TRIZ Forum: Conference Report (22-E)

TRIZ シンポジウム 2009
The Fifth TRIZ Symposium in Japan

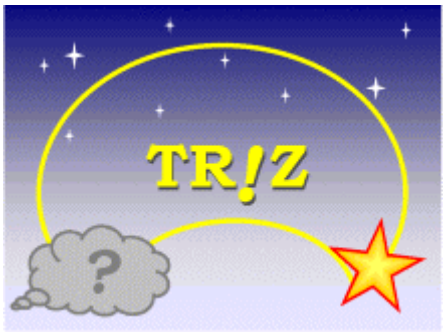
Personal Report of The Fifth TRIZ Symposium in Japan, 2009

Held by the Japan TRIZ Society, NPO, on Sept. 10-12, 2009, at National Women's Education Center (NWEC), Saitama, Japan

Part E. Promotion of TRIZ in Industries

Reviewed by Toru Nakagawa (Osaka Gakuin Univ., Japan), Dec. 13, 2009

[Posted on Dec. 24, 2009]



TRIZ Home Page in Japan Jap.

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

Editor's Note (Toru Nakagawa, Dec. 20, 2009)

This page is Part E of my Personal Report of Japan TRIZ Symposium 2009. Please see the Parent page Engl. 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 quote their slides here for introduction.

Note: (TN, Mar. 11, 2010) Click here for the PDF file of this page of Personal Report. E PDF

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E7.	**Mitsuo Morihisa** (*1), Hiroshi Kawakami, Osamu Katai (*2)	(SKI), (Kyoto University)	Spreading and Socialization Model of TRIZ by an Activity Theory Approach". First I will quote the Authors' Abstract:	E

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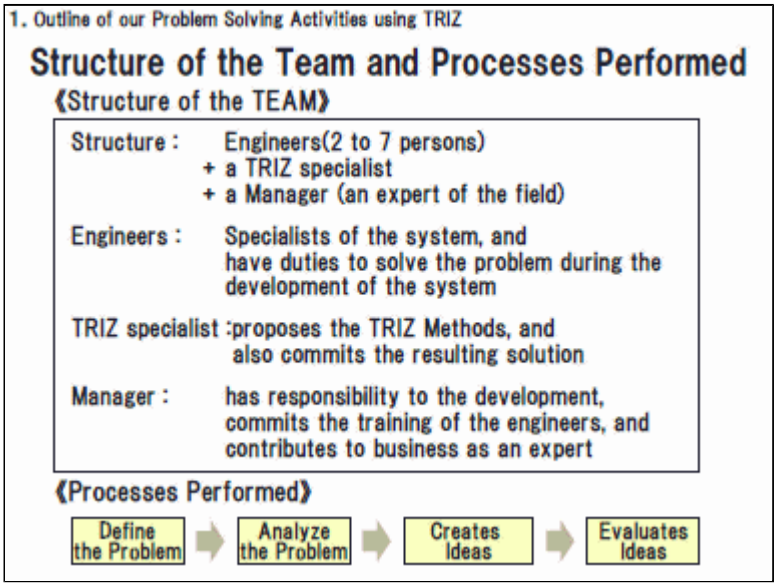
7. Promotion of TRIZ in Industries

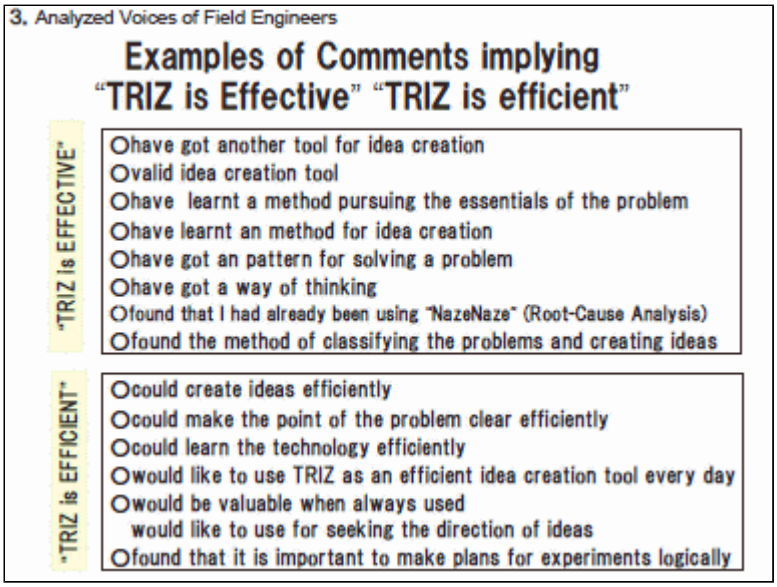
Yojiro Fukushima, Tsutomu Hata (Panasonic Corp.) [J24 O-7] gave a fine Oral presentation on **"Engineers' Understanding of TRIZ As a Consequence of Questionnaire Survey".**

The Authors have promoted TRIZ in the Corporate R&D Division of Panasonic Corp. since 2003 and have applied TRIZ to 156 real projects of their jobs in the field of IT & Software field (See Fukushima's presentation at Japan TRIZ Symposium 2008 Engl. Jap.). For each project, a joint team is formed by engineers (2 to 7 persons), a TRIZ specialist, and a manager as shown in the slide (right). Questionnaires have been carried out whenever a TRIZ project finishes its activity. Answers to the Questionnaires in the form of free description have been analyzed in the present paper. Among 372 answers from the engineers, simple and trivial comments are dropped and the remaining 262 comments are analyzed here.



In the analysis, a text mining method has been applied to find the frequencies and correlations of nouns/verbs/etc. (with Text Mining Studio 3.1 by Mathematical Systems Inc.) The Authors have thus found that the core messages of the comments are:

- TRIZ is Effective
- Clarification of the Problem is important but difficult
- Using TRIZ is difficult
- Efficiency is good



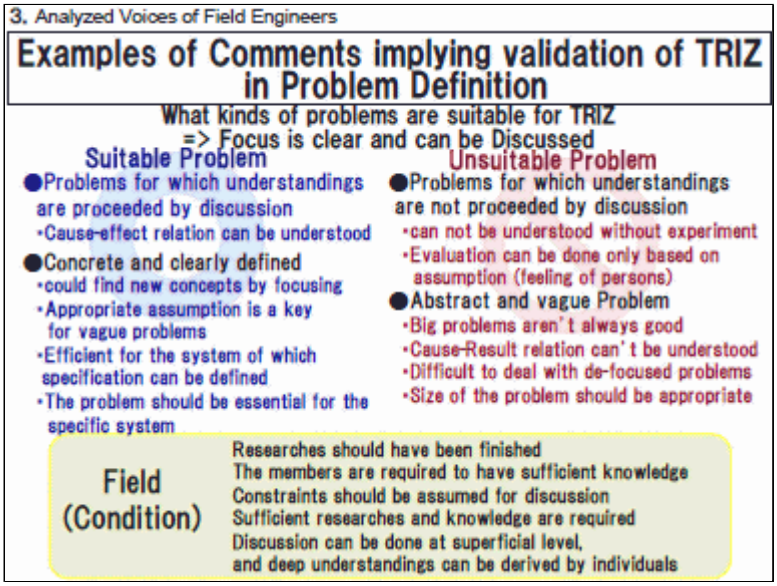
Examples of comments implying "TRIZ is effective" and "TRZ is efficient" are demonstrated in the slide (right).

The Authors list up examples of comments in a similar manner for all the steps of problem solving in TRIZ. The slide here (right) deals with the problem definition stage. The users clearly distinguish the problems suitable for TRIZ from the unsuitable ones.

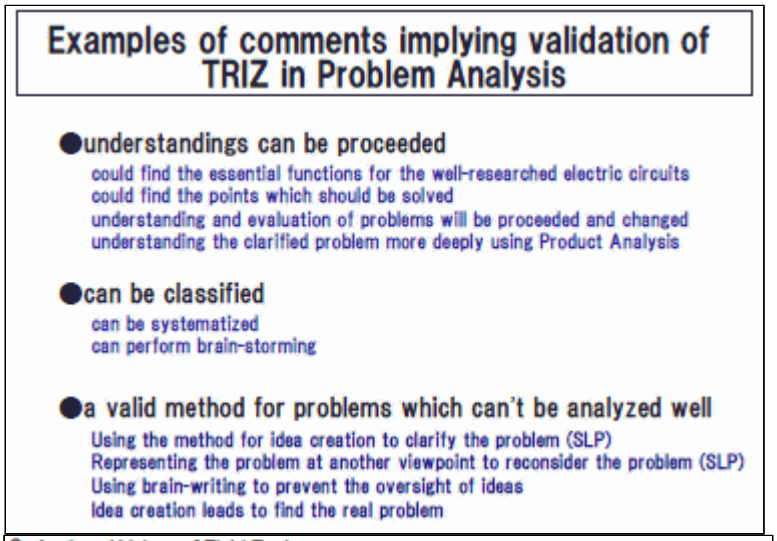
Suitable for TRIZ:
- Problems for which understandings are proceeded by discussion.
- Concrete and clearly defined.

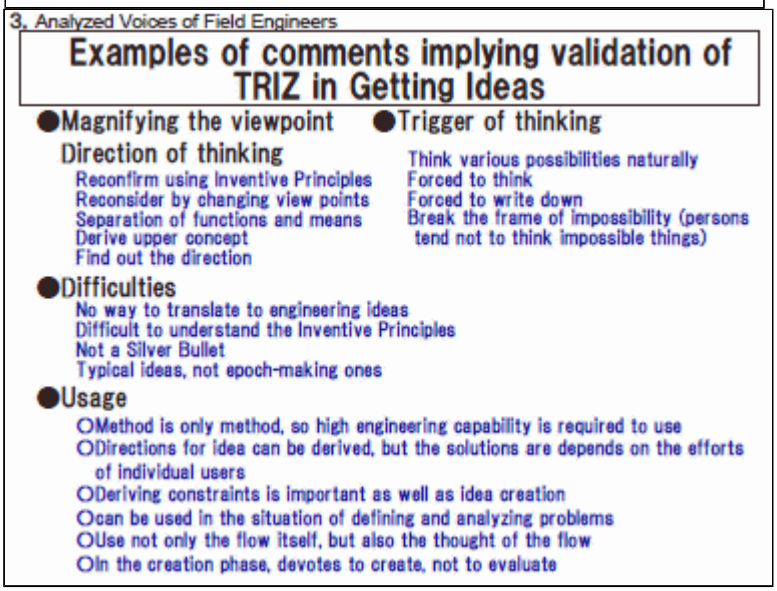
Unsuitable for TRIZ:
- Problems for which understandings are not proceeded by discussion
- Abstract and vague problem

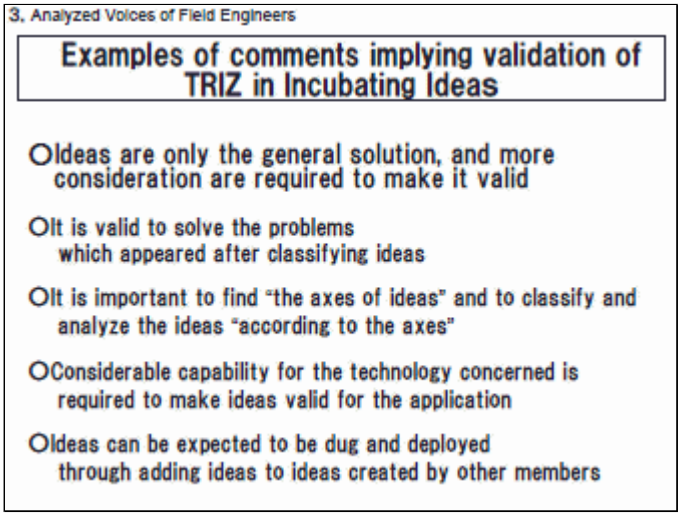
*** These descriptions by engineers are quite right, I think.

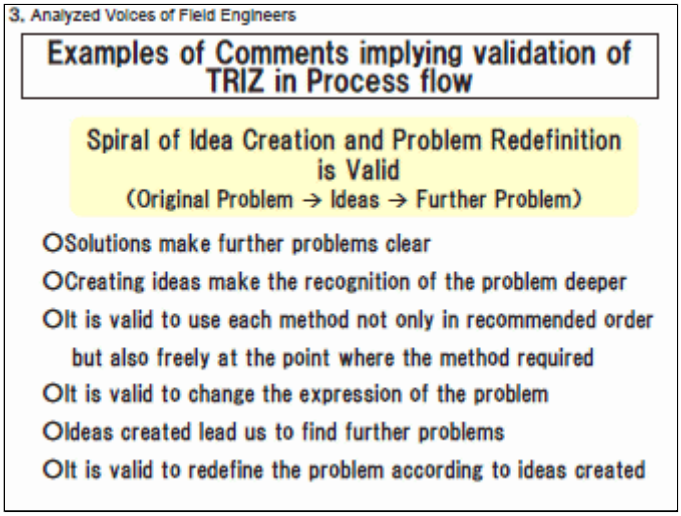


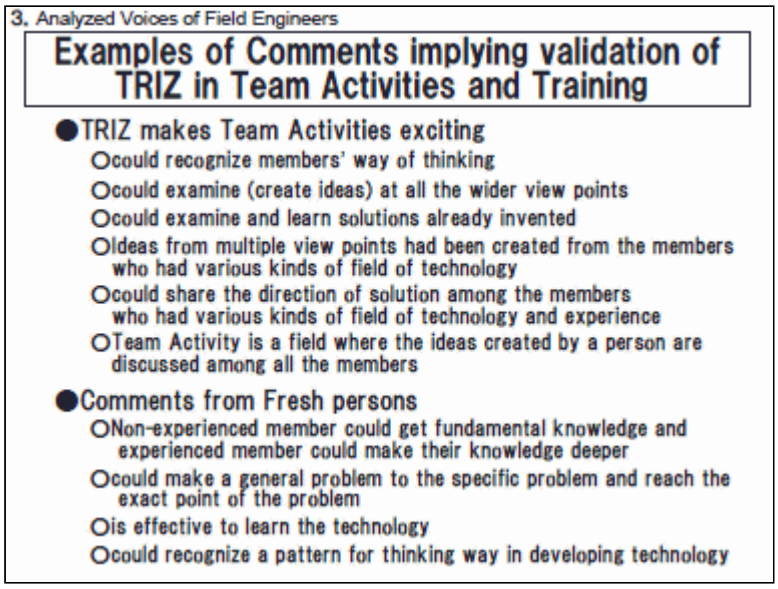
Comments by the engineers are demonstrated similarly in the following five slides (below).



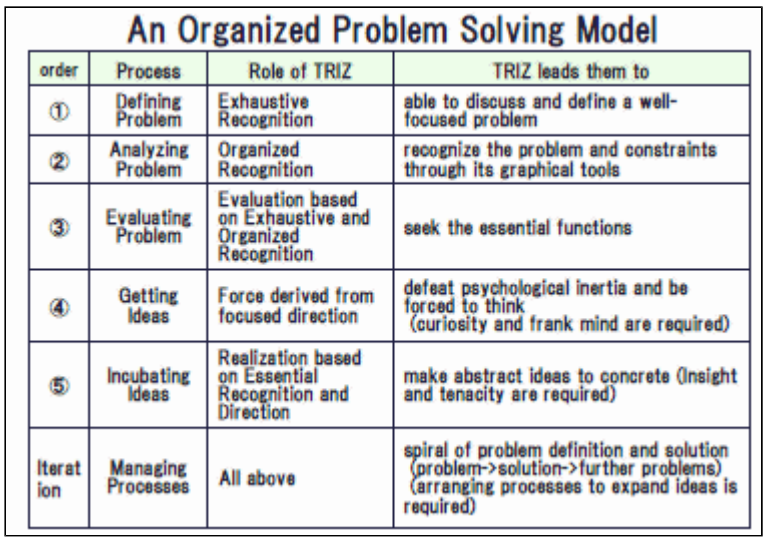






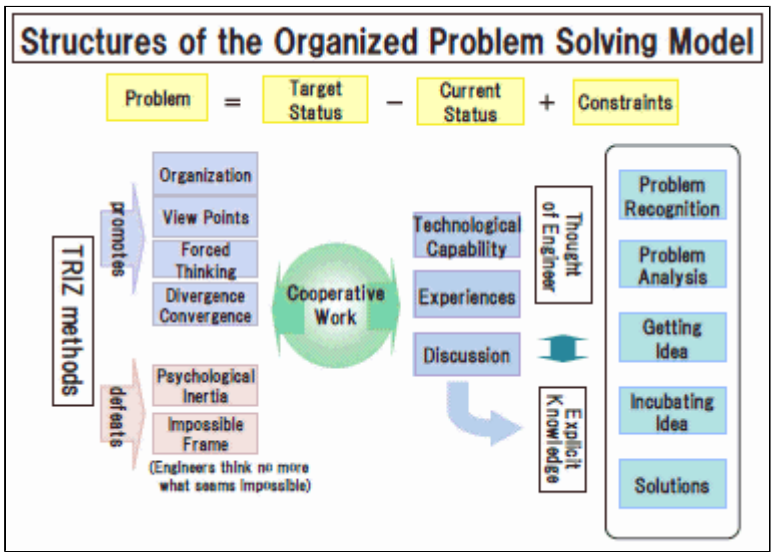


Having these comments from the engineers, the Authors have built and applied a model of their problem solving with TRIZ. The model is shown in the following two slides.

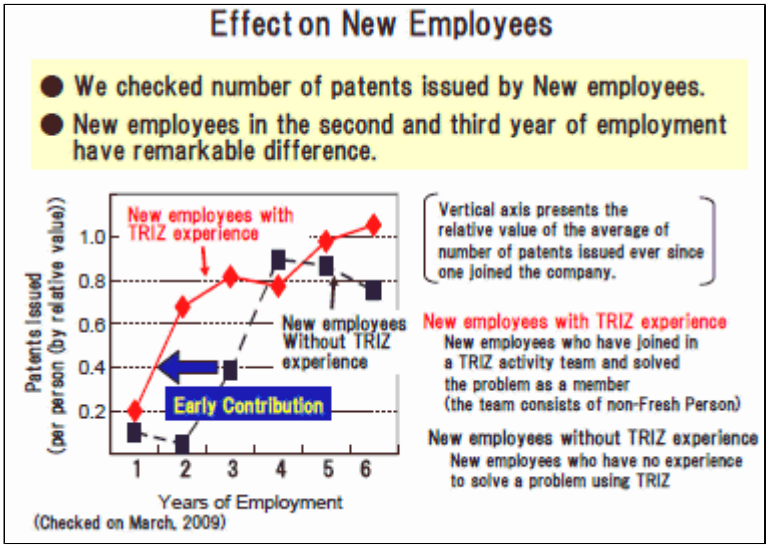


An Organized Problem Solving Model

order	Process	Role of TRIZ	TRIZ leads them to
①	Defining Problem	Exhaustive Recognition	able to discuss and define a well-focused problem
②	Analyzing Problem	Organized Recognition	recognize the problem and constraints through its graphical tools
③	Evaluating Problem	Evaluation based on Exhaustive and Organized Recognition	seek the essential functions
④	Getting Ideas	Force derived from focused direction	defeat psychological inertia and be forced to think (curiosity and frank mind are required)
⑤	Incubating Ideas	Realization based on Essential Recognition and Direction	make abstract ideas to concrete (Insight and tenacity are required)
Iteration	Managing Processes	All above	spiral of problem definition and solution (problem->solution->further problems) (arranging processes to expand ideas is required)



The actual effects of TRIZ on the engineers were clearly revealed in an objective records. As shown in the slide (right), the Authors have checked the patents issued by their employees. The number of patents issued by each employee are checked for each year. Special attention was paid to distinguish the employees whether he/she has or has not the experience of TRIZ problem solving in their freshman year in a TRIZ activity team together with non-fresh persons. The graph shows the number of patents issued per year per person (in an arbitrary scale) against the years of employment. The black square marks are for ordinary employees without TRIZ experiences in their freshman years, while the red diamond marks for employees with TRIZ experience in the first year of employment. In the second and third year of employment, the employees with TRIZ experiences have issued much more patents. The Authors evaluate this observation highly and interpreted as 'Earlier contribution is stimulated by the TRIZ experiences'.



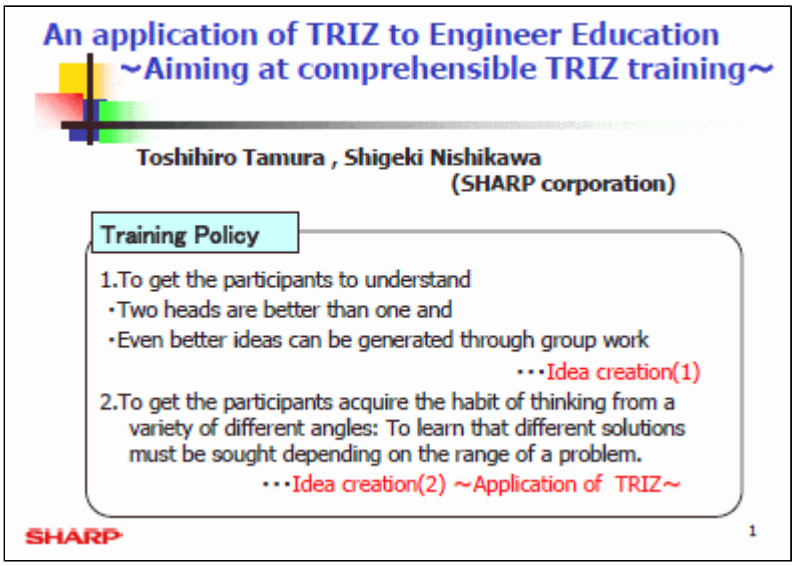
*** The Authors' TRIZ activities in Panasonic Corp. has been done very actively and steadily with the cooperation of several TRIZ experts and the managers in the Corporate R&D division in the field of IT & software. The answers to the Questionnaires well address the keypoints and are mostly positive. The graph of resultant effects on the employees in the patent issuing is very interesting. I recall Klaus-Juergen Uhrner's work of showing the numbers and levels of inventions in his company with and without the TRIZ experiences (ETRIA TFC 2005; TRIZ Home Page in Japan Engl). In the present paper, experiences of TRIZ on the job in the early years of employment (together with active older employees and guided by TRIZ experts) have revealed so much effects.

We should notice that this activity is not a seminar/class, not a training with textbook examples, not a training of a team of freshmen, not a guidance by outside consultants, not an experience of receiving a contract research, but is a real project of ordinary job. In a sense, this kind of team activities can be carried out everywhere and every time. A TRIZ expert (or a USIT expert in my sense) should just join them with the cooperation of their managers.

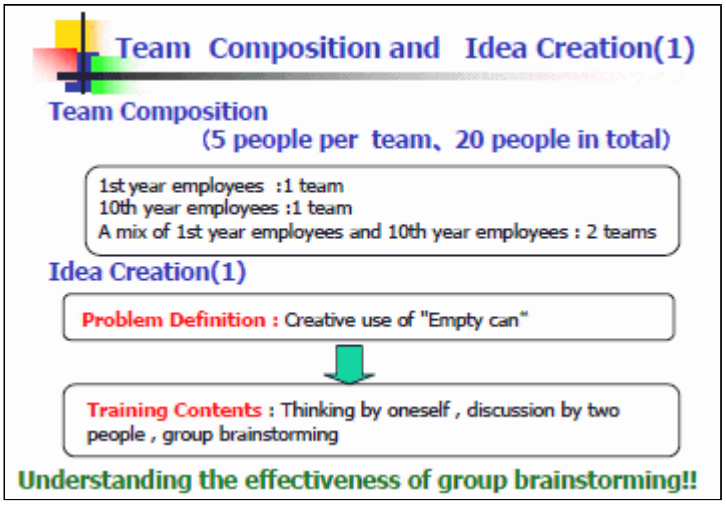
Toshihiro Tamura, Shigeki Nishikawa (Sharp Corporation) [J05 P-A3] gave a Poster presentation on **"Adaptation Example to Engineer Education That Uses TRIZ -- Aimed at Comprehensible TRIZ Training".** [Note: The slides will be shown after

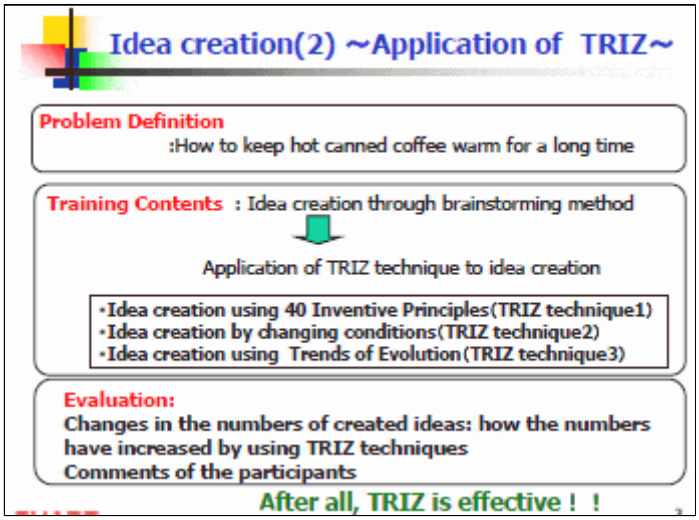
obtaining the company's permission (Dec. 23, 2009)]

The Authors report an experiment of engineers training by use of TRIZ. The aims of the one-day training are shown in the slide (right). I.e., for the participants to understand the merits of group work and of thinking from different angles (with TRIZ) in idea creation.



For the experimental training, they made 4 teams of engineers as shown in the slide (below-left); i.e., a team of 1st year employees, a team of 10th year employees, and two teams of 1st and 10th year employees mixed. The experiment was done in two stages as shown in the slides (below-left and below right). In the second stage, the problem of "How to keep hot canned coffee warm for a long time" were given to the 4 teams in parallel. The engineers worked to generate ideas on it first individually, then in team with brainstorming method, and then 3 more steps in team with different TRIZ methods (see slide (below-right)).

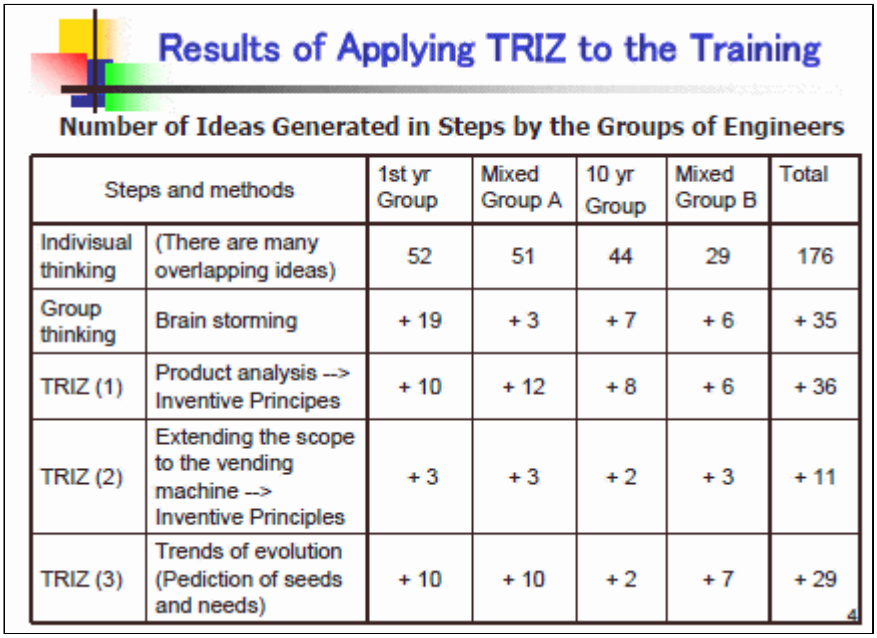




The results of the experiment in the 2nd stage are summarized in the table (right). The answers to the post-training inquiries to the engineers are analyzed [though not shown in this review], and the generated ideas were evaluated later by the Authors.

The Authors pointed out: (1) 1st yr engineers generated many ideas, while 10th yr ones not so many. (2) But the quality of ideas by 10th yr engineers is high, implementable with less cost. (3) The mixed-aged groups were not so productive in spite of the beforehand expectation; probably because the members were not familiar with one another

and hesitated in speaking up. (4) Introduction of TRIZ tools made the idea generation productive. And the participants realized the effectiveness of TRIZ tools.



Results of Applying TRIZ to the Training

Number of Ideas Generated in Steps by the Groups of Engineers

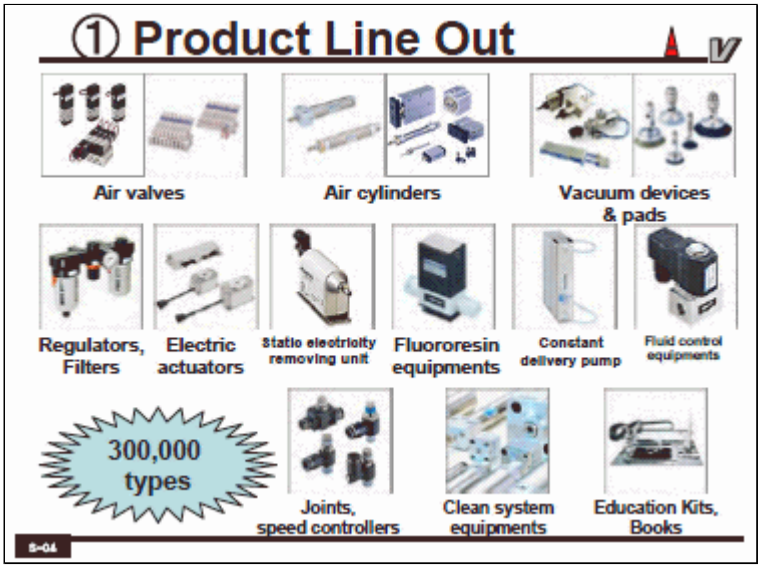
Steps and methods		1st yr Group	Mixed Group A	10 yr Group	Mixed Group B	Total
Indivisual thinking	(There are many overlapping ideas)	52	51	44	29	176
Group thinking	Brain storming	+ 19	+ 3	+ 7	+ 6	+ 35
TRIZ (1)	Product analysis --> Inventive Principes	+ 10	+ 12	+ 8	+ 6	+ 36
TRIZ (2)	Extending the scope to the vending machine --> Inventive Principles	+ 3	+ 3	+ 2	+ 3	+ 11
TRIZ (3)	Trends of evolution (Pediction of seeds and needs)	+ 10	+ 10	+ 2	+ 7	+ 29

*** The aims of engineer training in this paper are of much interest. It is not to teach/learn TRIZ but to teach/learn the importance of thinking cooperatively and differently with TRIZ. In many companies engineer trainings are done widely and regularly. Thus experiments of this kind are worthy of being designed, performed, evaluated, and reported publicly in order to improve the training methods and contents more and more effective and productive.

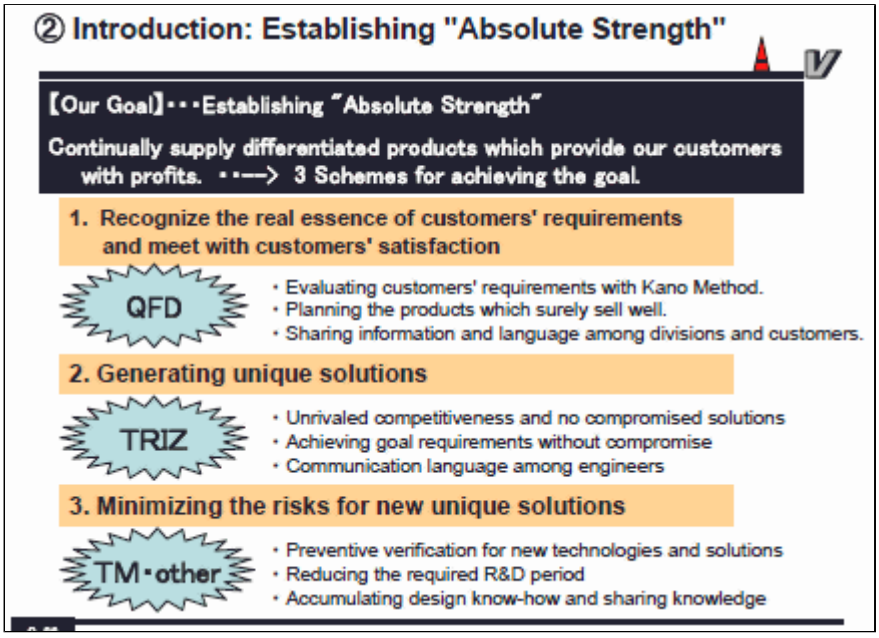
Tomohiko Katagiri, Toshiaki Tsuchizawa, and Shuichi Hosaka (Koganei Co.), [J14 O-5] gave an excellent Oral presentation with the title of **"Case Study of Introducing and Applying TRIZ to Real Projects for Obtaining Results (= Profits) (Part 2): Having Used QFD → TRIZ → TM, What are the Results? "**. This presentation has won the Award by the voting of Japanese participants this year again in sequence to their last-year presentation of Part 1 Engl Jap. The Authors' Abstract is quoted here first:

> Our Company, Koganei Co., Ltd., is a manufacturer of aero-pneumatic equipments, developing, manufacturing, and selling such devices with about 800 employees. As we reported in Japan TRIZ Symposium last year, we have introduced not only TRIZ but also QFD and TM (Taguchi Method) since October 2006 for innovating our whole development process. Our target is to achieve good results (i.e., profits), of course, and we have applied these methods to the real development process of our new products.
>
> The present paper is the second report of our introduction and application of QFD + TRIZ + TM. We will show you how we applied the methods in the actual development and what results we obtained. The following aspects will be reported with the real examples of the new products we developed.
>
> - How to match the product strategy with the marketing strategy (with QFD)
> - How to find (hidden) customers' requirements and set the target specifications of the products, which are surely well sold (with QFD)
> - Breaking through the unsolved barriers of current technology (with TRIZ)
> - Organizational learning by engineers with a common communication language (with TRIZ)
> - Robust and optimal design and its verification without depending on KKD (i.e., experiences, simple guessing, and guts) (with TM)
> - For establishing "incomparable strength" (with QFD + TRIZ + TM)

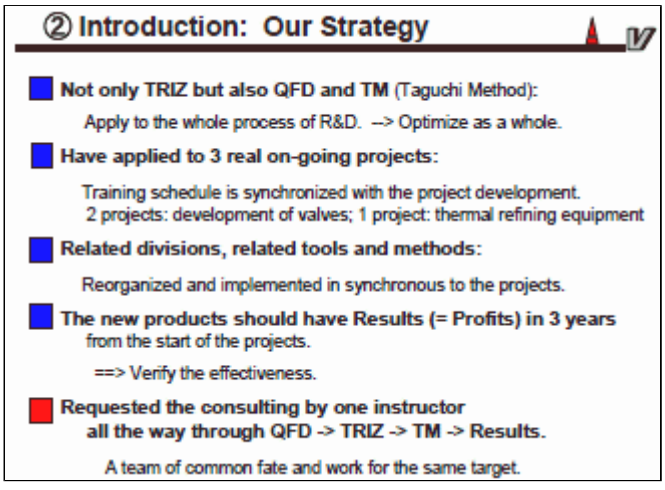
The Authors' company is a manufacture of aero-pneumatic equipments. The slide (right) shows their Product Line-out. There are 300,000 types of products, they say.

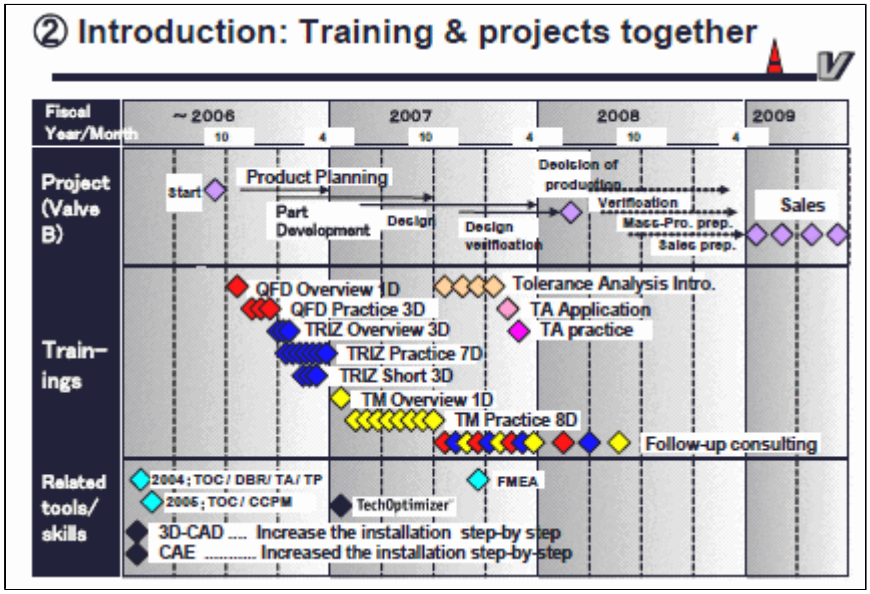


The slide (right) shows the intension of the present project. The Goal is stated as 'Establishing "Absolute Strength" '. I.e.,to supply differentiated products continually which provide their customers with profits. For achieving the goal, they realize 3 key points. (1) To recognize the real essence of customers' requirements and to meet with customers' satisfaction. -- QFD was introduced for this purpose. (1) To generate unique solutions. -- TRIZ. (3) To minimize the risks for new unique solutions. -- TM (Taguchi Method) and others (including 3D-CAD and CAE) were introduced.

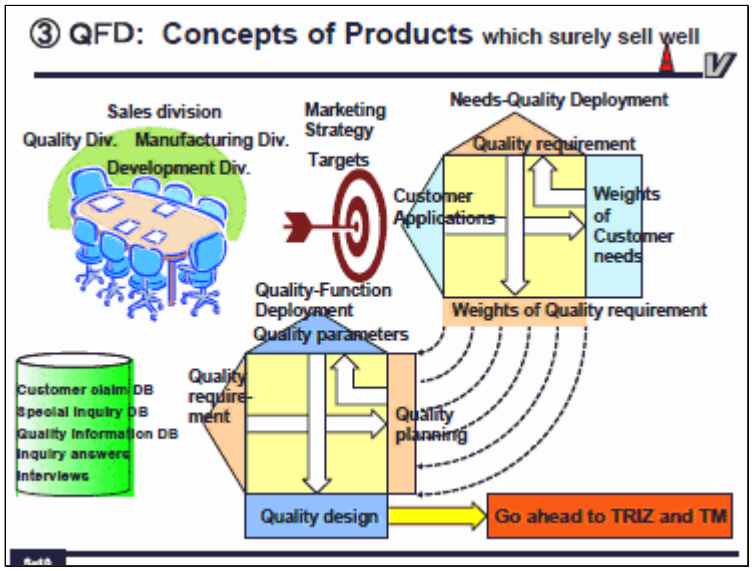


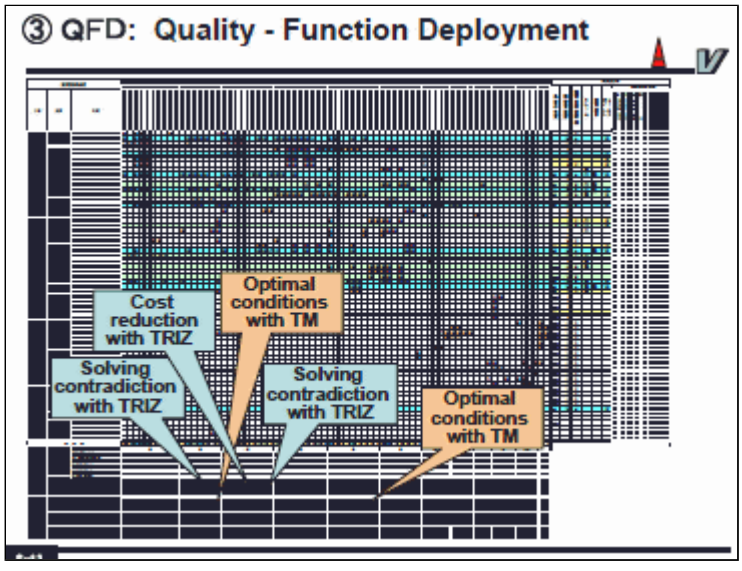
Thus they have chosen the strategy as shown in the following slide (below-left). They introduced not only TRIZ but also QFD and TM as a set. They have applied these methods to 3 real on-going projects. They were unique in requesting the consultancy by only one instructor all the way through the 3 methods. They also arranged the training schedule to match the progress of the projects, as shown in the slide (below-right).

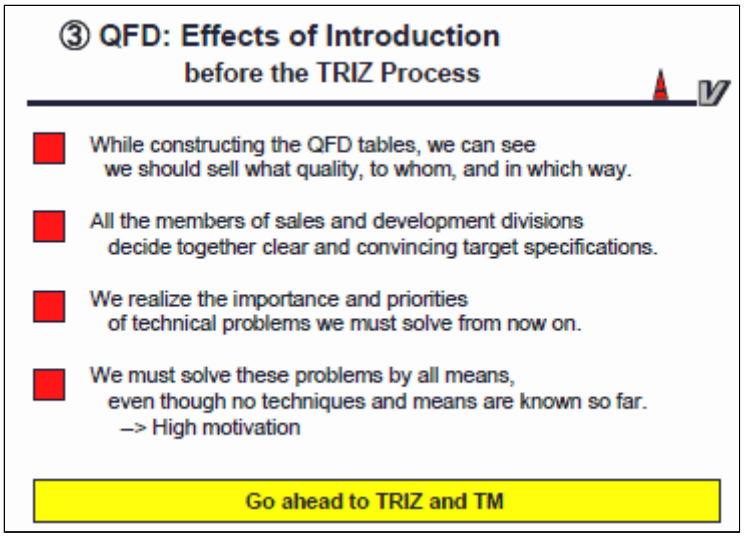




(1st Stage): The conceptual scheme of QFD is shown in the slide (right). Members from sales, quality, manufacturing, and development divisions work together with the QFD scheme. They gather and classify the customer needs, weigh the needs, and convert the information into the quality requirements. Then (in the Quality-Function Deployment) they make quality planning, and convert the information into the quality parameters. As shown in the slide (below-left), at the end of the Quality-Function Deployment, the project team understands the key issues (e.g. contradictions, cost-reduction requirements, optimal condition setting, etc.) they need to solve with TRIZ and further with TM. The next slide (below-right) is a nice summary of the effects of introducing QFD before the TRIZ process. They realize the importance and priorities of technical problems they have to solve by all means.



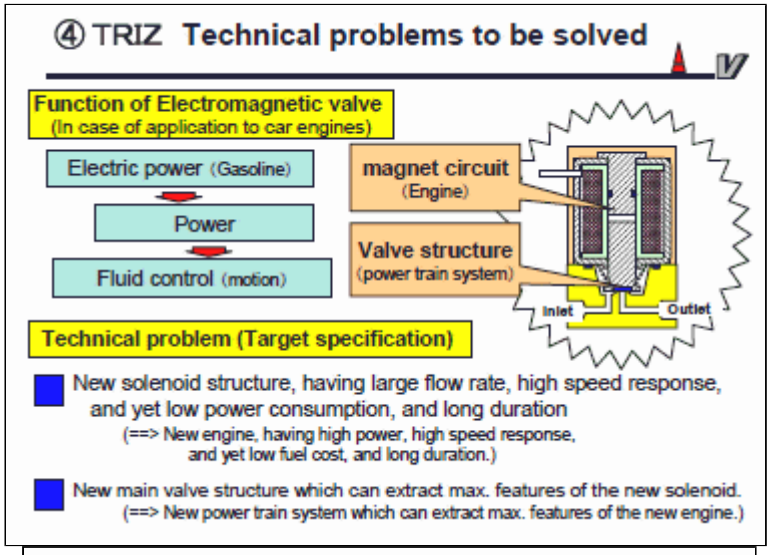


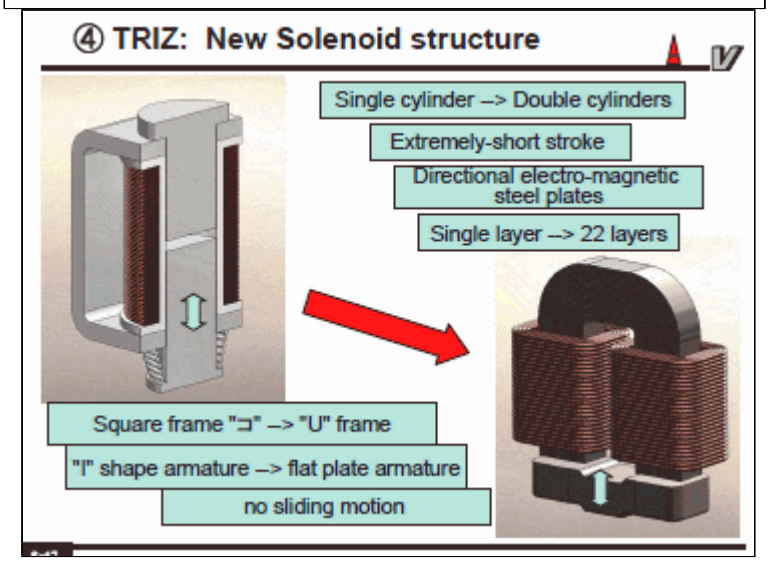


(2nd Stage) Key technical problems are solved by use of TRIZ. In the next slide (below-left), one of the key technical problems actually solved in the present project is illustrated. The key technical problem which got the consensus by the project members in the QFD stage is to develop a high-performance air valve and a new solenoid structure for deriving the valve. In the slide (below-left), the solenoid structure and the valve are

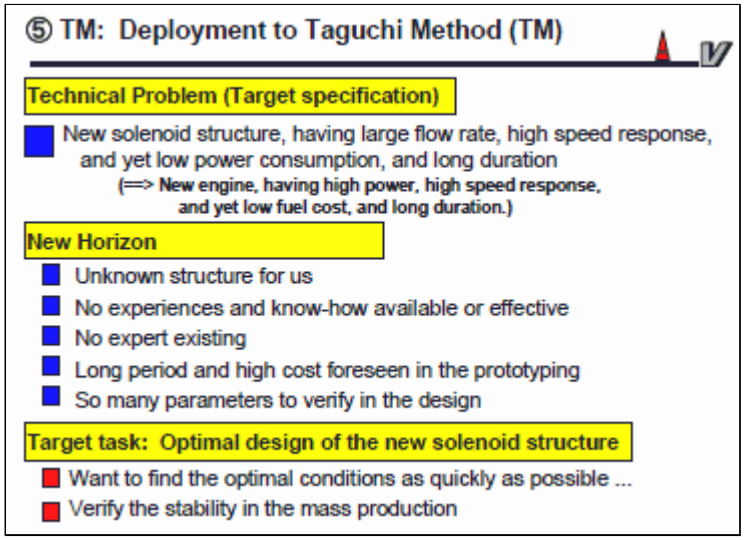
compared to the automobile engine and its power train. The target specification is to develop a new solenoid structure for an air valve, having large flow rate, high-speed on/off response, and yet low power consumption and long duration.

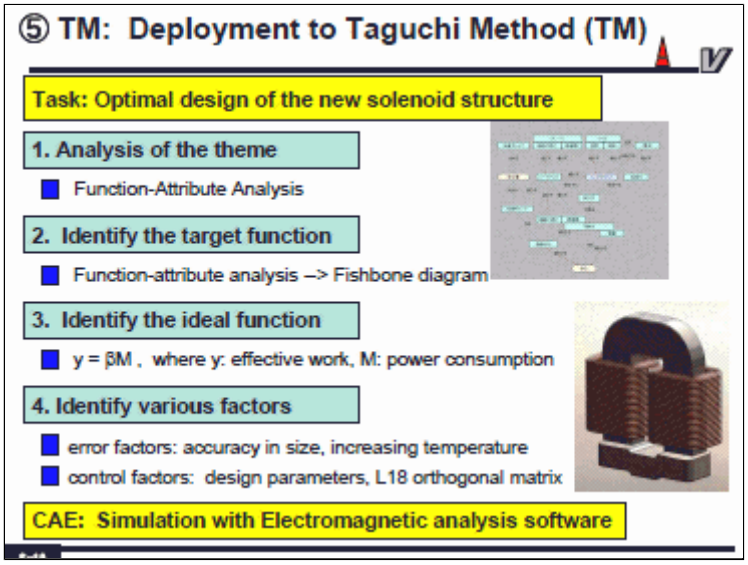
[*** You may notice that the target requirements appear very aggressive, high and broad, at first. You will soon see that the new product satisfying these requirements open a new horizon in various application areas.] In the slide (below-right), the solution concepts obtained with TRIZ are listed up, together with the illustrations of the conventional and the new solenoid designs.



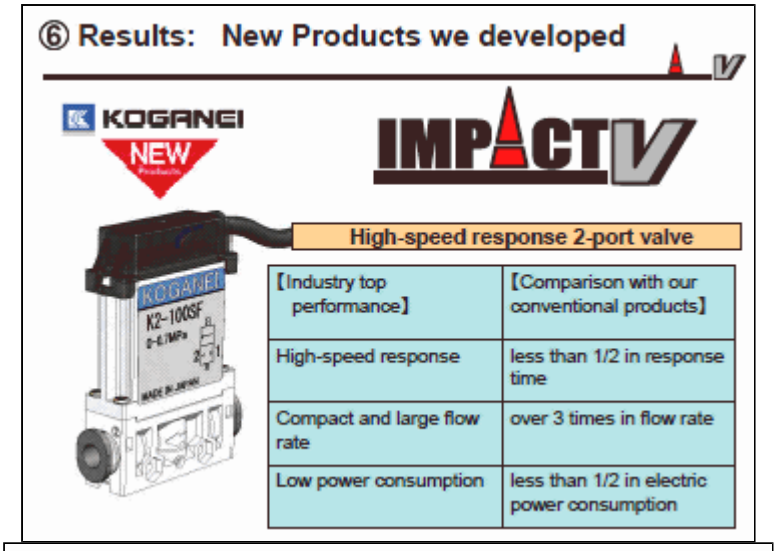


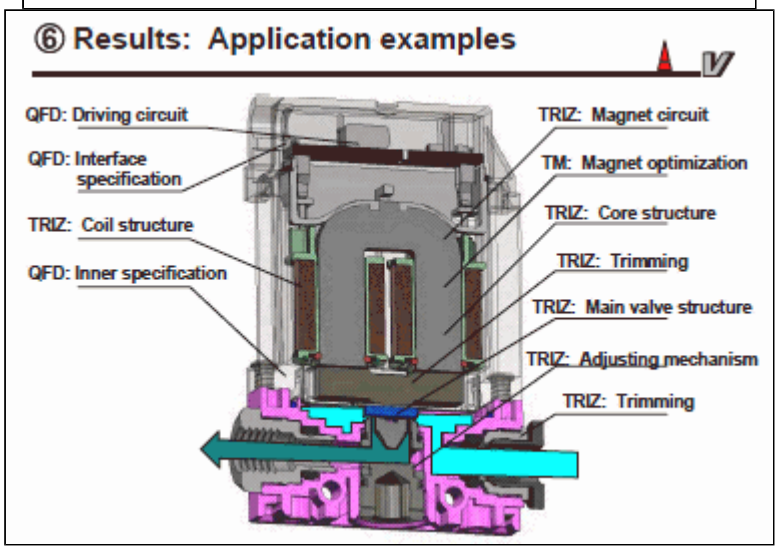
(3rd stage) Since several of their new ideas were out of the range of their experiences and expertise, there could be a lot of risks of failure in the design, manufacturing, performance, etc. (see slide (below-left)). Thus the target task in this stage is to find the optimal and robust design of the new solenoid structure, as quickly as possible. Thus the Authors adopted TM (Taguchi Method), as shown in the slide (below-right), for setting up various design parameters for testing. The testing itself was done mostly with CAE (i.e., simulation with electromagnetic analysis software) instead of physical prototype experiments. This approach has shortened the development period and has made the Authors confident in their design.





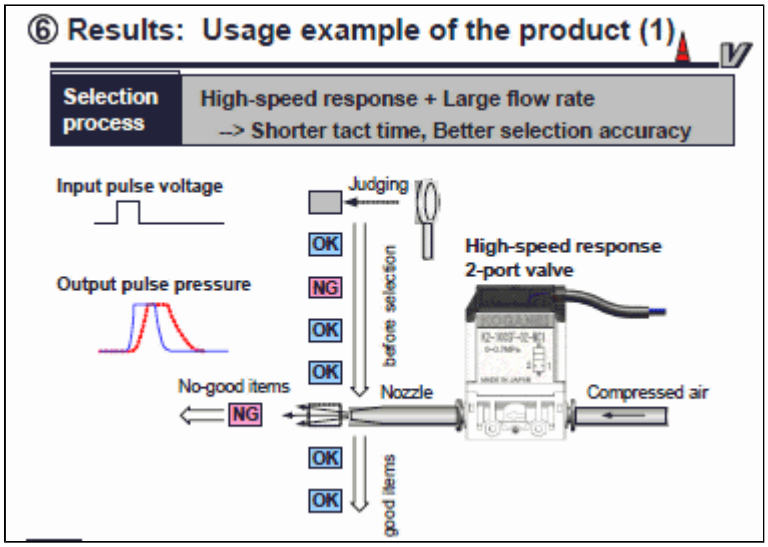
The following 2 slides (below) demonstrate the new product the Authors developed in the present project. The product is a 'High-speed response 2-port valve'. The valve, having the profile as shown (slide (below-left)), is used at the end (or in the middle) of a pipe of air flow and turns the flow on/off with high-speed response. The table in the slide (below-left) shows the achievement of performance. I.e., less than 1/2 in response time, over 3 times in flow rate, and less than 1/2 in electric power consumption in comparison with the company's conventional ones. The slide (below-right) shows the inner structure of the valve and the solenoid structure for driving it. The 3 methods (QFD, TRIZ, and TM) have contributed to the design choices as shown by the keywords in the slide (below-right).

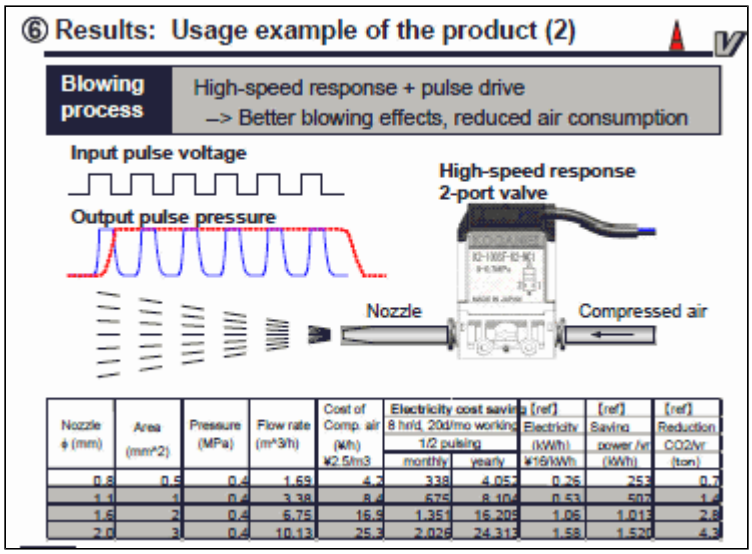




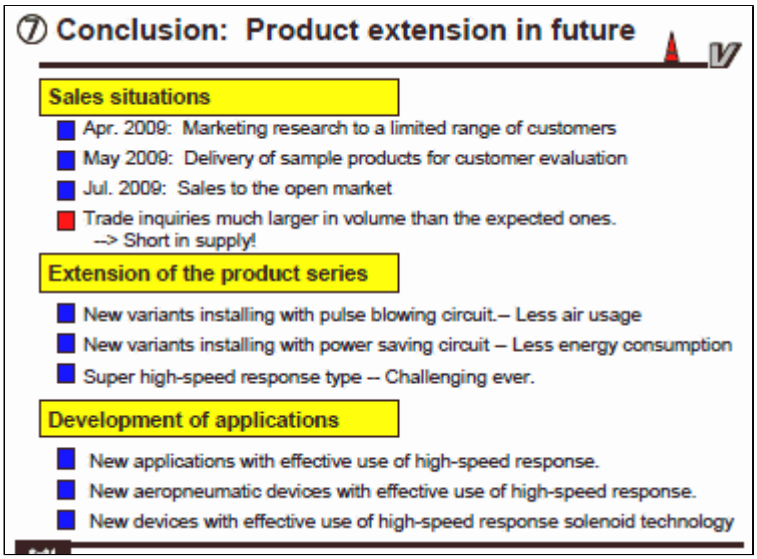
Usage examples of the new valve are illustrated in the following two slides (below). The valve (below-left) is applied to the selecting process, where items on the conveyer are judged whether OK or NG and then only the NG items are blown out by the compressed air switched on/off by the present valve. In response to the input

pulse voltage, the new valve gives the sharp output pulse pressure (in blue curve) in comparison with the slower pulse pressure (in red curve) obtainable by the conventional valves. This means shorter tact time and better selection accuracy. In the next slide (below-right) the new valve is applied to the blowing process. The valve is operated in pulse drive, giving the blow of compressed air in pulses. This gives better blowing effects, especially controllable in high speed, and reduced air consumption.





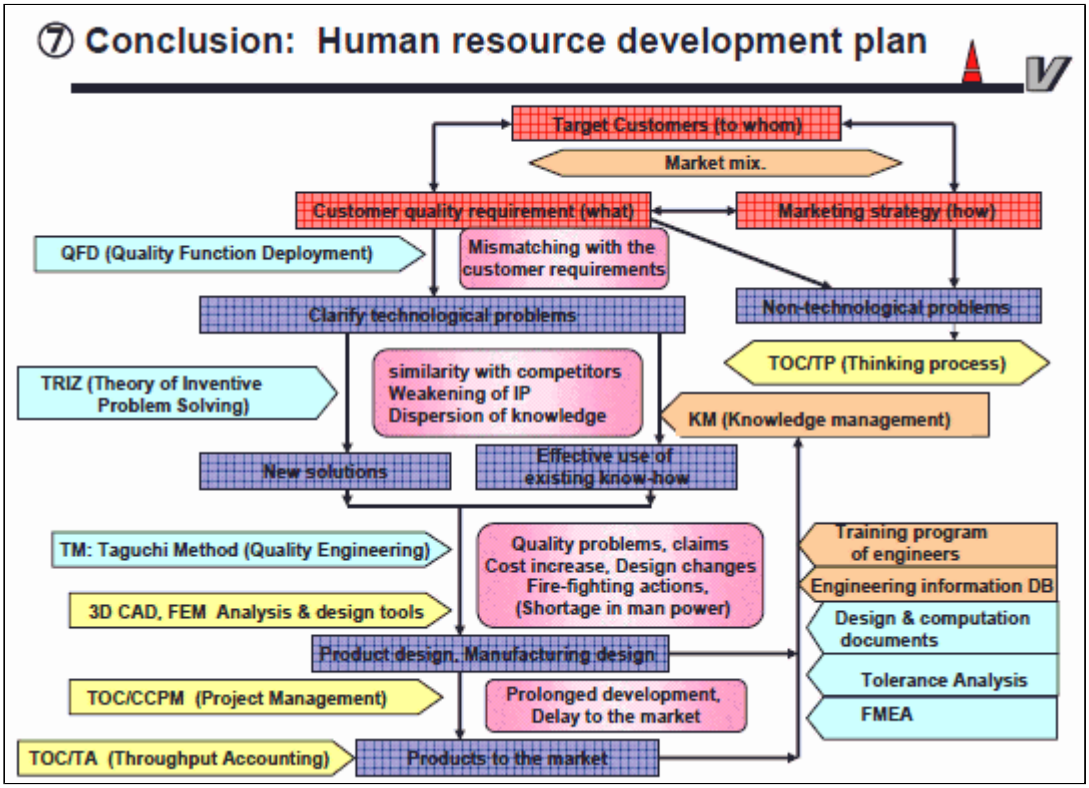
As mentioned above, the new valve has achieved much higher performance in response speed, flow rate, and power consumption than the conventional valves. The slide (right) summarizes the current sales situations and future extension. They started the sales to the open market in Jul. 2009, and received trade inquiries much larger in volume than expected. Thus the company is now planning the extension of the product series and further development of new applications with effective use of the high-speed response of the valve and of the solenoid technology.



*** This result is a tremendous achievement in the area of pneumatic valves, which are the company's main products working over several decades, i.e. the technology was thought already quite mature.

The Authors discuss, in conclusion, about their Human resource development plan (slide right). This diagram describes the tasks (in rectangles) to be tackled in the process of new-product development. In rounded rectangles problems and issues to be addressed are

mentioned. The (arrow-like) pentagons show the methods applicable to (and introduced in) such processes. The light-blue pentagons (especially QFD, TRIZ, and TM) were introduced in the present work. The yellow ones and orange ones are (probably) the methods already used.

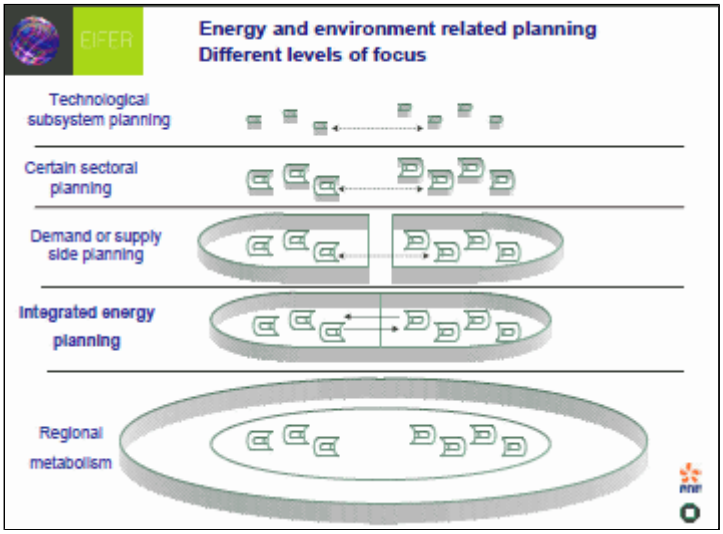


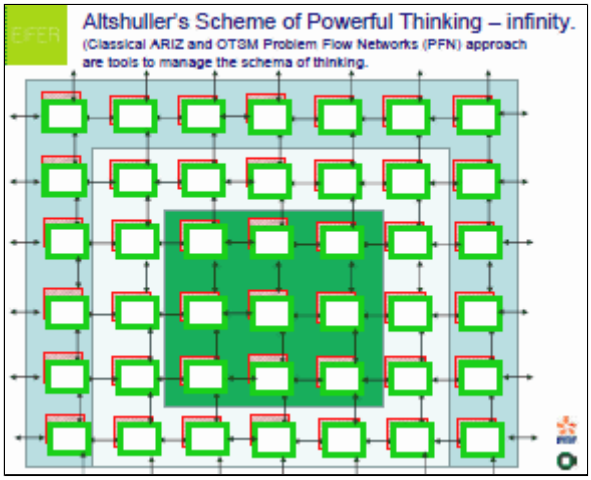
*** This is an excellent work achieved by use of TRIZ (and QFD and TM) and an excellent presentation of case-study achieved with TRIZ in its scope, contents, and vividness. It is amazing that the Authors were new in QFD, TRIZ, and TM when they started this project. Congratulations to the Authors, the company, and the consultant, Mr. Hajime Kasai (IDEA), for their wonderful achievement. We are very happy and proud of having this presentation in the Japan TRIZ Symposium 2009.

Atom Mirakyan, Nikolai Khomenko, Laurent Lelait, Igor Kaikov (European Institute for Energy Research, Karlsruhe, Germany) [E11 O-22] gave an Oral presentation on "The potential of OTSM-TRIZ as a frameworking method for modern regional, integrated energy planning and modeling". Let me quote the Authors' Abstract first:

> The reorganization of national energy markets in many countries, the increasing energy and environmental restrictions, the further energy market uncertainties and the diverse, regional conditions makes regional energy and environmental planning tasks very complex and region-specific. Numerous methods and tools have been used and are still useful for energy planning and modeling. However, there is a need for a systematic and well structured method to deal with these challenges.
>
> This paper presents OTSM-TRIZ as a potential method, which is intended to deal with modern challenges creating innovative solutions and supporting the whole modeling and planning processes. The initial use of OTSM-TRIZ in a case study provides useful guidelines for the planning and modeling processes, creating not only typical solutions but also combinations of typical solutions with various innovative solutions which fit the specific regional conditions.

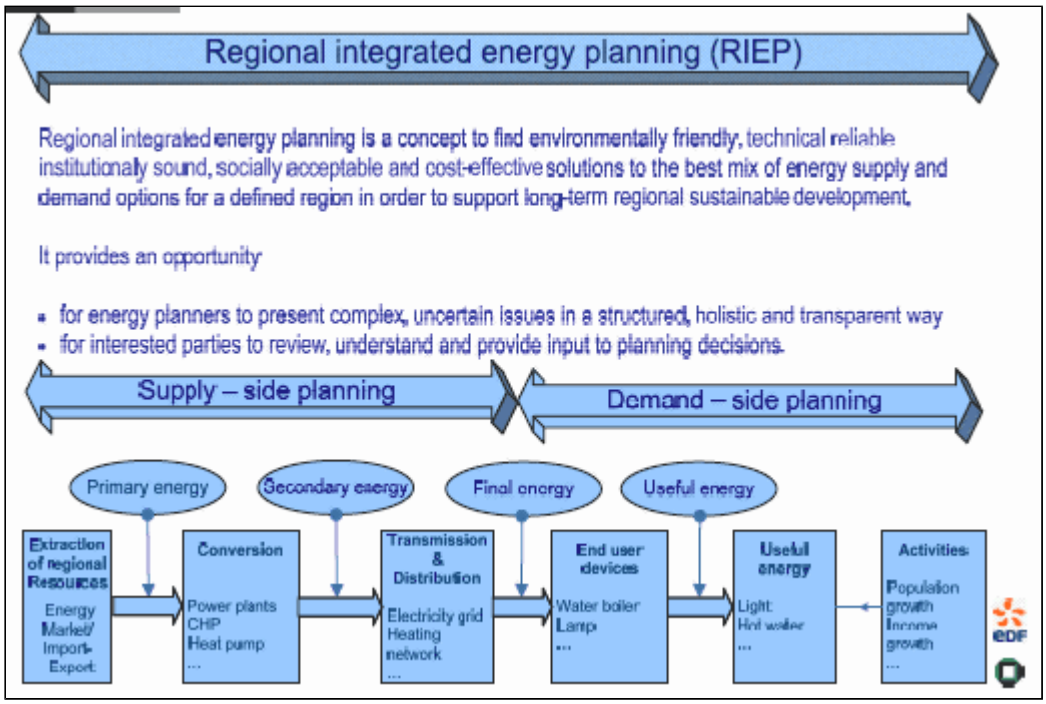
This paper deals with a very large-scale problem. The slide (below-left) shows different levels of focus. The smallest scope of planning written here is technological systems, and then the scope of planning extends to sectors,demand or supply side, demand-supply integration, and regional metabolism. (In the present paper, Region means an area at sub-national level.) Such a large-scale problem naturally requires the thinking of systems in a large hierarchy. The slide (below-right) is the Altshuller's Scheme of Powerful Thinking, i.e., infinity extension of multi-screen thinking. For each system in certain hierarchy of space (vertical in the diagram) and time (horizontal), an Anti-system (which challenges the evolution of the system) is also considered.



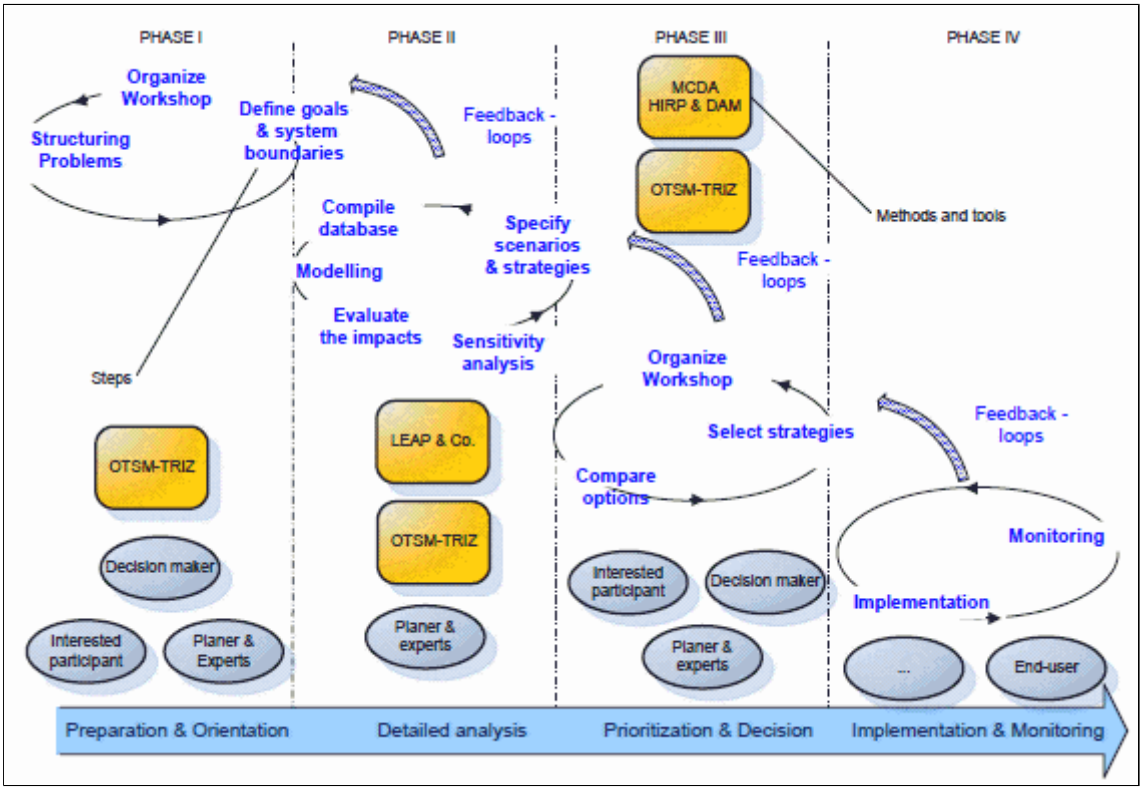


The task RIEP of the present project is defined in the slide (right). The project is to build an integrated plan for a region by implementing a methodology supported by OTSM-TRIZ. The target of the plan is stated as: environmentally friendly, technically reliable, institutionally sound, socially acceptable, cost-effective, and supporting long-term regional sustainable development.

In the lower half of the slide the energy flow is shown from the supply side to the demand side; this clarifies the framework of the project.



The RIEP project is not a simple planning in technology. It needs the process of forming a social consensus. The slide (below) shows the General overview of RIEP procedure. It shows four phases, (I) Preparation & orientation, (II) Detailed analysis, (III) Prioritization & decision, and (IV) Implementation & monitoring. We should note (at the bottom part of the slide) that different groups of people are involved. The Authors belong to the Planner & experts group, and get involved in the Phases I to III. The tasks and steps in each phase are described as cyclic procedure, and they go down to the next phases, being backed up with feedback loops.



For performing these tasks as the Planner & experts, the Authors use OTSM-TRIZ as the framework of methods. The Authors write in their Extended Abstract:

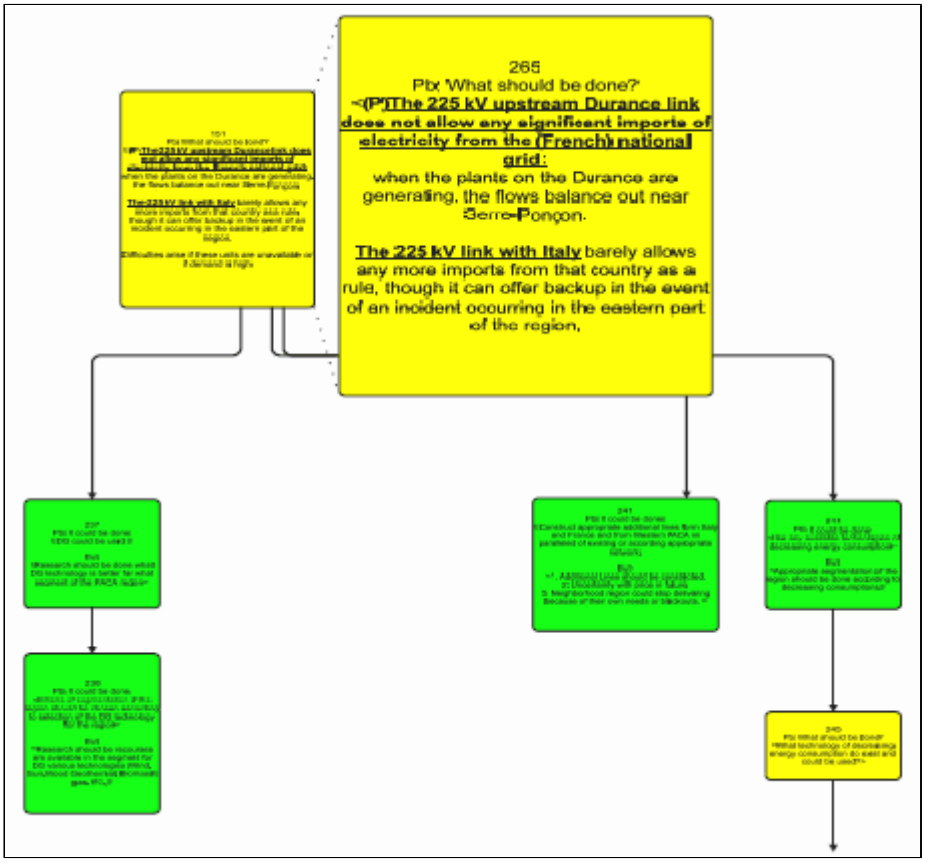
> OTSM is further development of Classical TRIZ aimed to manage complex interdisciplinary problematic situations. OTSM notions related to the Law of Ideality: Ideal Solution (IS) and Most Desirable Result (MDR) were used in the case.

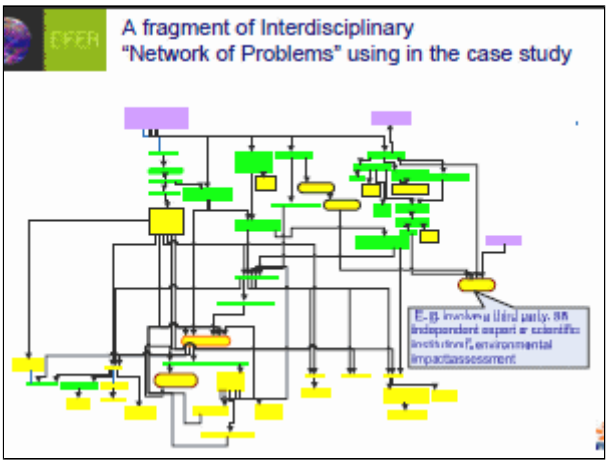
The slide (right) states the mission for OTSM-TRIZ for the present project.

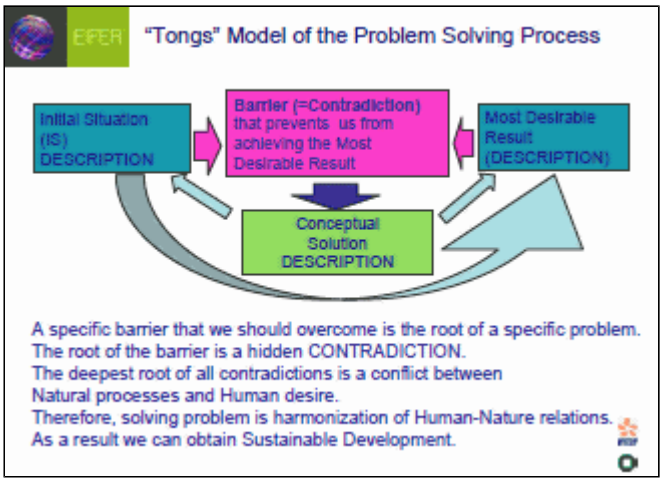
Among many tools in OTSM-TRIZ, two tools are shown in the 3 slides (right and below). First is the 'Network of problems', where various facts, events, and observations are related in the form of network flow. The slide (right) is a detail, while the slide (below-left) is an example of the overall structure. This representation is useful to understand the complex relations in the problem.

Second is the 'Tongs Model' (see slide below-right) for clarifying the contradictions and for solving them. Tongs Model is a simplified process of ARIZ. The Initial situation (IS) and the Most Desirable Result (MDR) are compared, and the Barrier (= Contradiction) is revealed, and then is solved. See more

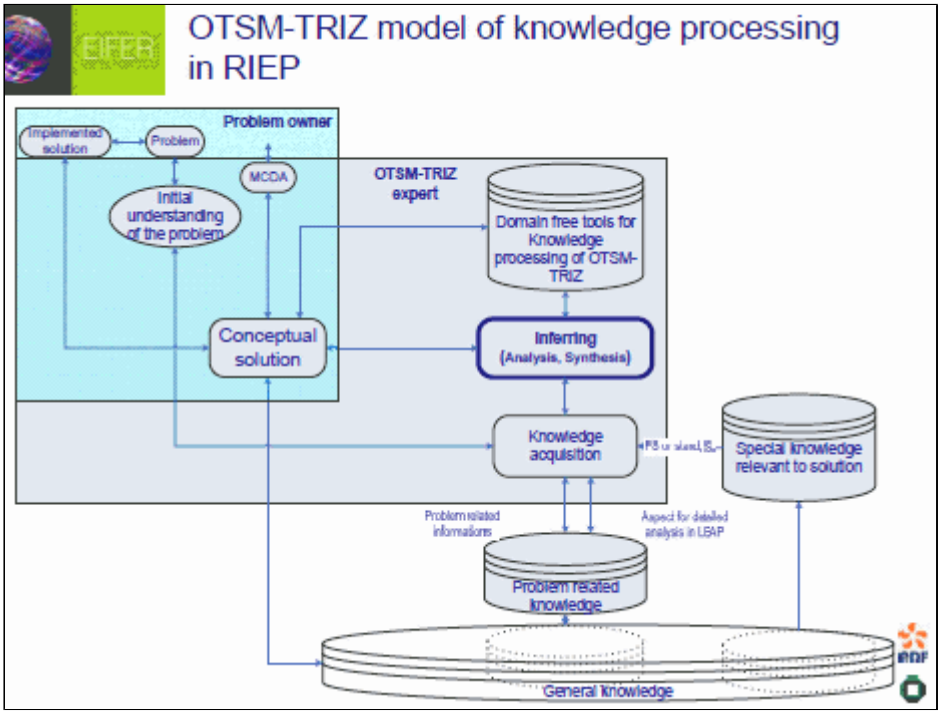
detail in the bottom part of the slide (below-right).







Knowledge gathering and knowledge processing is an important part of OTSM-TRIZ. The slide (right) shows the Authors' model of knowledge processing in RIEP. The upper-left block in the slide is the area of knowledge of the Problem owner, while the middle block (partially overlapped with the upper block) is the area of Planner & experts. In the bottom part, general knowledge is shown.



For visualizing the problem, the Initial Barriers (see the 'Tongs Model' in the previous slide) or potential conflicts are listed in a tabular form (slide right). Existing solutions or proposed solutions are listed in the rows, while different aspects are shown in the columns; they include technical, environmental, economic, social & institutional, and schedule barriers. The X marks represent direct barriers, while X? potential barriers. We can see the overall view in this kind of tables/diagrams

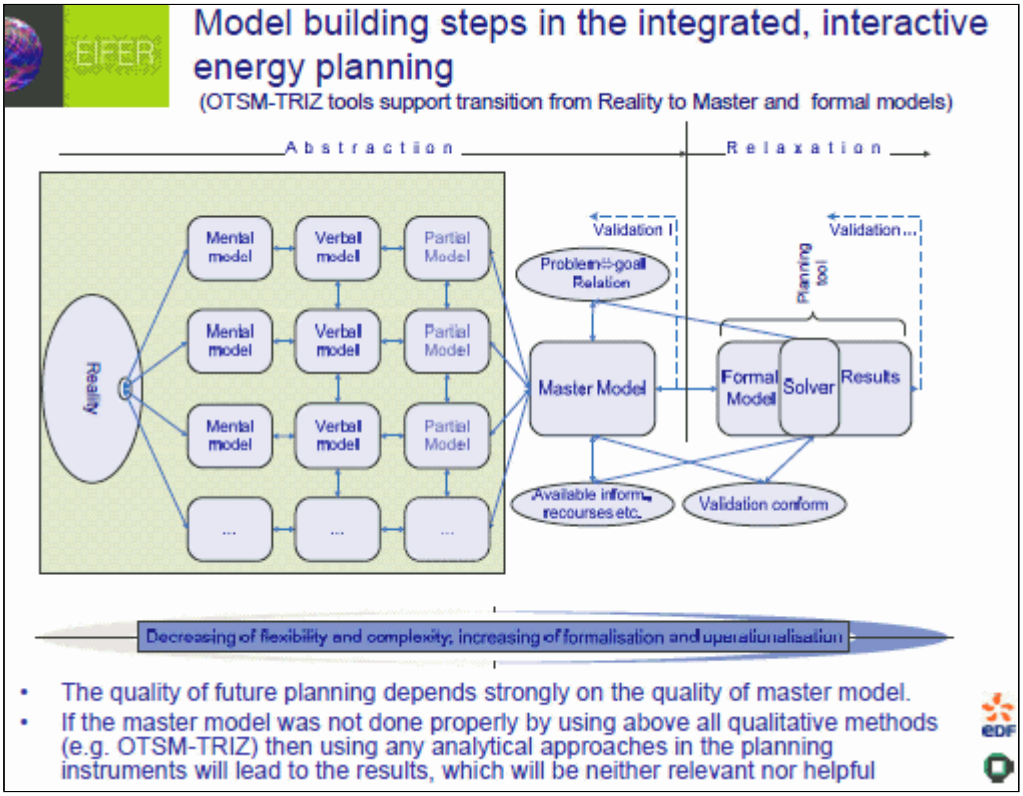
EIFER

Initial barriers or potential conflicts of some existing or proposed standard solution

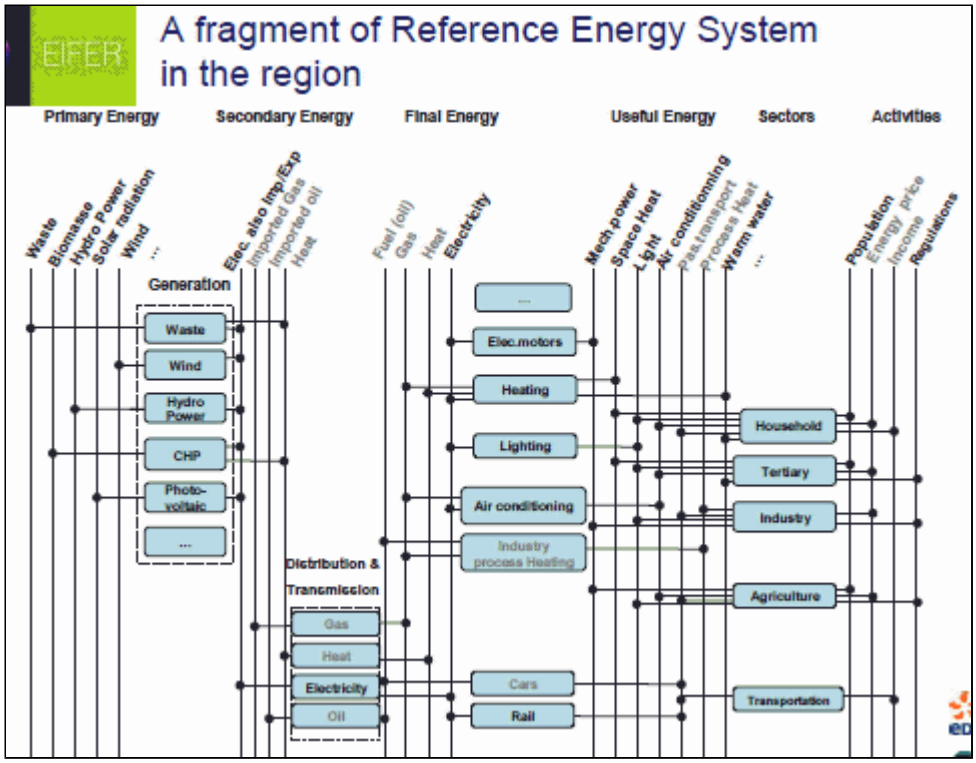
Partial or potential solutions	Technical barrier	Environmental barrier	Economic barrier	Social, Institutional barrier	Schedule barrier
Increasing the use of existing hydropower production	X	X			X?
Construct new thermal power plants in east PACA	X	X?	X?		
Export		X		X	
Increase the installation of PV, wind or other DG			X	For wind X	X?
DSM measures, load management			X?	X	
...					

The logical process of model building is illustrated in the slide (below). From the reality, models are built step by step using mental models, verbal models, and partial models. Then they are integrated into the Master Model. This is the most important model, the Authors write in the bottom part of the slide. [I asked the Authors what kinds of diagrams and tables we need for it. "There is no need for additional diagrams, etc.", the Authors say.] It must be supported with the (KB of) Available information resources and the Problem-Goal relation. The Master Model must be constructed and validated in Phase I (and in Phase II).

Then various problems/barriers need to be solved for planning (in Phase II) as shown in the right part of the slide. This is the stage of full use of OTSM-TRIZ. The results thus obtained are shown to the workshops of Prioritization & Decision (in Phase III), where the leadership should be handed to the decision makers.

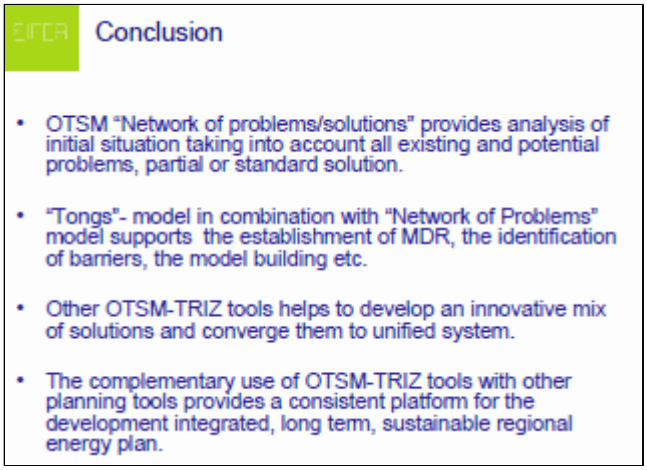


The slide (right) shows an example of a component of the Master Model. This is a fragment of the reference model of the overall energy system (corresponding to the scheme shown in the slide of RIEP) in the region. Complex input-output relationships in several stages are shown with grid-type connections (instead of ordinary arrows) for the clarity of representation.



A lot of concrete work seem to have been done in the project, and the contents themselves are too large to be shown in this presentation, whose main purpose is to demonstrate the methodology of planning.

The Authors' conclusion is shown in the slide (right). The Authors emphasize the roles of two tools based on OTSM. One is the Network of problems/solutions, the other is 'Tongs' model. These two, working together, have the special features of representing the problem situations (or initial situations, existing or potential) and various solutions (existing, partial, most desirable, feasible, etc.). OTSM-TRIZ tools with other planning tools together in complement provide a consistent platform for the complex task of regional energy planning, which must be integrated, long-term, and sustainable.



*** This paper gives an excellent methodology for a large-scale project of technical and social planning. It has been applied in the real regional planning project. The concepts of OTSM were started in 1970s by Altshuller and then since middle of 1980s developed mostly by Nikolai Khomenko, one of the coauthors of this presentation. OTSM seems to have been accepted by a number of European groups, e.g., INSA-Strasbourg, EIFER-Karlsruhe, etc., and have been applied to various real projects. Nikolai Khomenko told me that he has published 4 papers on OTSM last years in scientific international journals. We wish to learn about OTSM more closely. [See Nikolai Khomenko's blog site: http://otsm-triz-sustainable-innovation.blogspot.com/]

KyeongWon Lee (Korea Polytechnic Univ., Korea) [E15 O-4] gave an Oral presentation with the title of **"TRIZ Activities in Korea and Its Success Factors until 2009".** [This paper was accepted late in mid August as a Poster presentation, and was actually presented in an Oral session on the First day afternoon due to a cancel of other speaker after only one-day notice in advance.] The Author's Abstract is quoted here first:

> Many big companies and Universities in Korea are very interested in TRIZ applications until 2009 more and more. In this paper the TRIZ activities at Samsung, LG, Hyundai Automobile and LS Cable are briefly summarized. The Departments of Mechanical Engineering of Korea Polytechnic University and Ajou University etc. have opened the TRIZ course for "Creative Engineering Design Education" certificated by ABET. Specially main factors on why TRIZ applications in Korea are most active in the World, will be explained in the view of the author with some demos on Korean TRIZ books, TRIZ online/ offline education (& consulting) programs and the good results that may be possible to be opened to public domain in Japan.

The first two sides shown (below) are the overview of TRIZ history in Korea. The Author writes that TRIZ was introduced into Korea in 1996-1997, and it provided good case studies at Samsung Electronics, as reported in TRIZCON2004, and such good results stimulated much the penetration and usage of TRIZ. And today TRIZ in Korea is at the stage of rapid progress with excellent industrial cases and education for engineers and in universities, the Author says.

[*** On the TRIZ activities in Korea, we have met several presentations which support this paper. They include: Nikolai Shpakovsky et al. on TRIZ online training program (ETRIA TFC 2001) , Hyo June Kim (Japan IM User Group Meeting, 2003); Sun-Wook Kang et al. and Mijion Song et al. on TRIZ promotion (TRIZCON2004) , Valery Krasnoslobodtsev et al. (TRIZCON2005); Jung-Hyeon Kim et al. on the TRIZ propagation in Samsung Electronics (ETRIA TFC 2005); Valery Krasnoslobodtsev (A seminar in Japan, 2006); SeHo Cheong et al. on the TRIZ promotion in Samsung Electro-Mechanical Co. (Japan TRIZ Symp. 2008)]

I. Overview of TRIZ in Korea

In 1996, 1997, Introduction to LG, Samsung first
Meantime, not active and drop of TRIZ team at LG and slow

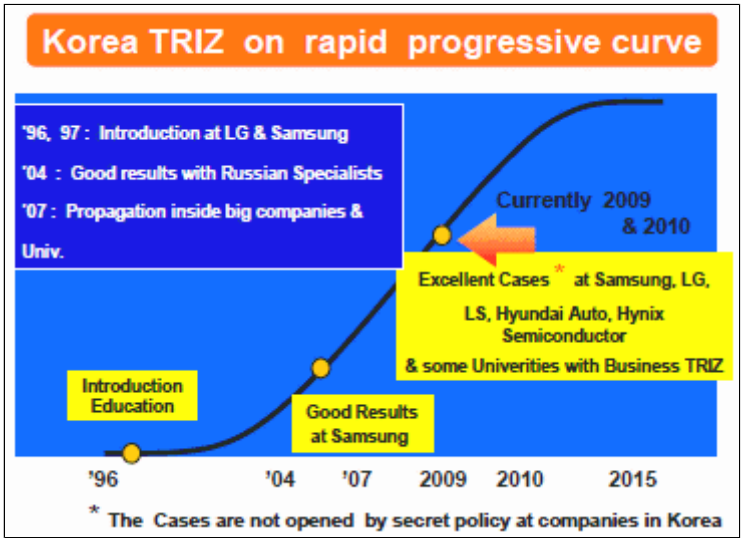
In 2004, Cases study at Samsung Electronics at TRIZCON2004, Korea TRIZ Study Gr. , KTA & STA (Samsung TRIZ Asso.)

In 2006, Online Samsung TRIZ course (20,000 person completion)

In 2007, TRIZ intro. edu. for all Directors at R & D of Samsung ; basis for bigger result and TRIZ education for all engineers

In 2008, Interests in Business TRIZ, Online Non-Technical course, Good results at LG, LS Cable, Hyundai Auto. & medium size

In 2009, more TRIZ results & TRIZ expert in international TRIZ conferences as TRIZFest, ETRIA & Japan TRIZ Symposium



After obtaining successful results with TRIZ in big industries, such as Samsung group companies, they put much weight in TRIZ education programs, especially online intranet programs. Now they have online TRIZ education program in the public domain for a very cheap tuition (see slide below-left). TRIZ books have been published in Korean language, including some original, non-translation ones (see slide below-right).

II. Online TRIZ Education Program

- Korea is strong country on IT fields in the world.
- Most Koreans have enjoyed the online education including TRIZ.
  Specially, TRIZ (16 hours) with dynamic multimedia animation, are easy to understand, funny and useful for TRIZ beginners.
- Those are opened to public domain with cheap tuition (about 100 Japanese currency, yen for 16 hours) serviced by "Samsung SDS" (www.muticampus.co.kr 中)
  "CREDU" company (www.credu.com 中)
  and "Korea Polytechnic Univ." (www.ikpu.ac.kr 中)

Appendix - Recent Korean TRIZ books (not translation edition)

HyoJun, Kim (2008) On Creativity
Korea TRIZ Asso. (2008) On Business TRIZ
MI Jung, Song (2008) on 40 Principles
HoTaek, Han (2007) Novel with TRIZ
Changil, Choi (2007) On Marketing with TRIZ
Hojong, Kim (2007) Simplified TRIZ book

- New Easy & Cartoon-based TRIZ books will be published before 2010;
1) Cartoon-based TRIZ Story book 1 (Series books by Ikchul Kim, Kyeongwon Lee, Jaewhan Lee et. al.)
2) TRIZ 100 倍 活用 (October, by ChanKeun Jung, Da Hye Jung and Kyeongwon Lee)

One illustration for book cover of Cartoon TRIZ Story book

The Author discusses on the factors contributed to the success of TRIZ promotion in Korea in the following two slides (below). This summary is very interesting.

III. Success Factor of active TRIZ application - 1

1) Compensating defects in Idea generation in "Improve" stage of 6 Sigma process that is most popular during past 15 yrs

2) TRIZ champion, CEO Shon Wook's strong support during 5 yrs in initial stage at Samsung Advanced Institute of Technology

3) Direct introduction from Russia (10 Russian TRIZ specialists not through U.S.A, Europe and Japan) to biggest companies

4) Strategic Approach of TRIZ team at Samsung Companies sharing big results at company-inside annual event with top executive managers & many Engineers

III. Success Factor of active TRIZ application - 2

5) 70 TRIZ Korean translations and books & Online TRIZ Education Courses to public domain

6) Currently, effective tool for "Creative management" at Samsung & "Creative Environment" by Government administrations

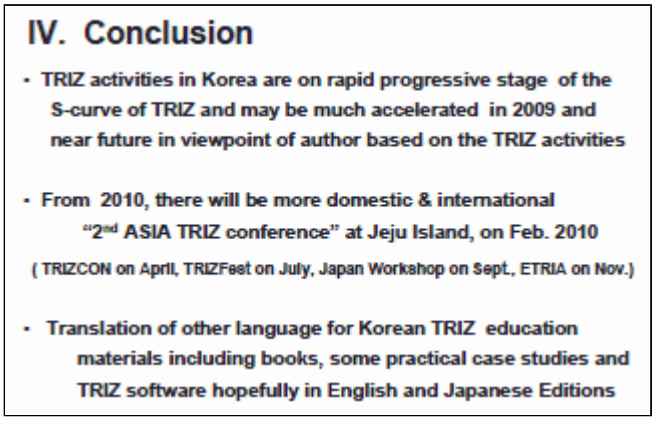
7) Almost Engineering Schools at many Universities have opened "Creative Engineering Design" official and mandatory subject for ABET (America Board for Eng. Edu.) certificates these days

8) TRIZ application education programs with seminar & consulting

9) Korean nationality to like new issues is more active and faster than other countries compensating defects in "Idea generation"

The Author concluded his presentation with the slide (right). The Author concludes that the TRIZ activities in Korea are now in the stage of rapid growth in its S-curve. This conclusion seems to be supported by various facts presented here (and probably many more not presented yet publicly).

[On the second point of this conclusion slide, Nakagawa made a comment during the Oral presentation session, saying: "The name of 'ASIA TRIZ conference' is not appropriate for the conference organized only by Korean people. (Nakagawa claimed on the same point a year ago for the case of the 'First' event.)" -- After the Japan TRIZ Symposium 2009, the Author and people in Korea have thoughtfully changed their plan. They are now calling for papers to "Global TRIZ Conference 2010 in Korea" (or shortly "Korea TRIZCON 2010") to be held on March 11-13, 2010 in Seoul. See their Web site www.koreatrizcon.kr]



*** It is interesting to think and discuss of various factors which contributed successfully or missed to contribute to the promotion of TRIZ in your own (and various other) country (or company, university, etc.) I would like to try some comparison below in the case of TRIZ in Japan, on the basis of the Author's view points.

View points	Situations in Japan
1. Relation to previous background	Japan has very strong backgrounds in various Quality Movements and also in Creativity methodologies. TRIZ has absorbed only a small percentage of such people. Integration and collaboration with various such movements/methodologies need to be sought further.
2. TRIZ champions	TRIZ pioneers and leaders in Japan are mostly senior engineers and middle managers. We have not succeeded in getting executive managers who strongly promote TRIZ in the company-wide scale.
3. Russian TRIZ experts	In the early days of TRIZ introduction, we had various seminars by Russian (and US) TRIZ experts. But soon afterward, we tried to study and apply TRIZ by ourselves while introducing various classical and new TRIZ thinking/tools through conferences, books, Web articles, etc. from over the world. We do not think this a poor choice. Japan has its own style of understanding and applying TRIZ, especially in the form of integral use of QFD-TRIZ-TM and in the form of USIT.
4. Strategic approach inside a company	Various approaches have been made in each company. Hitachi, Panasonic, Panasonic Communications, etc. are the known cases of establishing company-wide TRIZ promotion teams with success. Many more companies have their own styles of promotion, mostly operated by middle managements and having bottom-up organizations.
5. Books and Online education	Standard TRIZ textbooks have been published in Japanese translation since the early days, and several original Japanese TRIZ books have been published. Online education course of TRIZ is not available in Japan. However, public Web sites, especially "TRIZ Home Page in Japan", provide up-to-date high-quality articles in Japanese (and in English, as you see).
6. Business application of TRIZ	Application of TRIZ in business and management areas is starting slowly.
7. Education of TRIZ in academia	There are about 10 universities, where TRIZ is taught. However, they are mostly based on the individual work/interest by professors. We need to do much more for TRIZ (or creative engineering design) being accepted as regular subjects. Research of TRIZ in Japanese universities is also still very weak. TRIZ is not recognized in academic societies in Japan.
8. Trainings and consulting	There are a number of TRIZ training/consulting firms, and also a number of in-company TRIZ training teams. It is noticeable that many TRIZ practitioners join voluntary study groups on open multi-company basis to study and share TRIZ knowledge/experiences.

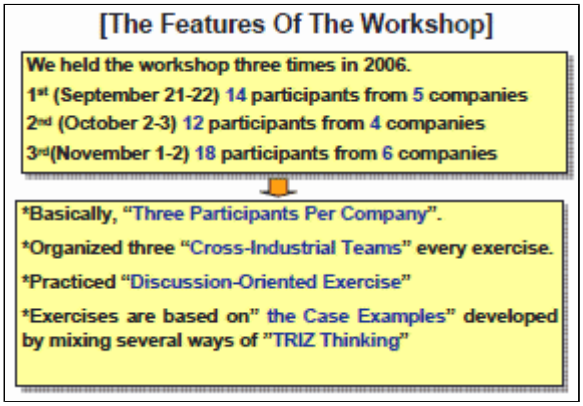
9. Characteristics of people	Japanese people are sincere to work and study.
-- TRIZ software tools	Big companies introduced TRIZ software tools (in Japanese edition) since the early days of TRIZ promotion. Companies have different weights on TRIZ software tools, I suppose.
-- National center in TRIZ	TRIZ community in Japan has had close and friendly relationships since its early stage of 1997 and has progressed step by step to established Japan TRIZ Society, NPO, in late 2007. The Society covers almost all the people working and interested in TRIZ in Japan, including vendors/consultants, industrial users, and university people. Holding the TRIZ Symposium annually is its main job at moment.
-- National conference in TRIZ	TRIZ Symposium in Japan has been held every year since 2005. It is an open national conference, and is partially international obtaining presenters and participants from overseas as well.
-- Education with TRIZ at school	Education of/with TRIZ in high schools and in elementary schools has not started yet in Japan. We will need to get teachers interested in TRIZ. In this relation, penetration of TRIZ in society is none at moment.
-- TRIZ research/application centers	There are some TRIZ teams inside industrial companies and in consulting firms. But we do not have TRIZ research/application centers in universities nor in governmental institutes.
-- Governmental recognition	TRIZ is not recognized at all in the government or municipal organizations in Japan. Not taken in the programs, projects, policies, organizations, etc.

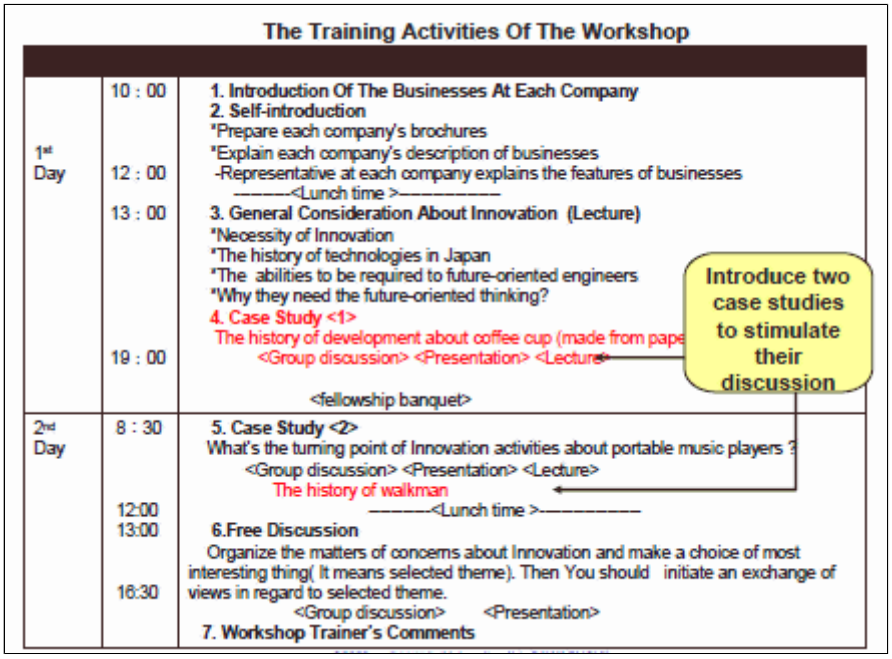
*** Describing this table (and reading it again and agin for revision), I feel that we have a lot of things to do for TRIZ in Japan and in the World.

Manabu Sawaguchi (SANNO University) [J11 O-24] gave an Oral presentation with the title of **"On The Roles of TRIZ at the Workshop Based on "Cross-industrial association" - TRIZ to facilitate Innovation Activities -".** I will quote the Author's Abstract here (leaving its conclusion part later):

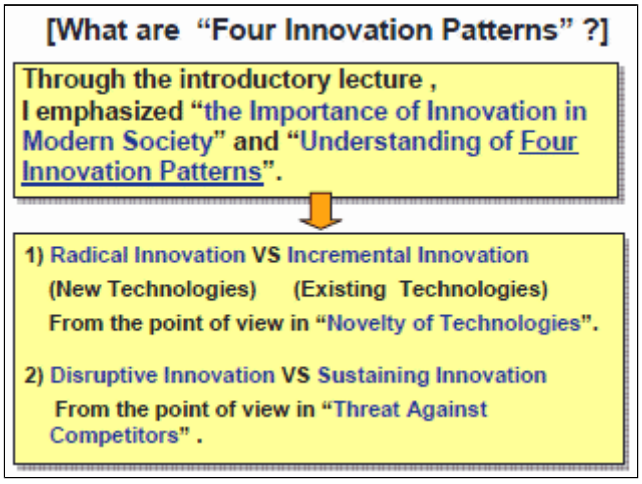
> The survey conducted by the SANNO in 2006 revealed that a majority of engineers lack confidence in both "Innovation Power" and "New Product Planning Power". Based on the considerations of the survey results, in order to facilitate the discussion about "Innovation", I tried to develop "the discussion oriented workshop" based on "Cross-industrial association", with the preparations of the appropriate case examples focusing on "Innovation". The workshop is expected to be one of the "good fields" to seize the opportunities to enforce "engineer's innovation power".
>
> Therefore, in this presentation, I would like to introduce the highly- valued workshop programs and a several unique case examples, which were utilized at the workshop focusing on the technical evolutions as the empirical law in TRIZ field. On the latter of my presentation, I'm going to introduce "attendee's evaluation regarding the workshop".

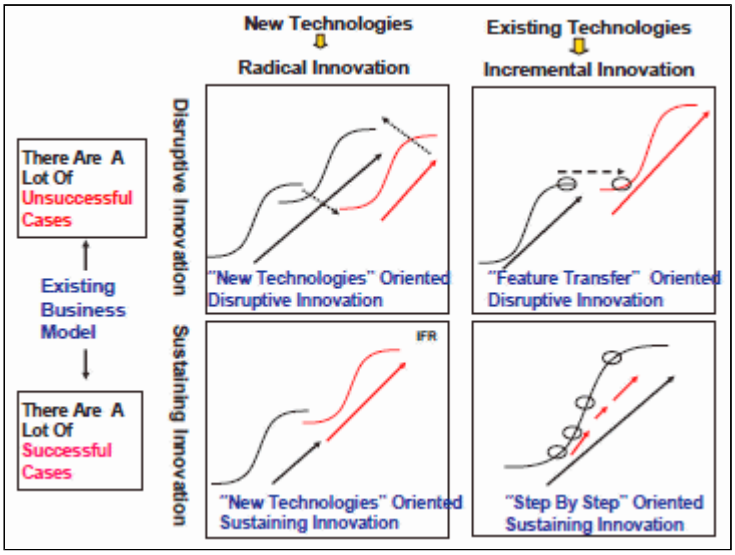
The Workshops were organized as shown in the slide (below left). Each workshop invites N companies (N= 4 to 6), with 3 participants for each company, and forms 3 teams having N members coming from different companies. The Agenda of training in the Workshop is shown in detail in the slide (below-right). Since it intends to be discussion-based training, the first day morning is devoted to forming friendly atmosphere by self-introduction of members and of their companies. In the lecture part, the concept of 'Four Innovation Patterns' is presented together with two elaborate case studies of innovation history.





As the basis of discussion, the Author presents his concept of "Four Innovation Patterns", as shown in the two slides (below). The Author uses the term Radical/Incremental innovation from the viewpoint of novelty of technology, i.e. whether new/existing technology is used, while the term Disruptive/Sustaining innovation from the viewpoint of threat against competitors, i.e. in relation to the business model. The four graphs shown in the slide (below-right) illustrate the cases. [*** I am interested in the case of Incremental & Disruptive innovation by use of 'feature transfer' of existing technology from a different area of business (or industry) (upper-right graph), and also the case of Radical & Sustaining innovation by introducing/developing new technologies while staying in the same business model (lower-left graph).] The Author describes that there are a lot of unsuccessful cases in trying the disruptive (i.e. changing in the business model) innovation.





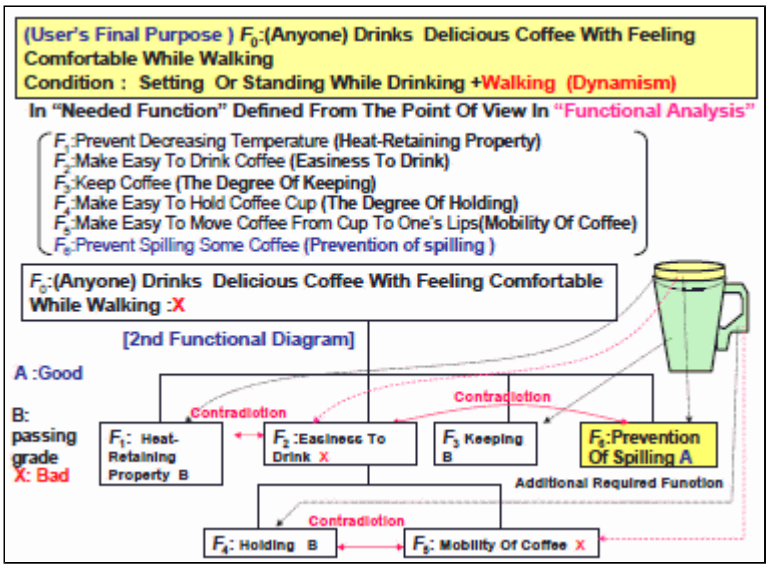
During the Workshop the Author presents two case studies of innovations. The first case is related to the coffee cups made of paper and deals with the innovation of making them useful for drinking coffee while walking.

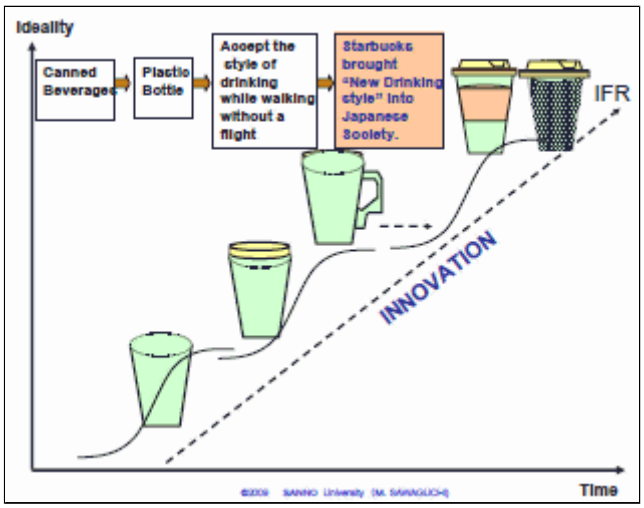
The slide (below-left) shows the S-curves of evolution of coffee paper-cups, while the slides (right and below-right) show two stages before and after the innovation.

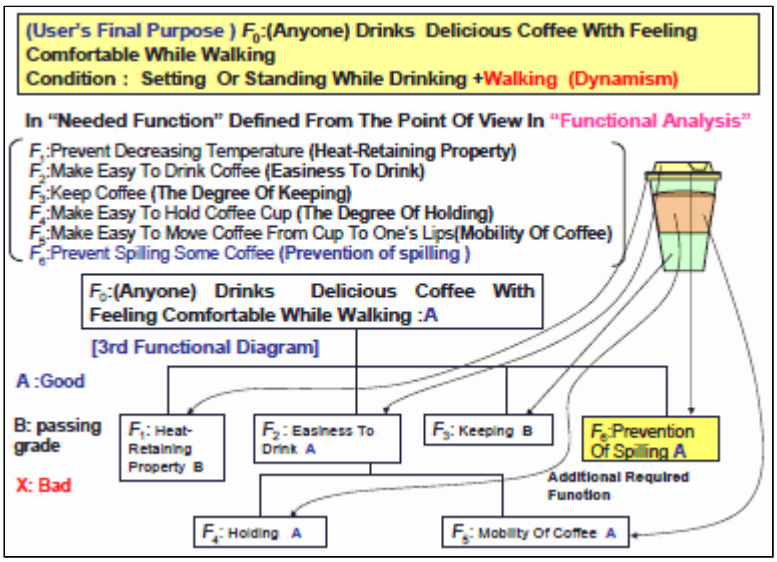
The Author breaks down the needed functions and show them in the Functional Diagram in a tree-style (slide right). Relating each component of the cup to the relevant function makes the design

intentions clear. When a new requirement (i.e., additional condition of Walking) is introduced, the old design (i.e., having a tight lip for prevention of spilling) is no good confronting contradictions (especially with easiness to drink).

The introduction of a pin hole in the lid solved these contradictions (see slide below-right). This brought in a new style of drinking coffee even while walking (mainly contributed by Starbucks, in Japanese society). [*** I am not sure to which pattern of innovation the Author is assigning this case; maybe to the incremental sustainable innovation.]

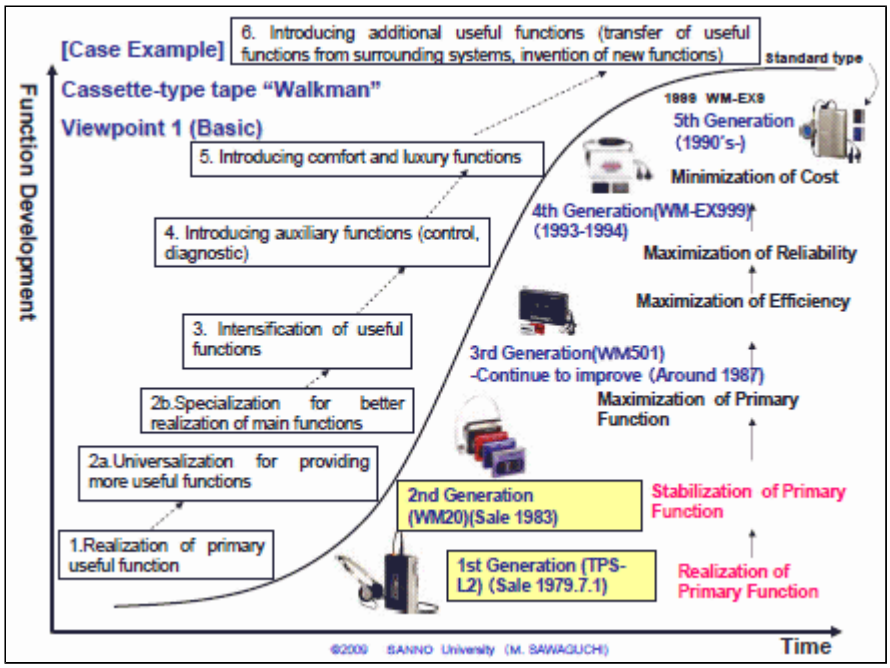






As the second case study, the Author discusses the innovation and evolution of "Walkman", developed by SONY.

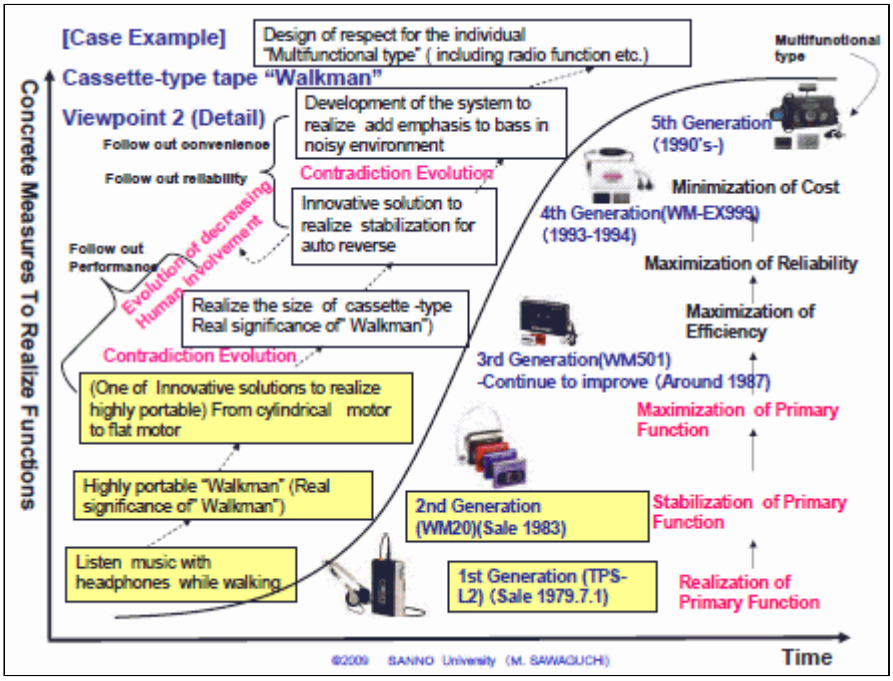
The Author shows the innovation/evolution stages of SONY's "Walkman", i.e., cassette-type tape recorder/player useable while walking. In the slide (right), the Author describes the development of "Walkman" in the 1st to 5th generation. The most general way of S-curve evolution of technical systems are described in the right column in the slide, while the characteristic functional development of this product series is described in the left column boxes.



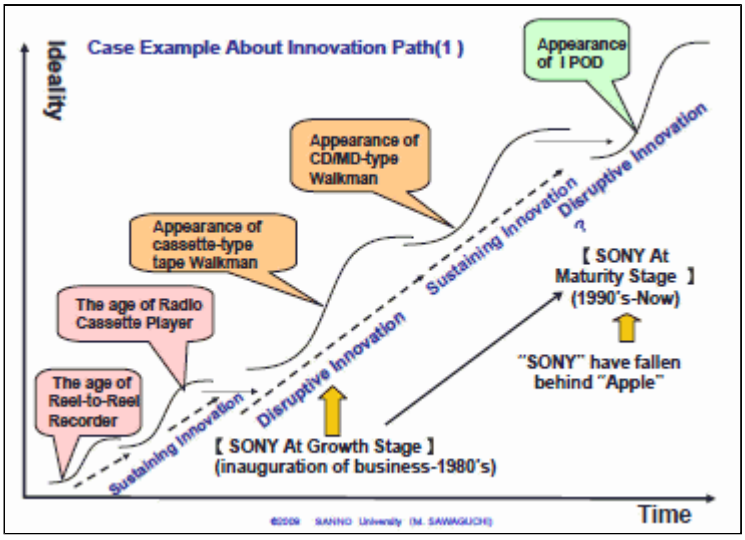
The slide (right) illustrates the

evolution stages from detailed viewpoint, i.e. concrete technical measures to realize the functions. Along with the successful development of various elements of system, some contradictions among components grew and needed to be solved to get in the next stage.

The Author also analyzes the evolution from different viewpoints, including lightweight, hour of use, and price [though the slides are not shown here].



The slide (right) illustrates the evolution of portable, oral recorder/players in a larger scope. Five S-curves represent reel-to-reel recorder, radio cassette player, cassette-type tape Walkman, CD/MD-type Walkman, and finally iPod, respectively. The Author evaluates the appearance of cassette-type tape Walkman as a case of Disruptive innovation and that of CD/MD-type Walkman as Sustaining innovation, both led by SONY. And the appearance of iPod, i.e. a network-type player developed by Apple Corp., is (probably) a case of Disruptive innovation, the Author describes.



Then in the following two slides (below), the Author discusses about the growth and maturity of SONY, as a representative case of evolution of business in its power of innovation.

[Sony's Growth stage (from inauguration of business-1980's]

*Age of founders (Ibuka & Morita): They actively tried to create "New market"

They didn't depend on market research.

*Sony became one of destructive innovators.

*Sony had created twelve products based on destructive innovation until 1982

[Representative cases about destructive innovation by Sony]

-Sony developed "Portable transistor radio" by utilizing transistor technology from Western Electronics in US. At that time, the majority of adolescents in US love Sony's portable radio.-

-Sony developed "Cassette-type tape Walkman" in 1979 and it received overwhelming support from all corners of the world.

*At the time, Sony respected "field-oriented management ".

Sony's maturity stage (from 1990's-now)

*Sony changed to a sustaining Innovator.

*Sony has been focusing on products based on sustaining Innovation since 1982.

*Sony respects market research.

[Representative cases about sustaining innovation by Sony.]

-Sony developed "VAIO ,PS1 and PS2". These products are very popular for customers because of highly-valued products. But these products are not destructive. They are representative cases of sustaining innovation in existing market.

-Sony shifted from "field-oriented management" to "American-style management" since 1990's.

Speculation

Sony had the big power to get "No1"in new market by producing "network type Walkman" by utilizing Sony's existing strong technologies, which have been sophisticated through the development activities regarding cassette-type tape and CD/MD type Walkman. But, Sony unfortunately avoided proceeding the way of realizing the network type Walkman. As a result of that, Apple got the heels of Sony with the development of i-POD.

Conclusion

The resistance against "Innovation activities" are usual phenomenon at the companies even Sony. Therefore, even if incumbent (Sony) has the priority to realize Innovative products, their speed to shift from conventional to innovative products are relatively late.

The Author conducted the Workshops by using the two case studies described so far. Then, the Author concluded his presentation by mentioning the participants evaluation of the Workshop. I will quote the conclusion part of the Author's Abstract here:

> To conclude, the majority of respondents (37/45= about 82 %) at some workshops imply that their ways of both looking and thinking at things were changed through the workshop. What this result makes clear is that the workshop is "one of the good fields" to seize the opportunities to enforce "engineer's innovation power". Moreover, it is particularly worth noting that nobody had negative answer.

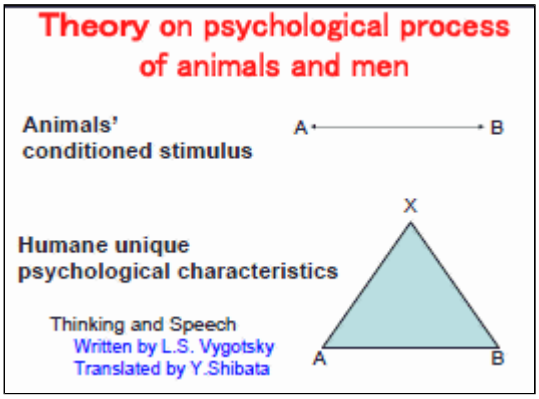
Mitsuo Morihisa (SKI), Hiroshi Kawakami, Osamu Katai (Kyoto University) [J17 O-21] gave an Oral presentation on "Spreading and Socialization Model of TRIZ by an Activity Theory Approach". First I will quote the Authors' Abstract:

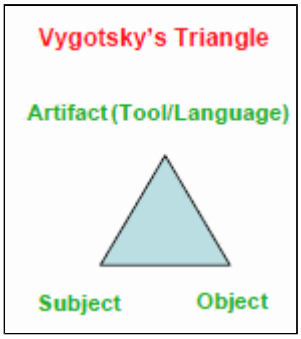
> TRIZ is going to raise expectations for the technological breakthrough, as it has richer contents on invention and creative inspirations than any other problem solving methods. In this paper, benefits not only of the symbiotic systems theory that yields each full inherent characteristics with harmonious symbiosis among Man, Systems and Environment but also of the Activity Theory model by Yrjö Engeström, the world's leading researcher in learning sciences and education are shown. The Engeström's model that stands on the minimal triangle model invented by L.S. Vygotsky, the Russian psychologist was considered to give both theoretical and practical contributions to the symbiosis.

As you read in the Abstract, this presentation is somewhat theoretical but clear because the Authors use diagrammatic representation of their models. For the purpose of discussing how to spread or promote TRIZ into society, the Authors use three theories/modelings; i.e.,

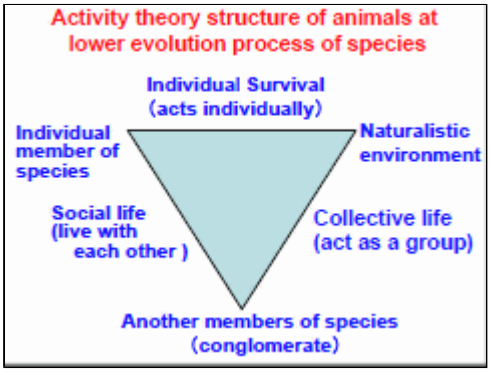
(a) Mediation theory model by L.S. Vygotsky
(b) Activity Theory model by Yrjö Engeström, and
(c) Man-Systems-Environment Symbiosis model by Osamu Katai et al.

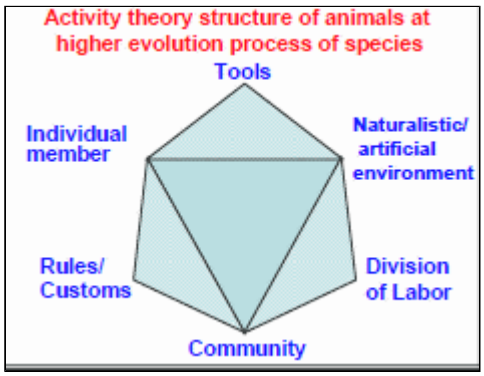
The basic model by Vigotsky compares the psychological processes of animals and of men, as shown in the slide (center). Using Artifact (e.g. tools/languages) is the unique characteristic of human psychological process. This Vigotsky's triangle model forms the basis of the present study (slide right).

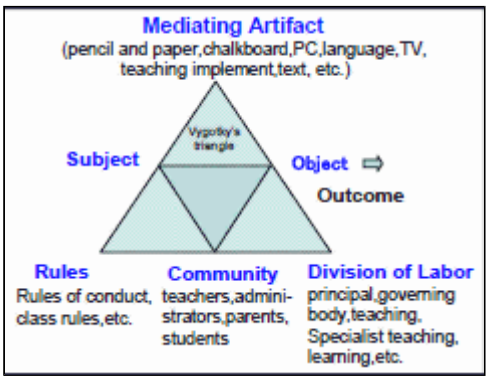




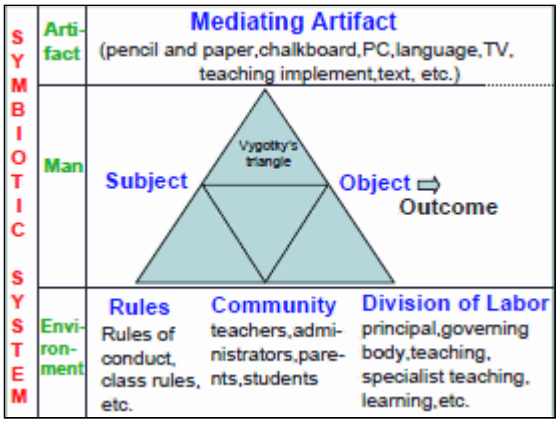
The Activity Theory (by Engeström) considers the relationships among members of (animal) species and naturalistic environment, in the three steps of evolution (of animals) as shown in the three slides (below). In the stage of lower evolution, the relationships are simple and direct as shown in the slide (below-left). In the cases of higher evolution of animal species, there appears a Community, Rules/customs, Division of labor, and even Tools (slide below-center). In the case of humans, the parts of Rules, Division of labor, and Mediating artifacts become much much larger and form the human culture (slide below-right).



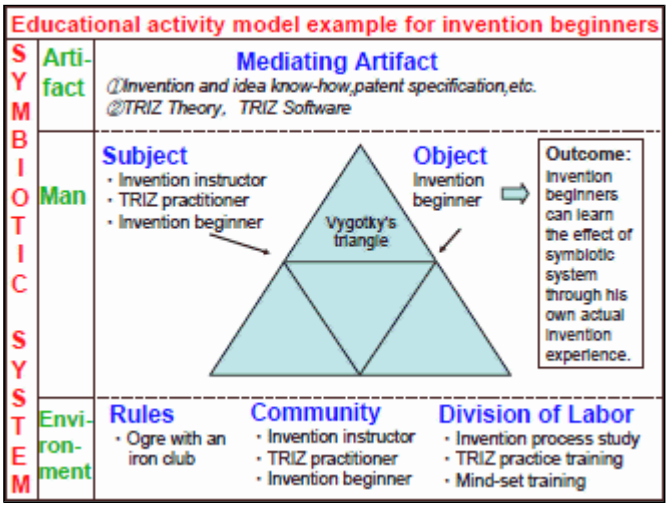


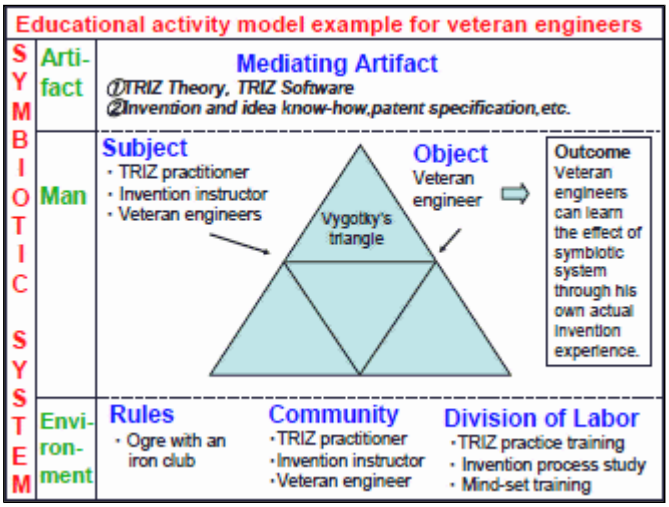


Then the Authors have found the correspondence of their own model of 'Symbiotic System of Man-Systems-Environment' with the resultant Activity Theory model (slide above-right). Thus the Authors' final model is shown in the slide (right). The central level is Man; Subject is a man who acts on another man, i.e. Object, resulting some outcome. The small upper triangle is the original Vigotsky' triangle, whose top node (Mediating Artifact) forms the upper level in this diagram and is now interpreted as the System in the Authors' MSR Symbiotic model. At the bottom in this slide, the Environment of the MSE symbiotic model is shown to include Rules, Community, and Division of labor. The Authors apply this model to the educational activities, especially the training of TRIZ in the present paper.

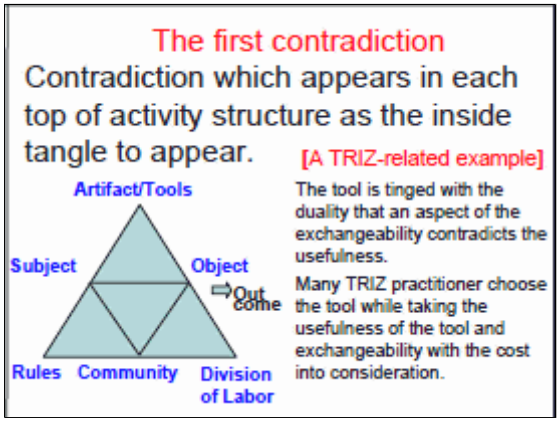


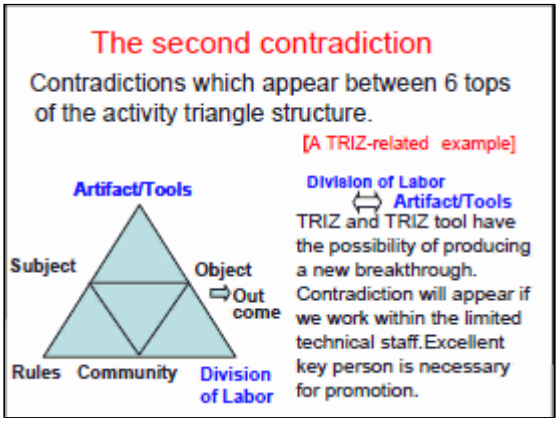
The following two slides (below) are the applications of the present model to the education activities of TRIZ. Particular attention is paid to the cases where the students (i.e. Object in this diagram) are invention beginners (slide below-left) or veteran engineers (slide below-right). [The differences shown in these slides are not so large but the readers of this article are already familiar from their experiences, I hope.]



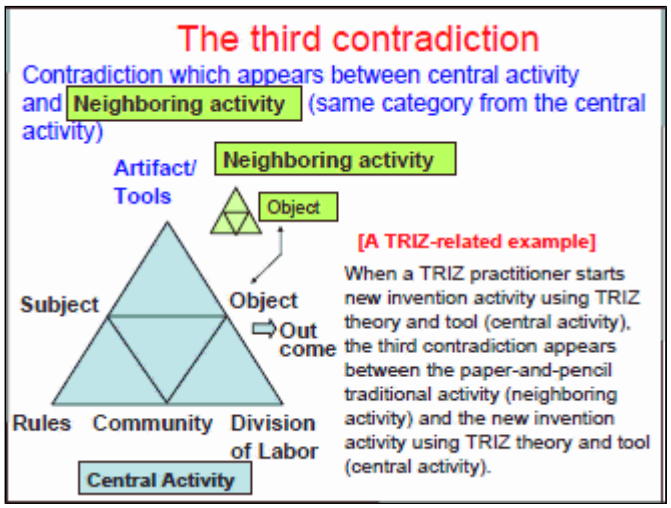


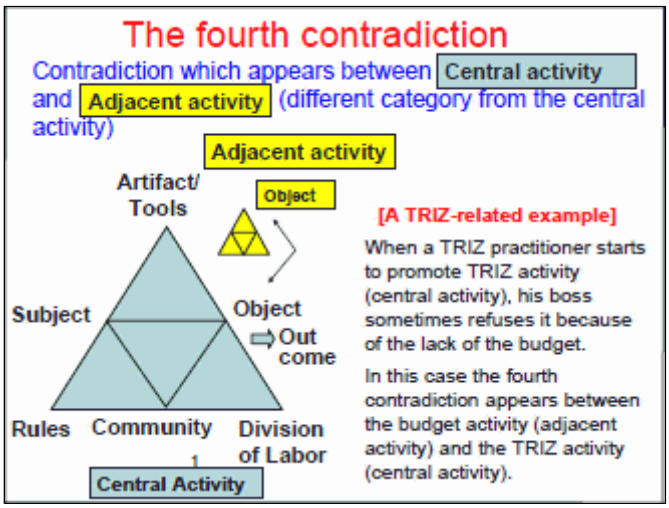
The aims of the Authors are to discuss (and solve) various contradictions in the TRIZ education. Contradictions are shown in the four different levels in the following four slides (below). Contradictions in the first level appear in each of the 6 vertexes of the diagram (slide below-left). In the slide an example is shown for the case of contradiction inside the Tool (i.e., contradiction between usefulness and exchangeability of a TRIZ Tool). Contradictions in the second level appear between the 6 vertexes (slide below-right). An example is shown between the Tools and Division of labor (in the sense that a useful TRIZ tool needs (or become effective only with) promotion by a key person in a company.



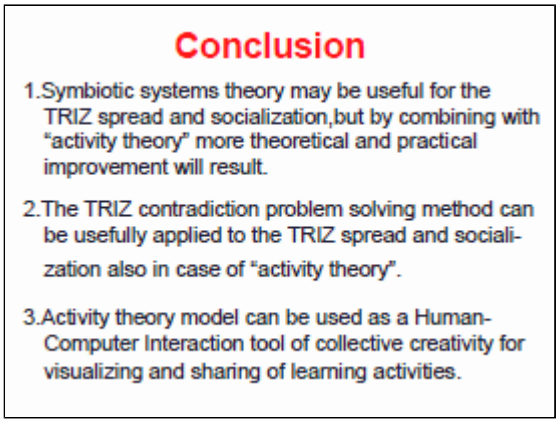


Higher levels of contradictions are also noted in the following two slides (below). In the third level, the central activity (represented by the 6 vertexes diagram) (e.g., the TRIZ education activity in the present focus) meets contradiction/conflict with a neighboring activity in the same category (slide below-left). Further in the fourth level the central activity meets contradiction with adjacent activity in a different category. The Authors make these contradictions clear with the hope that TRIZ can be applied to each of the contradictions.





The conclusion by the Authors is shown in the slide (right).



*** It is important that the present paper introduces the Activity Theory in the discussion how we should educate TRIZ to different people and how we should promote TRIZ in industries and in society. The framework of education activities has become much clear in this presentation. Various contradictions we meet in TRIZ education/promotion need to be revealed and solved step by step.

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10. Non-technical		11. Miscellaneous	12. Concluding	TRIZ Symp 2009 Official page Engl.	TRIZ Symp 2005 Personal Report Engl.	TRIZ Symp 2006 Personal Report Engl.	TRIZ Symp 2007 Personal Report Engl.	TRIZ Symp 2008 Personal Report Engl.	Japan TRIZ Society Official Page	Japanese page Jap.

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