Engineers' Understanding of TRIZ from Questionnaire Survey

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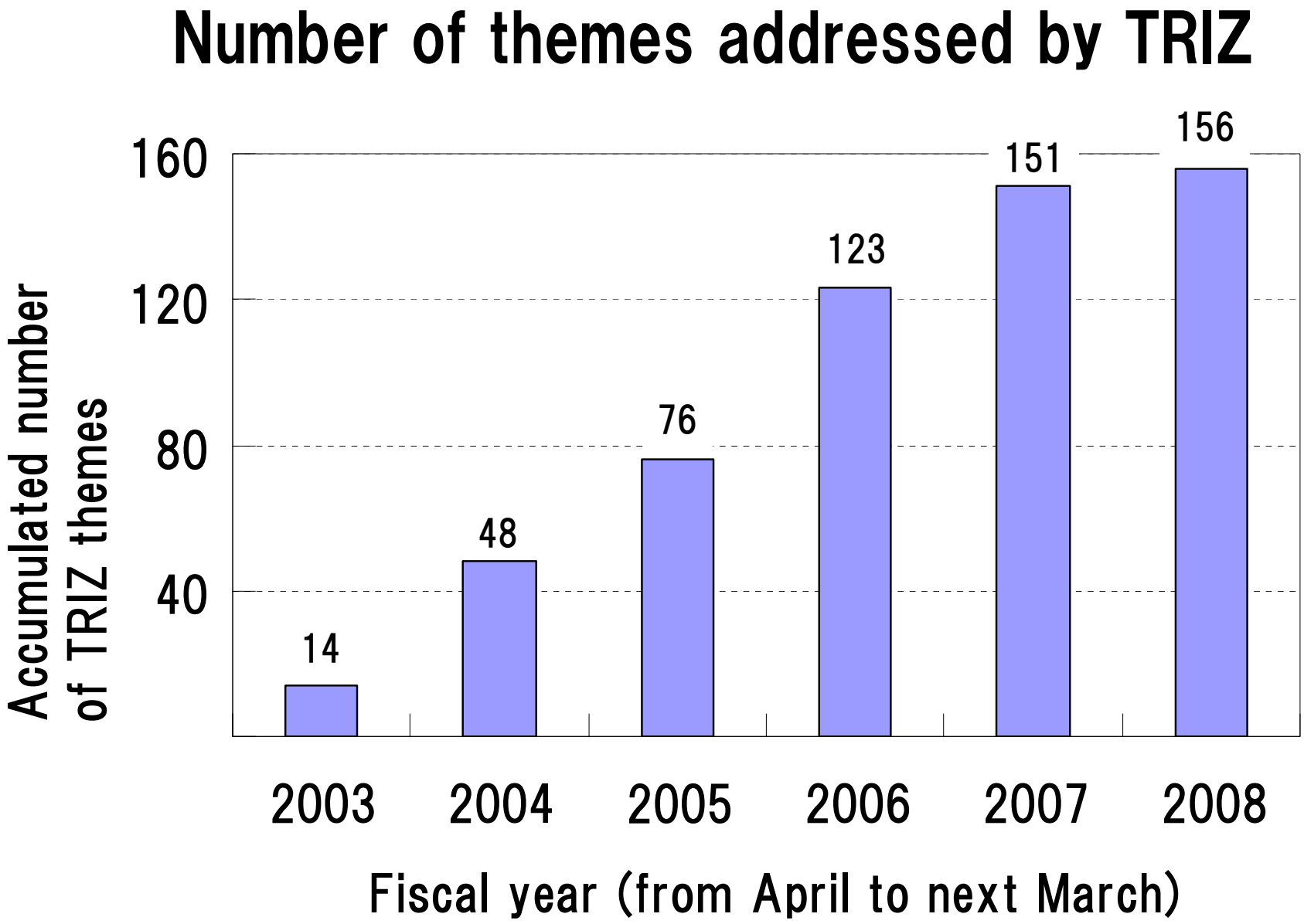
Contents

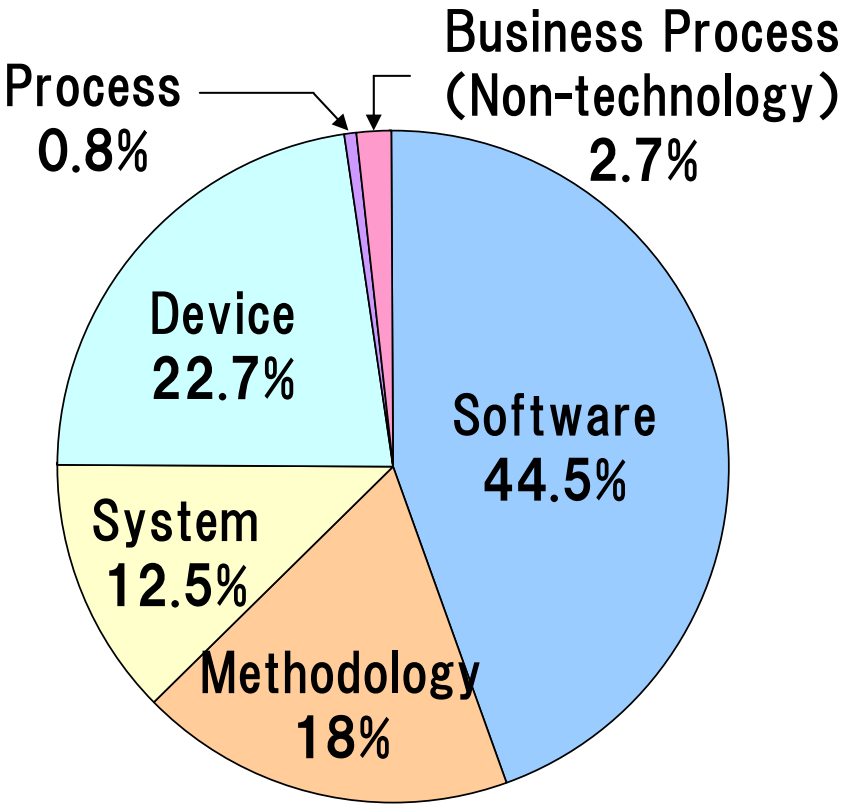
1. Outline of our Problem Solving Activities using TRIZ



Fields and purposes of application

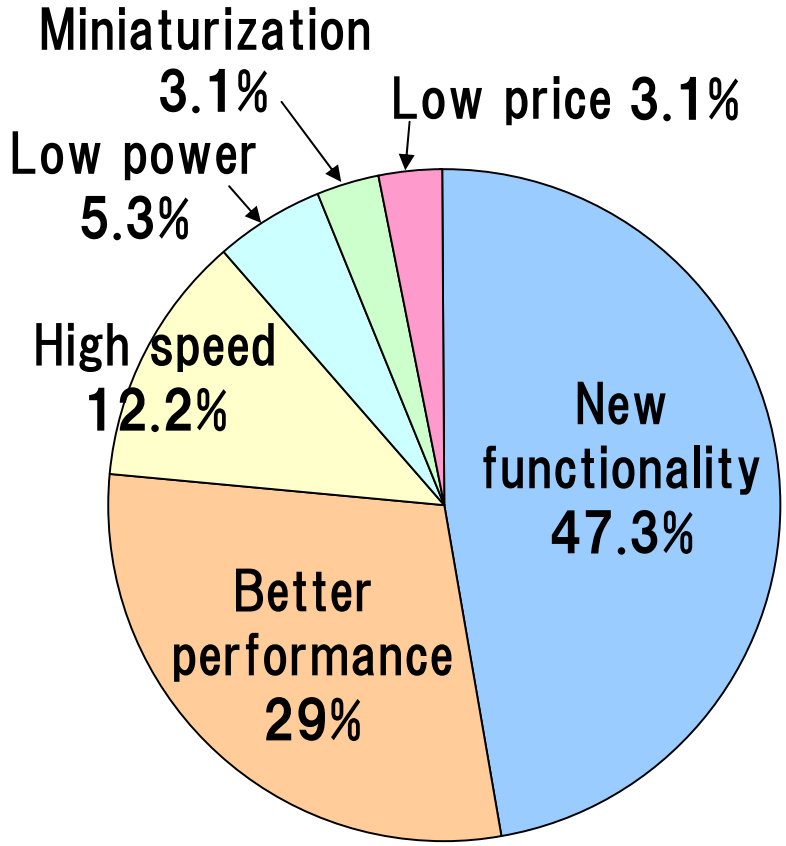
Technology fields

【75% are concerning to Systems, Methodology and Software】



purposes of application

【50% are Functionality Development】



Structure of the Team and Processes Performed

《Structure of the TEAM》

Structure : Engineers(2 to 7 persons)
+ a TRIZ specialist
+ a Manager (an expert of the field)

Engineers : Specialists of the system, and have duties to solve the problem during the development of the system

TRIZ specialist :proposes the TRIZ Methods, and also commits the resulting solution

Manager : has responsibility to the development, commits the training of the engineers, and contributes to business as an expert

《Processes Performed》

Define the Problem → Analyze the Problem → Creates Ideas → Evaluates Ideas

Questionnaire Survey and Items Analyzed

Answers are described as free comments by the Engineers who have finished the TRIZ Activities

Number of whole comments: 372
Number of analyzed comments:262
(Simple and trivial comments like as merely “Good” are removed)

Items:

1. Nouns frequently occurred => Concerns of Engineers
2. Combinations of two related words frequently occurred
   => Core messages for TRIZ
3. Examples of comments implying “TRIZ is Effective” “TRIZ is efficient”
4. Examples of comments implying validation of TRIZ in each process
   In processes for Problem Definition, Problem Analysis,
   Getting Ideas and Incubating Ideas
5. Examples of comments implying validation of TRIZ in Process Flow,
   Team Activities and Training

Nouns Frequently Occurred

《Frequency presents the concerns of the Engineers》

- ○Ideas (Way of thinking, resulting ideas)
- ○What problems should be
- ○TRIZ、Effective、Methods
- ○SLP、Principles

Words	Frequency
Ideas	21.5%
Problems	16.8%
TRIZ	13.8%
Methods	13.4%
Effective	5.3%
SLP	4.9%
Necessary	4.9%
Deployment	4.5%
Duties	4.3%
Way of thinking	3.7%
Principles	3.4%
Apply	3.4%

Analyzed Frequency of Nouns using
Text Mining Studio 3.1 by Mathematical Systems Inc.

Combinations of two related words frequently occurred

《Core messages of the combinations》

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

Related from	Related to	Frequency
TRIZ, Tools, Methods	Effective	22.0%
Problems	Clarify	17.1%
Apply/Using	Difficult	12.2%
Efficiency	Good	9.8%
Problems	Difficult	4.9%
Ideas	Important	4.9%
Efforts	Necessary	4.9%
View Points	Different	4.9%
Classify	Valid	4.9%
Combination	More	4.9%
Vary	Important	4.9%
Field of Application	Valid	4.9%

Analyzed Relation of two Words using
Text Mining Studio 3.1 by Mathematical Systems Inc.

Examples of Comments implying "TRIZ is Effective" "TRIZ is efficient"

"TRIZ is EFFECTIVE"

- ○have got another tool for idea creation
- ○valid idea creation tool
- ○have learnt a method pursuing the essentials of the problem
- ○have learnt an method for idea creation
- ○have got an pattern for solving a problem
- ○have got a way of thinking
- ○found that I had already been using "NazeNaze" (Root-Cause Analysis)
- ○found the method of classifying the problems and creating ideas

"TRIZ is EFFICIENT"

- ○could create ideas efficiently
- ○could make the point of the problem clear efficiently
- ○could learn the technology efficiently
- ○would like to use TRIZ as an efficient idea creation tool every day
- ○would be valuable when always used
  would like to use for seeking the direction of ideas
- ○found that it is important to make plans for experiments logically

Examples of Comments implying validation of TRIZ in Problem Definition

What kinds of problems are suitable for TRIZ
=> Focus is clear and can be Discussed

Suitable Problem

- Problems for which understandings are proceeded by discussion
  - Cause-effect relation can be understood
- Concrete and clearly defined
  - could find new concepts by focusing
  - Appropriate assumption is a key for vague problems
  - Efficient for the system of which specification can be defined
  - The problem should be essential for the specific system

Unsuitable Problem

- Problems for which understandings are not proceeded by discussion
  - can not be understood without experiment
  - Evaluation can be done only based on assumption (feeling of persons)
- Abstract and vague Problem
  - Big problems aren't always good
  - Cause-Result relation can't be understood
  - Difficult to deal with de-focused problems
  - Size of the problem should be appropriate

Field (Condition)	
	Researches should have been finished
	The members are required to have sufficient knowledge
	Constraints should be assumed for discussion
	Sufficient researches and knowledge are required
	Discussion can be done at superficial level, and deep understandings can be derived by individuals

Examples of comments implying validation of TRIZ in Problem Analysis

●understandings can be proceeded

could find the essential functions for the well-researched electric circuits
could find the points which should be solved
understanding and evaluation of problems will be proceeded and changed
understanding the clarified problem more deeply using Product Analysis

●can be classified

can be systematized
can perform brain-storming

●a valid method for problems which can't be analyzed well

Using the method for idea creation to clarify the problem (SLP)
Representing the problem at another viewpoint to reconsider the problem (SLP)
Using brain-writing to prevent the oversight of ideas
Idea creation leads to find the real problem

Examples of comments implying validation of TRIZ in Getting Ideas

●Magnifying the viewpoint Direction of thinking

Reconfirm using Inventive Principles
Reconsider by changing view points
Separation of functions and means
Derive upper concept
Find out the direction

●Trigger of thinking

Think various possibilities naturally
Forced to think
Forced to write down
Break the frame of impossibility (persons tend not to think impossible things)

●Difficulties

No way to translate to engineering ideas
Difficult to understand the Inventive Principles
Not a Silver Bullet
Typical ideas, not epoch-making ones

●Usage

○Method is only method, so high engineering capability is required to use
○Directions for idea can be derived, but the solutions are depends on the efforts of individual users
○Deriving constraints is important as well as idea creation
○can be used in the situation of defining and analyzing problems
○Use not only the flow itself, but also the thought of the flow
○In the creation phase, devotes to create, not to evaluate

Examples of comments implying validation of TRIZ in Incubating Ideas

- Ideas are only the general solution, and more consideration are required to make it valid
- It is valid to solve the problems which appeared after classifying ideas
- It is important to find “the axes of ideas” and to classify and analyze the ideas “according to the axes”
- Considerable capability for the technology concerned is required to make ideas valid for the application
- Ideas can be expected to be dug and deployed through adding ideas to ideas created by other members

Examples of Comments implying validation of TRIZ in Process flow

Spiral of Idea Creation and Problem Redefinition is Valid
(Original Problem → Ideas → Further Problem)

- ○Solutions make further problems clear
- ○Creating ideas make the recognition of the problem deeper
- ○It is valid to use each method not only in recommended order but also freely at the point where the method required
- ○It is valid to change the expression of the problem
- ○Ideas created lead us to find further problems
- ○It is valid to redefine the problem according to ideas created

Examples of Comments implying validation of TRIZ in Team Activities and Training

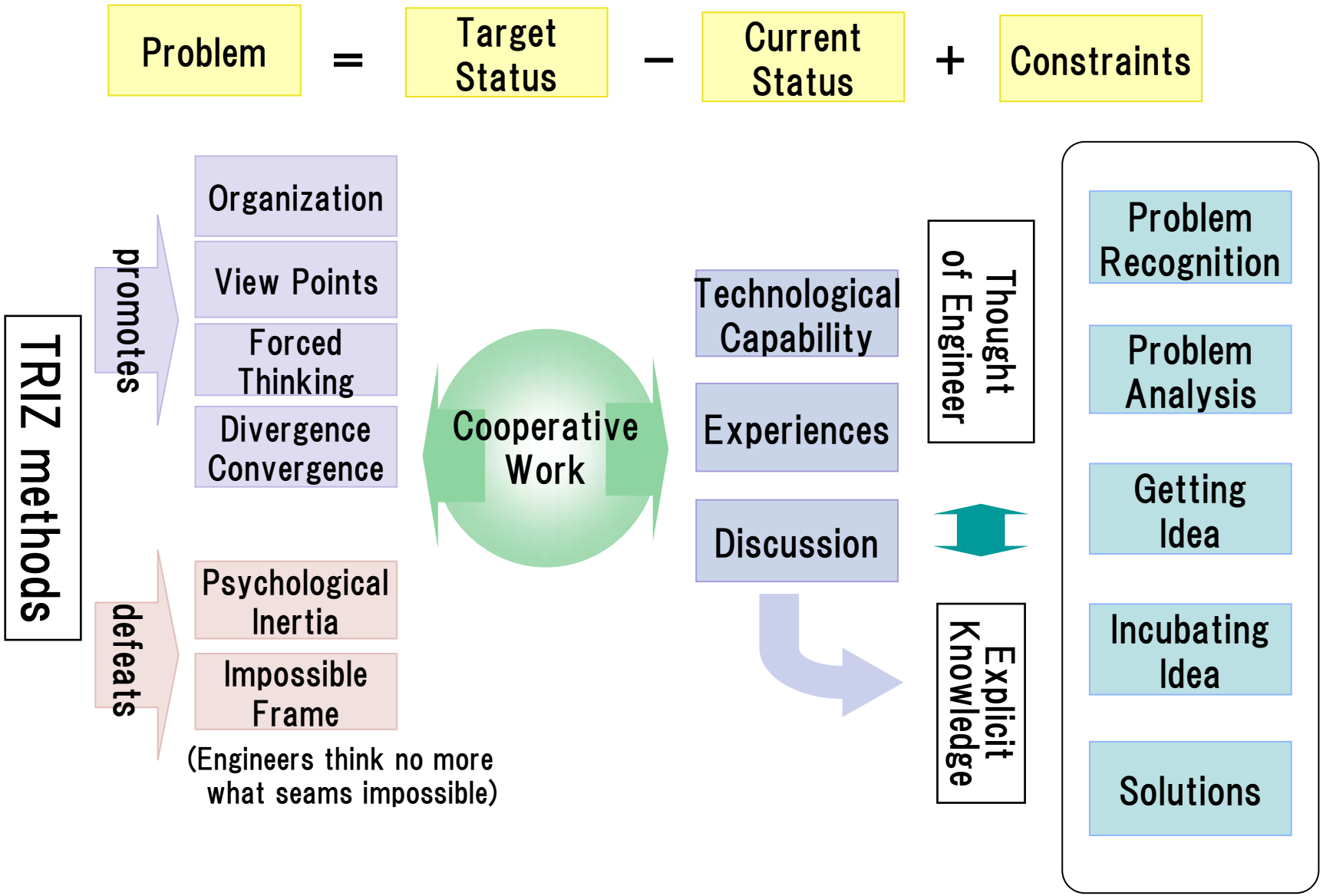
- TRIZ makes Team Activities exciting
  - could recognize members' way of thinking
  - could examine (create ideas) at all the wider view points
  - could examine and learn solutions already invented
  - Ideas from multiple view points had been created from the members who had various kinds of field of technology
  - could share the direction of solution among the members who had various kinds of field of technology and experience
  - Team Activity is a field where the ideas created by a person are discussed among all the members
- Comments from Fresh persons
  - Non-experienced member could get fundamental knowledge and experienced member could make their knowledge deeper
  - could make a general problem to the specific problem and reach the exact point of the problem
  - is effective to learn the technology
  - could recognize a pattern for thinking way in developing technology

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)

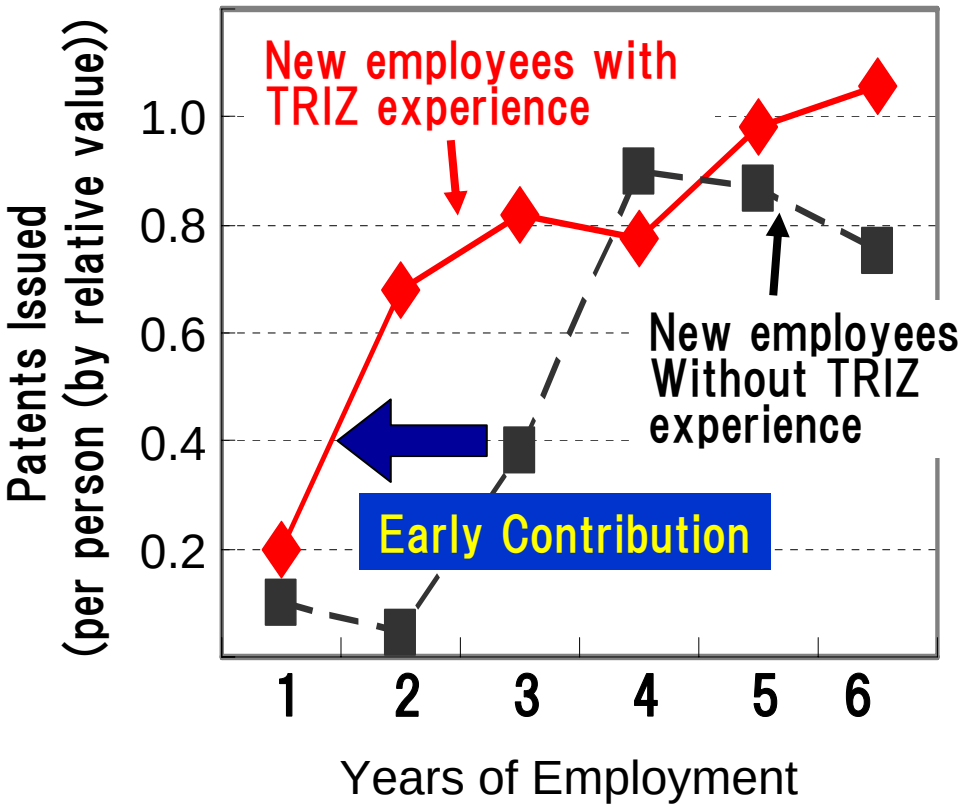
4. An Organized Problem Solving Model

Structures of the Organized Problem Solving Model



Effect on New Employees

- We checked number of patents issued by New employees.
- New employees in the second and third year of employment have remarkable difference.



(Checked on March, 2009)

Vertical axis presents the relative value of the average of number of patents issued ever since one joined the company.

New employees with TRIZ experience
New employees who have joined in a TRIZ activity team and solved the problem as a member (the team consists of non-Fresh Person)

New employees without TRIZ experience
New employees who have no experience to solve a problem using TRIZ

Summary

- We have tried to construct a Problem Solving Model from comments by engineers who have finished TRIZ activity.
- The model includes processes of defining the problem, analyzing the problem, getting ideas, and incubating ideas.
- It has been recognized that New employees, who we think don't know methodologies of engineering, can get capabilities to create patents earlier, through the experience of the model.
- TRIZ provides methods both to recognize the essentials of the problem and to find the direction to the solutions efficiently. And the effects of TRIZ methods lead engineers to discuss and recognize the problem deeply, and whole activities of them are expected to be improved.