slides (below-left and below-right). For business idea creation, it is important to understand the new business ideas and accelerate to realize them, and for technical seeds creation it is important to understand characteristics, limitation and feasibility of the new proposed technology seeds. These two statements request, from different standpoints, the same thing, i.e., the skill of making the ideas

'Comprehensive'. Prototyping and experiments, both in business and in technology, are useful and making a place for collaboration is effective, the Author says in the illustrations.

Confidential

### 4. New approach to creativity

#### 4.2 Methodologies need 'Comprehensiveness'

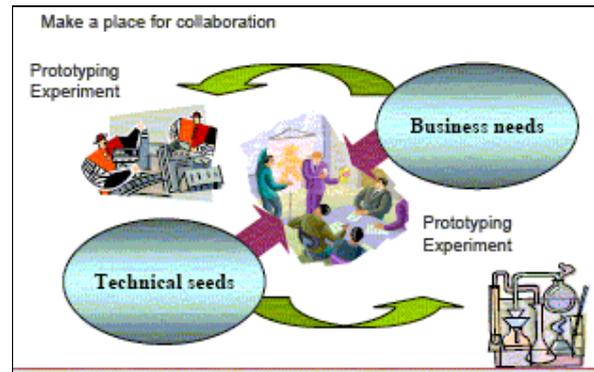
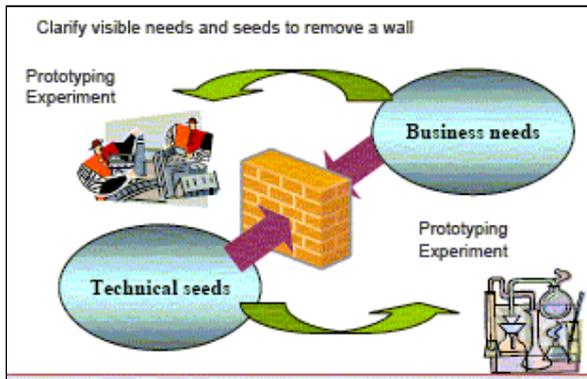
For business idea creation, it's important to

- understand new ideas and accelerate to realize them
- to believe feasibility of realization.
- to predict effectiveness of the idea.

For technical seeds creation, it's important to

- understand characteristics, limitation and feasibility of a technology
- to put results of a research into practice.
- to clarify differences between the technology and other technologies.
- to inhibit nonprofessionals to expect too much of the technology.

Same skill with different view points



**Hideto Sanjou (DOCOMO Systems, Inc.) and Yukie Hanaoka (Wisdom, Inc.)**[J07, O-14] gave an interesting Oral presentation with the title of "**A Practical-type Approach Applying TRIZ to the Mind Field - Toward the Establishment of a TRIZ Mind Training**". Let's read the Authors' Abstract first:

Comparing and selecting various tools for strengthening the problem-solving thought in the mind field such as employee training in companies, eliminating individual's worries, etc., TRIZ, which aids creative thinking, has proved useful. Psychological conflicts were cleared up following the TRIZ technique, psychological changes were predicted and the 40 Inventive Principles were applied for an approach to the creative ideal result that is not trapped by stereotypical views. As there were parts difficult to apply to the mind field with the traditional TRIZ technique only, an integration with tools which have been used in the mind field followed by optimization made it possible to establish a new field of "TRIZ Mind Training."

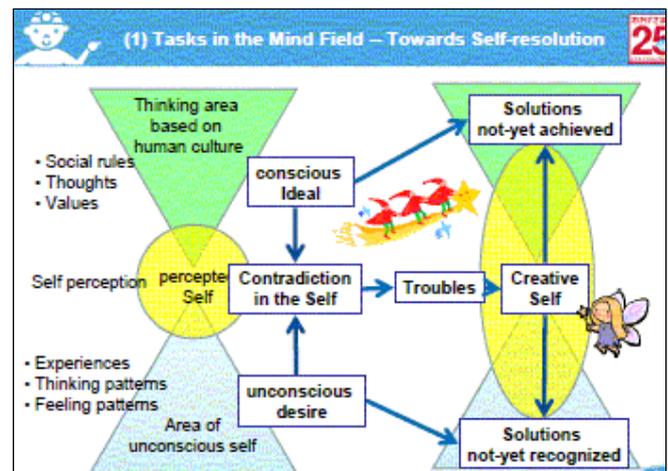
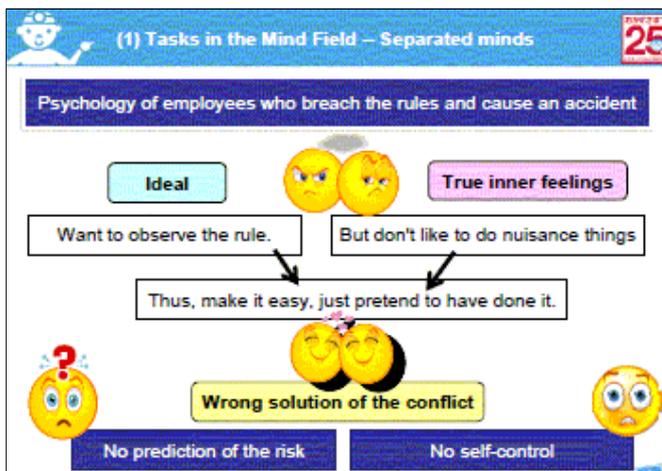
[\*\*\* This presentation has developed a new field of application of TRIZ and has already well adapted TRIZ to the new field, as I understand. English translation of the slides has not done by the Authors. I would like to introduce this presentation in more detail after translating some of their slides into English. (Mar. 30, 2011) --- Now that nearly half of the Authors' slides are ready in English, I will write the introduction of this interesting paper. (Apr. 23, 2011)]

The slide (right) describes the needs for the Mind Training, by example of the risk management. For risk management in industries, training of employees are necessary on how to prevent human errors. However, conventional training with lectures and with emphasis on knowledge has the limitations of "Knowledge, but no action". So the Authors wanted to make trainings to strengthen the mind.

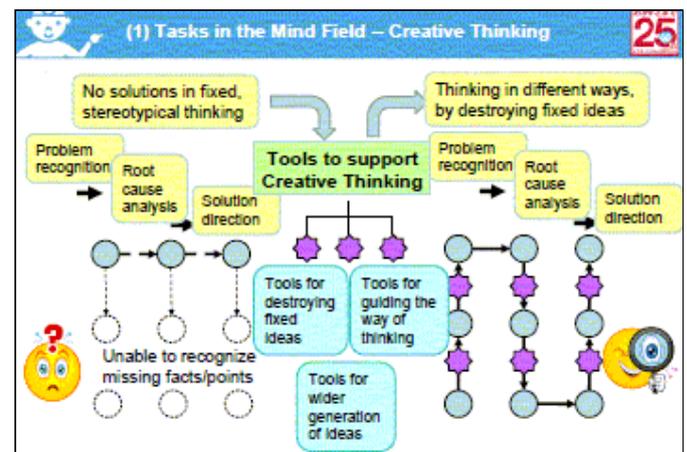
Since the Authors have been working in the field of psychology, they have the model of human errors originating in the depth of human psychology. The two slides (below) shows their model.



The slide (below-left) is the model of psychology of employees who breach the rules and cause an accident. They know the Ideal and want to observe the rule, but they have, in reality, inner feelings of not liking to do nuisance things. Making it easy, they just pretend to have done it, as a wrong solution of their inner conflict. The slide (below-right) explains the model in a more general scheme. Conscious Ideal and Unconscious Desire make the conflict (or contradiction) in the Perceived Self. For solving such a psychological conflict, it is generally desirable to reveal the conflict clearer in a way shown in the right part. Solutions not-yet achieved (i.e., Ideal) vs Solutions not-yet-recognized (i.e., unconscious desire) are to be solved by 'Creative Self'.



In the slide (right), the Authors discuss how to support the creative thinking for solving such a conflict. The basic process is understood as 3 steps, i.e., Problem recognition, Root cause analysis, and Solution direction. However, in fixed, stereotypical thinking, people can not recognize missing facts and root causes and can not generate good ideas. Thus, the Authors think the tools to support creative thinking should have the capability to destroy fixed ideas of the user, to generate ideas from wider viewpoints, and to guide the way of thinking.



The Authors looked for tools in the psychology for solving the conflicts. They had two candidates, i.e., Transactional Analysis and NLP (Neural Linguistic Programming). For the tool of solving mental contradictions, the Authors have three requirements; they are Destroying fixed ideas, generation of ideas widely, and

guiding the way of thinking. As shown in the slide (right), the Authors summarize these two methods, but they were not satisfied with them.

	Transactional Analysis	NLP
Overview	For character analysis and mental structure analysis, widely used in Japan	As a communication technique, fit with the structure of neural program, widely used in the world
Destroying fixed ideas	Understanding the mechanism of mental movements	Analyzing from a hierarchical system of viewpoints
Wider generation of ideas	Imaging the personal characteristics	Spread the images/ideas step by step
Guide the way of thinking	Process along the change in mental pattern	Process along the thinking steps

As a parent (P) Idealistic  
As an adult (A) Pragmatic  
As a child (C) Emotional

Values → Capability → Behavior → Environments

How can we resolve the conflicts among the senses?  
How can we resolve the conflicts among the stages of mind growth?

See the slide (right). While searching for methods of conflict resolution (in the field of Mind), they encountered TRIZ, which is the method for conflict resolution in the field of technology, originally. They understood the essential steps of TRIZ are: (1) Revealing the conflicts, (2) Refer to Inventive Principles, and (3) Ideals on the basis of Trends of Evolution. They thought "Can't we use TRIZ in the field of Mind?" They found TRIZ is useful but many TRIZ terms are not applicable directly in the Mind Field, hence they found the needs of rephrasing the TRIZ terms.

(1) Tasks in the Mind Field -- Meeting TRIZ

While searching for methods of conflict resolution in Mind, we met the TRIZ method for conflict resolution in Technologies.

- (1) Revealing the conflicts
- (2) Refer to Inventive Principles
- (3) Ideals on the basis of Trends of Evolutions

Can't we use TRIZ?  
But not applicable as it is. ...

The Authors' way of rephrasing (or translating) the TRIZ terms into those in the Mind Field is pretty systematic and interesting for me. The slide (below-left) demonstrates that 'Objects' in the technical TRIZ term corresponds to 'Mind' in the psychological area, and that Stationary Objects is interpreted as 'Thinking' while Moving Objects as 'Feelings'. Similarly, Weight (of objects) is interpreted as 'heaviness' (of feelings), and energy (of objects) as passion (of feelings). As shown in the slide (below-right), the Authors went ahead to translate TRIZ Inventive Principles into the phrases familiar to the people in the Mind field. They named the new ones '40 TRIZ Enlightening Principles'.

(2) Mental Contradiction Matrix -- Relationship between Objects and Minds

Can't we use TRIZ Technical Contradiction Matrix in the Mind field?  
Let's try to translate the technical parameters into the parameters for representing Mental Contradictions

Objects → Mind

- Stationary Objects → Thinking (Not ready to change)
- Moving Objects → Feelings (Changeable with situations)

Weight of moving object → Heaviness of feeling

Loss of energy → Loss of passion

(3) Enlightening Principles -- Translation of Inventive Principles

Can't we use technical Inventive Principles as 'Enlightening Principles' for creative idea generation in the Mind Field?

Translating the Inventive Principles into the terms in the Mind field:

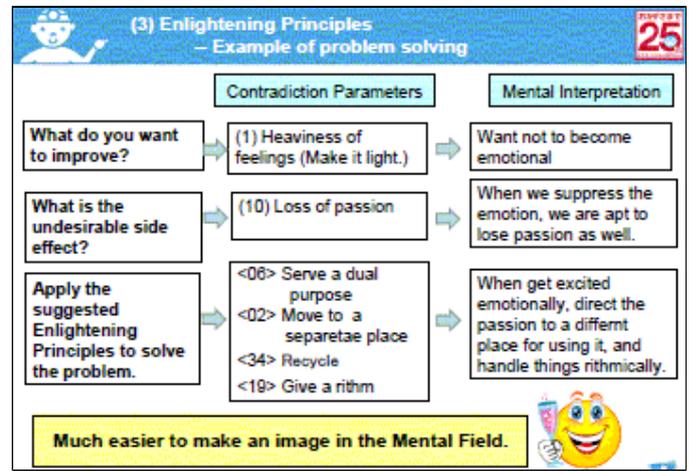
- Universality Principle → Serve a dual purpose.
- Separation Principle → Move to a different place.

Some of the Principles were not easy to translate:

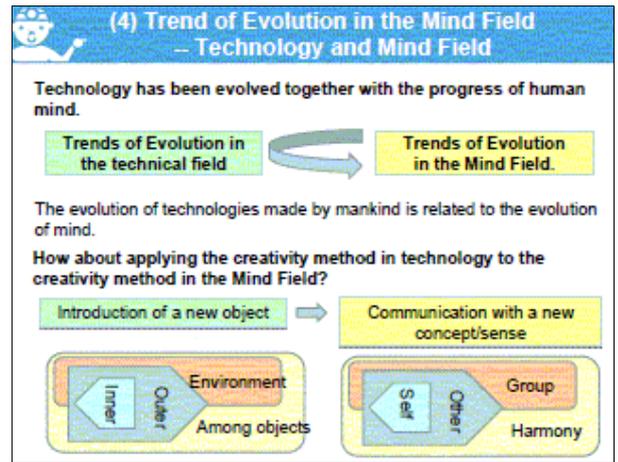
- Cheap Short-living Objects → Use & dispose
- Strong Oxidants → Cheer up

The slide (right) shows the standard way of applying TRIZ Enlightening Principles to the problem solving in the Mind field. This is the same framework of using the Contradiction Matrix for solving 'Technical Contradiction'. The three steps shown in the row in the slide (right) are the same as for the technical application, except using the rephrased parameters and rephrased principles. With these rephrasing, the usage of the (technical) Contradiction Matrix has become much

easier. The Authors seem to have found the hints generated by the Contradiction Matrix useful/effective in the Mind field.



Another feature the Authors found useful in TRIZ is the concept of Trends of Evolution (see side (right)). They say 'Technology has been evolved together with the progress of human mind.' Thus it is natural for them to expect some parallelism between the Trends of Evolution in the technical field and Trends of Evolution in the Mind field. Thus, just as the creative thinking in technology can be supported by the concepts of Trends of Technical Evolution, the Authors thought the creative thinking in the Mind field should be able to be enhanced by introducing the concepts of Trends of Evolution in the Mind field. In the slide (right), they show an example of such a parallelism. The trend of 'Introducing a new object' in the technical system may be interpreted as the trend of '(increasing) Communication with a new concept/sense' in the Mind field.



The slide (right) lists up the 'Trends of Mental Evolution', which the Authors thought of with reference to TRIZ (Trends of Technical Evolution). The Authors have listed 14 Trends in Mental Evolution, as shown in the left, yellow column. [\*\*\* I do not know how the Authors actually derived these Trends, and how well these Trends match with general understanding in the Mind field.] The Authors checked the standard mental methods (i.e., Transactional Analysis and NLP) whether they have any tool for enhancing each aspect of the Trends, and they have found the need to develop Mental Tools further in many aspects.

(4) Trend of Evolution in the Mind Field -- Tools for enhancing the evolution		
Trend of Mental Evolution	Transactional Analysis	NLP
1 Communication with a new concept/sense	○ Enhancing the parental conscious	○ Enhancing communication
2 Change by communication	○ Improving the childish conscious	○ Expanding the scope
3 Switching the conscious	○ Switching the parental/childish/adult conscious	○ Communication with the virtual conscious
4 Growth to the harmonized conscious	▲ Unable to build the harmonized conscious	▲ Unable to build the harmonized conscious
5 Diversifying the conscious and behavior	▲ Lacks in practical method	▲ Lacks in practical method
6 Diversified creativity	▲ Unable to cultivate creativity	▲ Unable to cultivate creativity
7 Higher level of sensitivity	▲ Unable to cultivate sensitivity	▲ Unable to cultivate sensitivity
8 Expanding the activity range	▲ Lacks in practical method	▲ Lacks in practical method
9 Harmonizing the rhythms of conscious	▲ Lacks in practical method	○ Harmonized communication
10 Adjustment of emotion	▲ Unable to adjust the emotion	○ Possible with anchoring
11 Control of the behavior	▲ Unable to control the behavior	○ Possible with anchoring
12 Changing the scope of conscious	▲ Unable to make multilateral viewpoints	▲ Unable to make multilateral viewpoints
13 Understanding the mental structure	○ Understanding the mentality in conflicting behaviors	○ Understanding the mental effects of environment
14 Growth of self desire	▲ Unable to grow self desire	○ Sublimating the desire

▲ The Mind Field has much less tools than the technological field. Need to develop tools further; TRIZ is a good reference.

In the slide (below-left), the Authors discuss the practices of using TRIZ in the Mind Training. For the purpose of eliminating human errors in industries, they introduced the Mind Training of resolving personal mental conflicts. Even though the framework of conventional thinking methods (i.e., TA and NLP) give us stereotypical solutions only, TRIZ Mental Principles (i.e. TRIZ Inventive Principles rephrased in the Mind field) stimulate to generate various new ideas, they say. The thinking framework supported with TRIZ is outlined in the slide (below-right). I.e., (1) Reveal the mental conflict in myself, (2) Search for the roots of the sufferings, and (3) Think of solution ideas from different viewpoints. TRIZ Mental Principles (or TRIZ Keywords) have been found useful, but still insufficient for giving influences on the emotional side, they say. [\*\*\* This point is enhanced much in the Poster presentation by the same Authors, which is reviewed next.]

**(5) Practices of Mind Training with TRIZ** 25

Practices aiming at resolving the mental conflicts for the purpose of eliminating human errors

Thinking frameworks give us stereotypical solutions only. TRIZ Inventive (Mental) Principles stimulate us to generate various new ideas

Group work exercises help us share others' ideas and deepen the personal relationships among the members.

Cooperated by: TRIZ Study Group of Japan Society of Project Management Kyushu Branch

**(6) Application to resolving personal sufferings** 25

Personal, private troubles are usually out of range of company's mental support. However, lessons of idea generation with the assistance of keywords along the thinking framework help people to solve some problems for themselves.

**Step①** Reveal the mental conflict in myself. **Step②** Search for the roots of the sufferings. **Step③** Think of solution ideas from different viewpoints.

Keywords of (Mental) Inventive Principles are found insufficient for solving troubles in feelings. Thus we are going to introduce visual and audio effects and physical actions as well for giving influences on the emotional side.

The slide (right) demonstrates another method of using TRIZ in the Mind field. The 9-Window Method in technical TRIZ is adopted here. In place of 'Super-system, System, Sub-system' in the Technical field, the Authors use 'Environment, Behavior, and Thinking'. The order of processing the 9 windows is the same, as shown in the slide. The viewpoints of thinking are described in the right part of the slide, and they are further enhanced with TRIZ Mind Cards, which may be taken randomly at each cell.

Practical ways of using TRIZ in the Mind field were demonstrated by the present Authors in the Poster presentation, which are reviewed next.

**(6) Application to resolving personal sufferings - 9-Window Method** 25

**9-Window Method is useful for reorganizing our mind.**

**Technology Field** → **Mind Field**

New Product, 1 year later      Image of myself, 1 yr later

	Past	Present	Future
Environment	6	3	8
Product	4	1	9
Elements	5	2	7

	Past	Present	Future
Environment	6	3	8
Behavior	4	1	9
Thinking	5	2	7

**[Analysis of the Present]**  
 ① Grasp the present behavior  
 ② Understand the underlying thinking  
 ③ Recognize the behavioral environment

**[Analysis of the past cases]**  
 ④ Reflect the past behavior  
 ⑤ Understand the difference in thinking  
 ⑥ Recognize the change in environments

**[Prediction of the future]**  
 ⑦ Predict the possible change in thinking  
 ⑧ Imagine the future environment  
 ⑨ Decide the behavior policy

At each cell, the user takes a TRIZ Mind Card at random, and tries to think of some solution ideas by using it as a hint, released from the psychological inertia.

**Yukie Hanaoka (Wisdom, Inc.) and Hideto Sanjou (DOCOMO Systems, Inc.)** [J16, P-B2] gave a Poster presentation with the title of "**Practice of Creative Thinking through TRIZ Mind Cards -- Everywhere with Essence of TRIZ --**". The Authors' Abstract is quoted here first:

A viewpoint from the mind field revealed that there is a mental discrepancy between ideal and reality in company employee training, in eliminating individual's worries, or in taking measures against and resolving each problem that could happen both socially and professionally. Upon Learning that the TRIZ technique, which assists creative thinking, also helps to solve contradictions on a technical level, and imagining that it could help to resolve the mental discrepancies on the mind level, Mind Cards, which applied the 40 Inventive Principles in a word game sense, were created. The Inventive Principles, which encourage creative operations and ideas, not only have the effect to break down mental stereotypes but also show extension to images, so they could be used in various fields.

[\*\*\* This Poster presentation was so attractive that it obtained the 'Best Presentation for Me' Award by the voting of the Symposium participants. English translation of the slides are not ready. I am going to introduce this presentation in more detail after translating the slides. (Mar. 30, 2011) --- I now have translated about half of their slides into English, I am going to review it here. (Apr. 23, 2011)]

In the preceding Oral presentation Sanjou and Hanaoka reported the theoretical part of their work, while in the present Poster presentation Hanaoka and Sanjou demonstrated the practical part. As shown in the slide (below-left), they encountered TRIZ while they were looking for a method for solving mental conflicts. And they have rephrased the TRIZ 40 Inventive principles so as to match in the mental field. An excellent idea here is that "With 40 TRIZ-based Mental Principles and 12 Mental Conflict, let's make a new set of Playing Cards!". Slide (below-right) illustrates how they made the TRIZ Mind Cards. (1) Translated the TRIZ Inventive Principles from technical terms into mental terms (as reported in the preceding paper), (2) Added illustrations so as to enhance the images in the mental world, and (3) Made a set of Playing Cards for adding the enjoyable feature. As you see the cards with illustration are very charming. [\*\*\* I remember Rikie Ishii's "Idea Pop-up Cards" reported in Japan TRIZ Symposium 2007 [E-TRIZ](#). Ishii made the same approach as (1)(2)(3) in the technical (and slightly wider) field so as to make TRIZ Principles much familiar to people.]

### An Encounter

Looking for a method for solving mental conflicts, we encountered **the TRIZ methodology**, for solving technical conflicts.

40 Inventive Principles and 12 Mental Conflicts ...  
Let's make a New Set of Playing Cards!

### Birth of the TRIZ Mind Cards

Inventive Principles are poor at expressing mental world.

**Transform!**

[TRIZ-19] Periodic Action  
\* Change in the rhythm  
\* Repeat  
\* Move periodically

(1) Transate into terms expressible mental world  
↓  
Give a rhythm.

(2) Enhance the images in the mental world with illustrations

(3) Widen the images in the form of Playing Cards

Words + Images + Playing

The slide (below) shows the design of the 52 cards. It has four suits, as usual. TRIZ Principles are assigned to the cards from Ace to 10. They correspond to 10 phases of 'Mental Change Cycle', the Authors say. On the other hand, 12 Mental Conflicts are assigned to Jack, Queen, and King, in the order of their seriousness. Some of the TRIZ Mental Principles do not fit well to the Mental Change Cycle, the Authors admit. [\*\*\* But we do not care much. Or else, there can be a policy of setting up revised 40 Mental Principles without sticking strictly to the original TRIZ Principles.]

### Design of the TRIZ Mind Cards

Configure the mind elements in the form of Playing Cards

			♣	♦	♠	♥	
Mental Conflicts	Seriousness	Critical to life	K	Don't make it	Don't be well	Don't be	Don't do anything
		Mental pain	Q	Don't be yourself	Don't think	Don't feel	Don't trust
		Worrying	J	Don't enjoy	Don't grow up	Don't belong	Don't be important
TRIZ Principles	Mental change cycle	Move	10	(27) Use and dispose	(02) Move to a separate place	(26) Make a substitute	(36) Transform
		Repair	9	(34) Recycle	(14) Make it round	(23) Reflect	(06) Serve a dual purpose
		Change	8	(35) Change the condition	(07) Change hierarchically	(03) Chage a part of it	(28) Move emotionally
		Give	7	(32) Change color	(20) Continue	(18) Stimulate	(39) Stabilize
		Combine	6	(05) Combine	(08) Make a balance	(33) Homogenize	(24) Intermediate
		Think	5	(13) Reverse	(01) Divide into two or more	(04) Unmatch	(40) Mix
		Use	4	(22) Turn harm into good	(19) Give a rhythm	(25) Self-service	(17) Think from different points
		Prepare	3	(09) Prevent from problem	(31) Use a gap	(11) Back it up	(10) Predict and prepare
		Enhance	2	(38) Cheer up	(12) Release	(37) Heat it up	(29) Soften
		Make free	A	(16) Think roughly	(30) Enclose to protect	(21) Do very quickly	(15) Make it free

[Note] Some of the TRIZ Mind Principles do not fit well to the Menta. change cycle.

The slide (right) illustrates a way of using the TRIZ Mind Cards. The cards are used in a way similar to he tarot fortune-telling.

Slide (below) is the more standard way of using the TRIZ Mind Cards for helping people solve (or get relaxed from) their mental conflicts. In Step (1), a Mental Conflict Card (i.e., either J, Q, or K) is (randomly) chosen (in this example, the card is 'Don't Think') and think over my own mental conflict from the specified aspect. Then in Step (2), we look into the root cause of the trouble using the suggestions shown in the orange boxes.

### Trials of usage

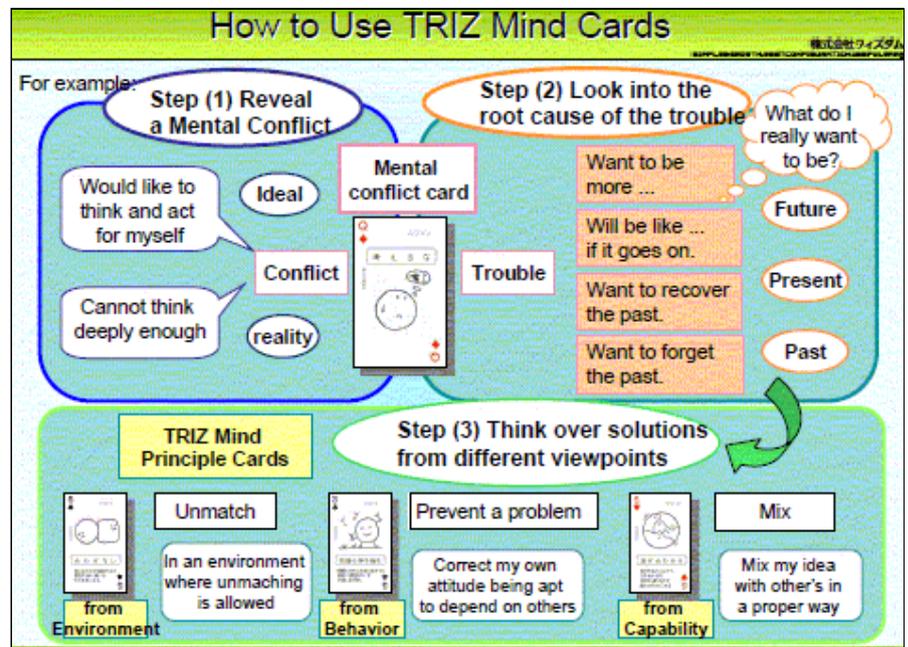
We all are living with some Mental Conflicts

How about using TRIZ Mind Cards in a way of tarot fortune-telling ?

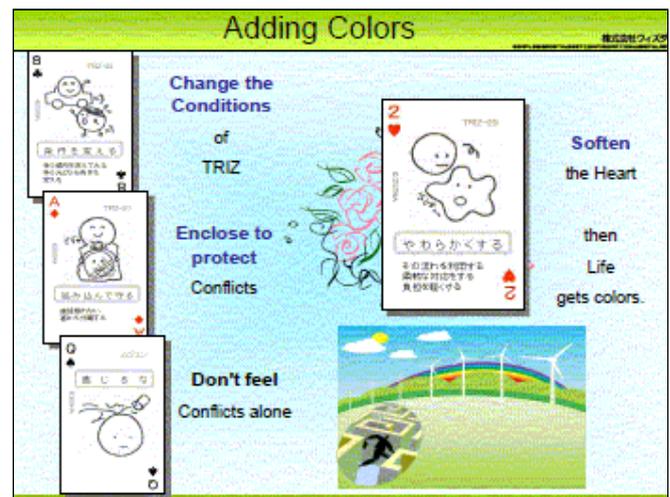
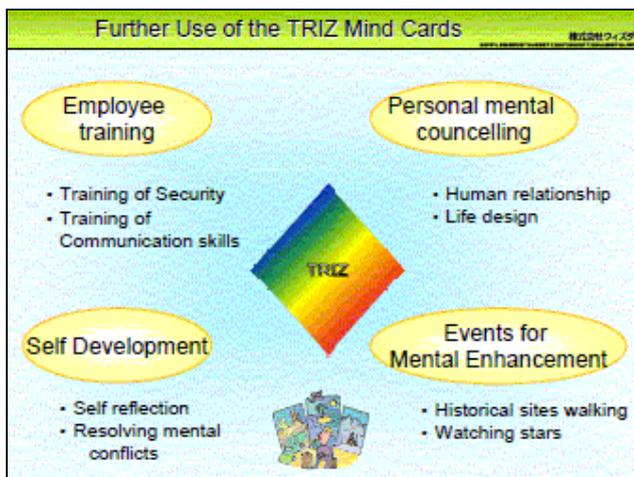
It's my turn ?

In Step (3), we think over various solutions from different viewpoints. There

are three basic perspectives, i.e., from Environment, from Behavior, and from Capability, which correspond to the 'Super-system, System, Sub-system' in the technical field. For each perspective, a TRIZ Mind Principle Cards (i.e., either one from Ace to 10) is (randomly) selected. With the card as a hint, we will think over some solutions, which would not come out from stereotypical thinking. Selecting cards in Step (1) and Step (3) may be done multiple times to think over from different viewpoints.



Slide (below-left) shows further applications of the TRIZ Mind Cards. [\*\*\* The Cards seem to fit well for the individual use of personal problem solving, but also suitable for open, group use for the sake of training and group thinking.] In the last slide (below-right), the Authors suggest 'Adding Color' by the use of the TRIZ Mind Cards, in the sense of playing. Four cards, more or less randomly chosen, are arranged for illustrating the basic policy in the present work.



[\*\*\* The Oral and Poster presentations by the team of Sanjou and Hanaoka are excellent work of introducing TRIZ to a new field (i.e.. Mind Field in the present case). Essence of TRIZ is well understood and adapted in a way easy to apply for the people in the new field, I think.]

**Toshio Takahara ( )** [J06, O-10] gave an Oral presentation with the title of "**The Ideal of TRIZ: TRIZ as the Way of Life? Part 2**". This presentation is philosophical and very much sophisticated as usual for the Author. However, surprisingly, once we accept his definitions of terms, the Author's statements are quite straight and clear, having much insights, I believe. I will try to introduce the Author's thought by use of his slides (and also backup descriptions in his full paper written both in English and in Japanese). Let's read the Author's Abstract first:

TRIZ could be applicable to every area including technological area and institutional area because TRIZ is an assemblage of methods consisting of changing one attribute, solving contradictions, segmenting and merging of attributes and objects, as I presented at the 4th Japan TRIZ Symposium. This paper surveys an idea of object, methods and thought of TRIZ. I will investigate the movement of objects of consciousness at the beginning process of barter as an example in the area which usual TRIZ does not deal with. And I will show unified four types of realization of purposes and propose a radical thinking for enumeration.

First, the Author wants to consider not only technology but also the whole area of human life and human society. Thus as an example, he considers about the start (or invention) of "barter" in some old stage of human history. He poses the question in the

slide (below-left) and considers the logical answers in the slide (below-right). "Barter" is discussed here as an simple, basic example of institution of human society.

**1. Life 1.1 Barter**

- **Invention of tool** brings about technology. **Invention of language** brings about communication.
- As same as tool and language "**barter**" was invented at some stage of the history of human. What brings about "barter" in history? What "barter" brings about in history? We must answer these two questions by logic.

**1. Life 1.1 Barter**

Before barter was invented, human being does not have the consciousness of individual, community nor possessing.

1. Recognition that my community has something and other community has another thing. Both have attributes to be bartered.
2. Image that we will give you something we have and you will give us something you have.
3. When, where and what quantity?

Something to be bartered is not changed. **Common idea for you and us** in representatives of each community is the start of barter. In this time **two Objects have the same attributes.**

The slide (right) shows the Author's scope in a simple manner. Technology is an assemblage of matter and its 'movements' (or action), he says. Person can work with matter onto outer real world. Institution is an assemblage of common idea and its movements, he observes. Person can work with idea onto real world of human society.

Human wants to resolve the differences (or gaps) between his/her desire and the present reality and try to change the reality intentionally. This is the basis of all human activities, which are carried out via technology and institution. Person act on Person and/or Matter in a general sense.

**1. Life 1.2 Life**

Matter and its movements  
→ **Technology**

Idea and its movements (including religion, sense of value): **Common Mind**  
→ **Institution**  
e.g. Politics, Economy, Family, Company

- **Intentional change (Resolving Differences) via Technology and Institution**

Person

With such a broad scope in mind, the Author tries to formulate how we can achieve 'Resolving differences' in a general context. For this purpose, the Author uses the 'radical thinking' of enumerating or classifying everything we can recognize and every change or modification we make intentionally.

For understanding the direction which the Author guides us, it may be useful here for us to read the Author's Conclusion (see slide (right)).

The Author tries to enumerate (or list up and classify) everything. Every thing recognized in the world is called 'Object' by the Author; while every change we make is called 'Modification' (or 'Change' or 'Realization').

The Author calls the goal of this trial 'Ideal TRIZ', because the present TRIZ has much of its basis and yet has to be expanded further. Understanding of the Object (in the extended sense by the Author) and function (or rather 'Modification' in the Author's term) forms the basis of this work.

**Conclusion**

- Trial for the **Ideal TRIZ** is made. Proper attitude for Object, granularity, function, structure of Object and attributes have a possibility to bring about logical structure and exhaustiveness in object and method to TRIZ, preserving existing vast amount of great contents of usual TRIZ. As an example unified method for solution is shown.
- **Radical Thinking for Enumeration** to recognize and change the Real World bring about the contents of this and previous papers (TS1-5)

The basis of 'Ideal TRIZ' is the understanding of 'Object'. The ordinary definition of Object (in TRIZ) is similar to the one defined by Victor Fey shown in the slide (right). But the Author wants to extend the concept much wider.

**2. The Ideal of TRIZ 2.3 Object Fey' s Definition**

- **Object - Article, Product** 50/100
- A component of the system that is to be controlled, processed or modified (e.g. moved, machined, bent, turned, heated, expanded, charged, illuminated, measured, detected, etc.).

[http://www.triz-journal.com/dictionary/Object\\_-\\_Article\\_Product-253.htm](http://www.triz-journal.com/dictionary/Object_-_Article_Product-253.htm)

The slide (right) explains the 'Object' in the Author's definition. 'An element of anything recognizable' is called 'Object'. Thus in addition to ordinary Matter, the Author includes 'Idea' (or fixed 'Mind'). He also included 'Movement' or 'Action' in his 'Object', making

a sub category of 'Process Object'. Movement is process from a viewpoint of time, while Action is process from a viewpoint of relation between Objects. Function is (primarily) the Meaning of Process Object (i.e., Movement or Action).

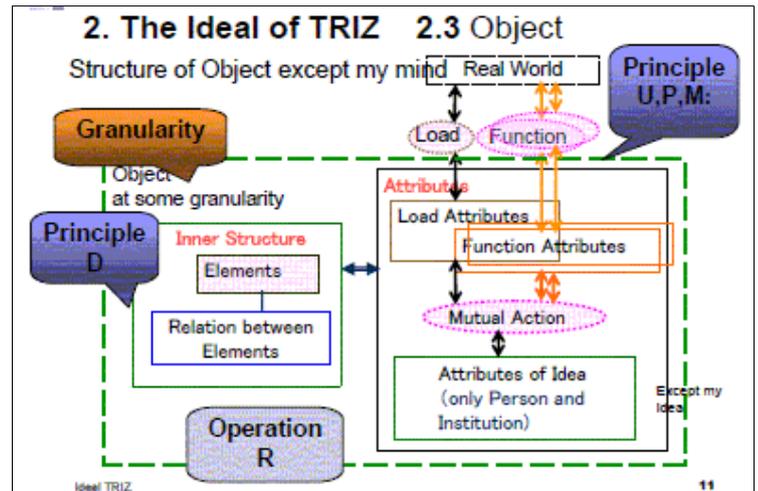
'Granularity' is also an important concept in the Author's logical scheme in grasping each Object.

### 2. The Ideal of TRIZ 2.3 Object

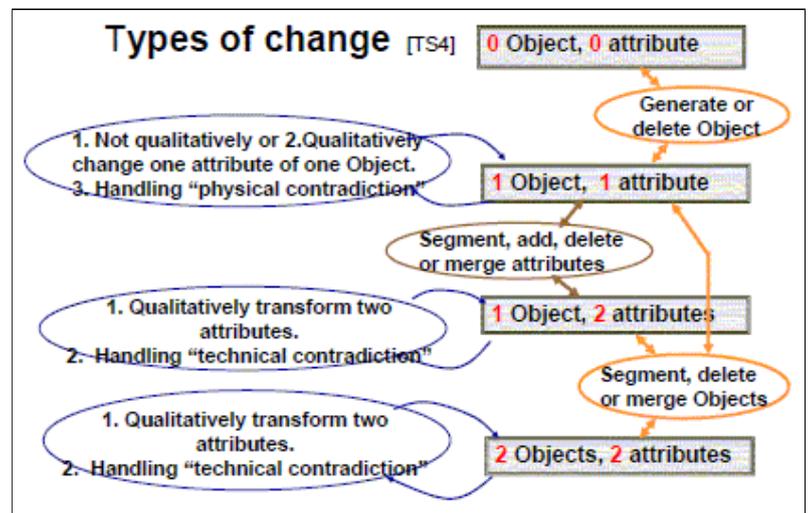
- An element of anything recognizable is called **Object**. I recognize three kinds of Objects. 70/100 cf. Definition by Feynman
  - (7.1) 1. **Matter** : System Object
    - 21. Information of individual or common notion which is taken by physical entity
    - 22. My fixed mind
  - 3. **Movement or Action** : Process Object **Movement is process from a viewpoint of time and action from a viewpoint of relation between itself and other thing to change itself and other thing.**
- → **I, Other Person, Matter, Movement** at different granularity
- **Granularity**= Size, magnitude or scope in space and/or time and degree of abstraction
- **Function**= (primarily) Meaning of Process Object, (secondly) Meaning of attributes of Object
- **Structure**= Granularity and inner structure

The slide (right) illustrates the structure of an 'Object'. 'Object' is grasped in some Granularity, i.e., size, magnitude or scope in space and/or time, and degree of abstraction. 'Object' has inner structure (i.e., elements and their relations) and so-to-speak outer structure (namely, granularity). This allows the hierarchical understanding of Object.

Attributes or Property is content of Object with specific description. Attributes (in a wider sense) is everything that concretely describe Object and contain Attributes (in a narrow sense, as shown in the slide (right)) and inner structure. Object, having inner structure and Attributes, produce Function to the outside, or Real World.



Another basis of the Author's theory is the understanding of the types of Change (or Modification, or Movement/Action) in various TRIZ operations. The slide (right) is such a summary the Author presented in 2008. Each TRIZ operation, such as those listed in 40 Inventive Principles, is essentially a function which converts a state (of some object(s) with some attribute(s)) into another. The state transition diagram in the slide (right) enumerate all such operations, under the limit of 2 Objects and 2 Attributes. The Author notices the handling 'Technical contradiction' and 'Physical contradiction' is included well in this representation.



On the basis of these concepts which the Author built up previously and has summarized so far, the Author has extended his theory of 'Resolving Differences' towards 'Ideal TRIZ', which can systematically describe and guide the whole process. Let's follow his logic:

The slide (right) describes the starting point of the Author's approach of the 'Ideal of TRIZ'. As explained above, the Author found TRIZ an assemblage of formal methods which cover all types of change (or modification) of Objects. Thus, TRIZ could be a unified method formally applicable to every action in every area. Depending on the applied area and on the purpose, the contents of operations may change but the form can be the same, the Author viewed. Thus TRIZ may be extended from technology area to much wider areas as the theoretical framework of operational science. This is the starting point of his approach presented in this work.

## 2. The Ideal of TRIZ 2.2 Starting Point

- TRIZ is an assemblage of formal methods consisting of changing 1 value of 1 attribute, handling 2 values of 1 Object (PC), handling 2 attributes (TC) and segmenting and merging of attributes and Objects, which cover all type of change of Object. [T54]
- This seems to mean that TRIZ could be a unified thought and method applicable to every action in every area and become formal basic of operational science.
- Contents change depending on view of purposes or applied area ( contents of existing TRIZ is preserved) but form can be the same.
- This is the starting point.

The slide (right) shows the Purpose for us to use 'the Ideal of TRIZ' and hence the Purpose for the Author to build it. The aim of 'the Idea of TRIZ' is to make everyone able to fulfill his/her proper Purposes by dealing with Objects and by specifying Changes among them. Since Objects can represent everything we can recognize, and since the Changes can cover any type of operation, our framework of 'the Ideal of TRIZ' should be able to describe any procedure we want to have. (The phrase 'immediately without any resources' is inserted here because this is the theoretical 'ideal' case.)

## 2. The Ideal of TRIZ 2.1 Purpose

- Everyone can fulfill proper purposes immediately without any resources,
- by dealing with Object everything one can recognize and
- by specifying one of possible types of change.

The slide (right) discusses on the Purposes for us to use 'the Idea of TRIZ'. There are three viewpoints of Purposes, the Author says. (1) Make new function (by making a new system with the desired function or by adding the function to the existing system). (2) Solve issues/problems in the existing system. and (3) Idealize the existing functions. The differences of these three viewpoints are relative, i.e., not essential, because they can be reformulated into one another by using the terminology of Objects (i.e., readjusting the granularity (or scope) of the Object we are going to handle). In this sense the Author express the Purpose as a single starting point in the subsequent procedure.

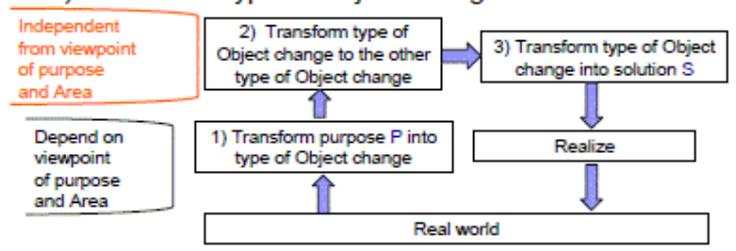
## 2. The Ideal of TRIZ 2.4 Viewpoint of Purposes

- 1) Make new function : Make new system or add new function to existing system
  - 2) Solve issues : Solve problems in existing system
  - 3) Idealize : Improve functions in existing system or realize existing functions with less resources
- The differences between these three [TRIZ] are relative. Any difference or problem is formulated by any viewpoints? using terminology of Object

The overall procedure of 'the Ideal of TRIZ' is shown in the slide (right). As you see this is similar to the 'Four Box Scheme' (or in some other sense to Nakagawa's 'Six Box Scheme'), but not the same. (1) The first stage is to clarify the Purpose P and transform it into some type of Object change. (2) Then in the second stage, the types of Object change are transformed into other types. (3) In the third stage, the type of Object change is now transformed into a Solution S. In the subsequent stage the Solution need to be realized in the Real World. We should note that the lower three boxes depend on the view points of Purpose and the area of application, i.e. the Real World, while the upper two boxes are independent of them and belong to the thinking world.

## 2. The Ideal of TRIZ 2.5 Elements of Realization

- 1) Transform purpose P into type of Object change
- 2) Transform type of Object change to the other type of Object change
- 3) Transform type of Object change into solution S



(1) Stage 1 for transforming Purpose into some type of Object change is described formally in the three ways as shown in the slides (below-left and below-right). [\*\*\* Sorry but I cannot follow the detail of logic here. We need to refer to the Author's previous papers on the definitions of O1, O2(PC), O2(TC), etc.]

### 2. The Ideal of TRIZ 2.5 Elements of Realization 1)-1

#### 1) Transform purpose into type of Object change

**P-O1**: Change one Object; change one attribute, delete or generate attribute or delete or generate Object within one Object.

- a) Purpose can be reached directly by a change of one attribute using existing environment
- b) Purpose can be reached by using causal relation

### 2. The Ideal of TRIZ 2.5 Elements of Realization 1)-2

**P-O2(PC)-S**: Transform purpose into handling two values of one attribute of one Object which is Physical Contradiction 2 PC2

c.f.: Physical Contradiction 1 PC1 expresses movement of the real world

**P-O2(TC)-S**: Transform purpose into Technical Contradiction 2 TC2 with two attributes of one or two Objects

Expansion of usual Technical Contradiction 1 TC1 which is handling two attributes of one or two Objects caused by side effect of solution

(2) Stage 2: Transformations from one type of Object change into another are as follows:

**2. The Ideal of TRIZ 2.5 Elements of Realization2)-1**

2) Transform type of Object change to the other type of Object change

**O1-O1**: Transform by the law autonomously  
Change of one attribute can autonomously cause deleting Object or attributes, generating Object or attributes according to the law of the mutual transformation of quantitative and qualitative changes or its expansion.

**O1-O2**: Transform by side-effect autonomously

**2. The Ideal of TRIZ 2.5 Elements of Realization 2)-2**

**O2-O2(TC)-S**: Handling Technical Contradiction 1 TC1 to deal with side effects  
Dealing with side effects under environment of usual Technical Contradiction 1

Even making new function or idealization can cause side effects. Technical Contradiction 1 does not necessarily depend on Physical Contradiction.

(3) Stage 3: Transformation from a type of Object change into a solution S has the varieties as shown in the slides (below-left and below-right). In these slides the Author mentions as the Methods about Object transformation (Principles U, P, M, D) and Object operation (Principle R). They all came from the TRIZ 40 Inventive Principles, reformulated and reclassified in the Author's framework. For example, Principle U is defined as "Object 1 and Movement (or Action) can change attributes of Object 2 (or Object 2 itself)"; thus the Author writes a comment in the slide (below-left): "Substance-Field" is one of the cases where Object is Matter in Principle U.

**2. The Ideal of TRIZ 2.5 Elements of Realization3)**

3) Transform into solution

**O1-S**: Transform within one value of one attribute of one (Except my mind) [TS4]

**Method**

Object Transformation Principle U  
Object Transformation Principle P  
Object Transformation Principle M



\*Substance-Field\* is one of the cases Object is matter in U

Object Operation R : We can bring in, bring out or replace Object or its element

**O1-S : (Continued)**

"object" is whole Object or element of inner structure of Object.

Object Transformation Principle D: Change of inner structure consisting of elements and the relation between them

**O2-S** : Transform type of Object change into solution within two attributes of two Objects  
This is buried in Separation Principles, Contradiction Matrix, 40 Principles [TS4] at present.

Combining the stages (1)(2)(3) together, the Author has found the four types of Realization procedure. All these are the routes from the Purpose P, via various forms of formulations in the middle, finally to the Solution S. In the full paper the Author writes:

We can try Type 1 at first for all purposes. This is to change one attribute, delete or generate attribute or delete or generate Object. A case of autonomous transformation by law O1-O1 may happen. If Type 1 would cause side effects we should solve Technical Contradiction afterwards. In Type 3, we solve Physical Contradictions in advance, and in Type 4, we solve Technical Contradiction in advance.

In the slide (right), the Author writes his findings what TRIZ needs, on the basis of his experiences of building 'the Ideal of TRIZ'. First he suggests 'Proper attitude for Object, granularity, function, etc.' He meant the extension of these definitions as he proposed here for the purpose of recognizing and handling all the things not only in technology but also human and society. Second he suggests the needs of enhancing/extending the logical structure and exhaustiveness in Object and methods. Current state of TRIZ provides a large mixture of elements and knowledge bases (as listed in the slide (right)), but lacks logical structure and exhaustiveness in them. Third he suggests the needs to activate radical thinking for enumeration.

**2. The Ideal of TRIZ**

**2.6 Four Types of Realization**

**1) P- O1, (O1- O1), O1- S**  
Change one Object for all purposes.

**2) P- O1, (O1- O1), O1- O2, O2- O2 (TC), O2- S**  
If case 1) would cause side effects we must solve Technical Contradiction 1 TC1 afterwards.

**3) P- O2 (PC), O2- S**  
Solve Physical Contradiction 2 PC2 in advance.

**4) P- O2 (TC), O2- S**  
Solve Technical Contradiction 2 TC2 in advance.

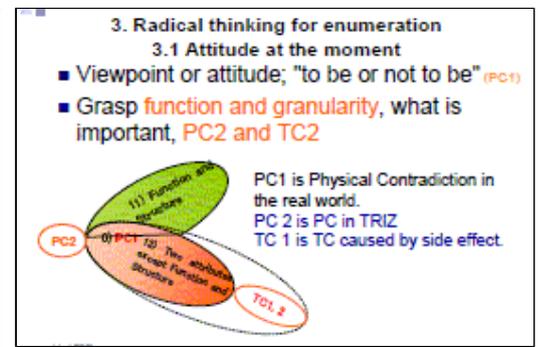
**2. The Ideal of TRIZ 2.7 TRIZ needs improvements for spread to everyone and advance**

- Proper attitude for Object, granularity, function, purpose, structure of Object and attributes, Root cause
- Lack of logical structure and exhaustiveness in object and method. Mixture of element, knowledge base (FAA, Su-F, IS, Effects, Technical Contradiction Contradiction Matrix, 40 Principles, Physical Contradiction, Trend, S-Curve, IFR, Trimming, Resources), viewpoint (9 windows, SLP, Ideality) and total picture/algorithm (ASIT, USIT, HTA(Larry Ball), ARIZ, OTSM)
- Proper attitude for "institution"
- Methods to synthesize (this paper don't deal with)
- Needs to activate radical thinking for enumeration which dialectics and TRIZ originally have some

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In the last part of the presentation, the Author further went on to show some sample results of his work with Radical Thinking for enumeration. It is an approach to try to list up a variety of cases as widely as possible, to find the structure in them, and to understand all possible cases in a general way. He first shows the structure of contradictions in the two slides (below-left and below-right).

3. Radical thinking for enumeration			Structure of Contradiction	
Real World and Attitude			Recognition	
0) Identity and Difference	11) Form and Content	12) Two attributes except Form and Content	2) Each part of one body, Unity	3) Mutually dependent two different recognitions
Two values of one attribute PC1, 2 A state and other state at the same time To be or not to be	Two attributes of one Object Function and Structure	Two attributes (TC1, 2) Opposites of movement except Function and Structure	History and Logic Recognition and Action Purpose and Mean Spread and Advance Objectification and Unification Possession and belonging Emotion and Logic Viewpoint and Attitude Modesty and Criticism	Part and Whole Phenomenon and Essence Concreteness and Abstraction Granularity and Inner Structure Function and Granularity Definition from outside and inside



The Author shows two more slides in his presentation. It describes the outline of radical thinking for structural enumeration to achieve possible extreme change in situation-independent area (such as TRIZ) and in situation-dependent area (i.e. concerning to the Real World). I am omitting them in this introduction.

[\*\*\* The Author, Mr. Toshio Takahara, has been working intensively for these eight years or so by himself, after his retirement of a manufacturing company. Please refer to the page of "[A Collection of Papers Written by Toshio Takahara \(2003-2007\)](#)" [Engl](#) [Japn](#) and his [presentation at TRIZ Symposium 2009](#) [Engl](#) [Japn](#). I am going to make a separate page of the present paper. I heartily wish him for good health to extend his thoughts further and further. I hope some of you will come and understand his approach better and push it further ahead.]

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