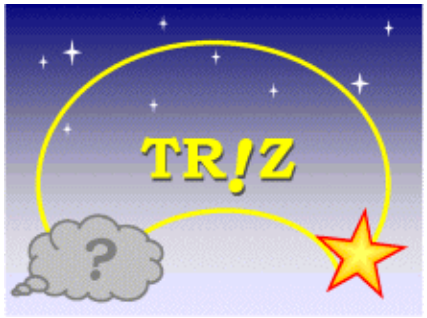
TRIZ Future Conference 2015
Held by ETRIA
at Berlin, Germany
on Oct. 26-29, 2015



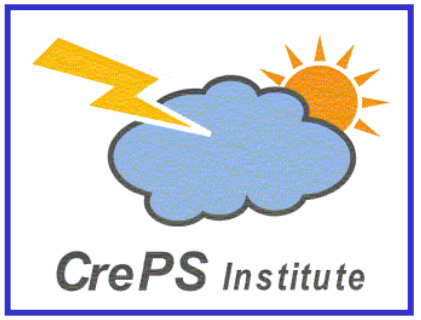
USIT:

A Concise Process for Creative Problem Solving Based on the Paradigm of 'Six-Box Scheme'

-- USIT Manual and USIT Case Studies --

Toru Nakagawa

Osaka Gakuin University
& CrePS Institute,
Japan



Introduction: My Understanding of the Recent Development of Methodologies of Creative Problem Solving

(1) Current conventional stage:
Science & Technology + Various 'Creativity Methods'

Four-Box Scheme of abstraction in problem solving
Theories and models in various specific disciplines

(2) Contributions of TRIZ

Knowledge bases of Sci. & Tech. across the fields (Four-Box Scheme)

(3) Contributions of USIT

A concise whole process of creative problem solving
Integration of various TRIZ methods, 'Six-Box Scheme'

(4) CrePS ('General Methodology of Creative Problem Solving')

'Six-Box Scheme' as the new paradigm
Unifying various methods (TRIZ and others)
USIT is a concise whole process executing CrePS

I will talk about CrePS and USIT based on this understanding.

Introduction: Outline of the Talk

A. 'Six-Box Scheme' as the new paradigm

The concept of the 'Six-Box Scheme'

Differences from the old paradigm 'Four-Box Scheme'

Requirements from the society in general

General methodology of creative problem solving

Integrating & Unifying various methods

CrePS methodology on the paradigm of the Six-Box Scheme

USIT process executing the Six-Box Scheme

B. USIT: A concise process of creative problem solving

USIT Manual

A Collection of USIT Case Studies

Idea generation step in USIT

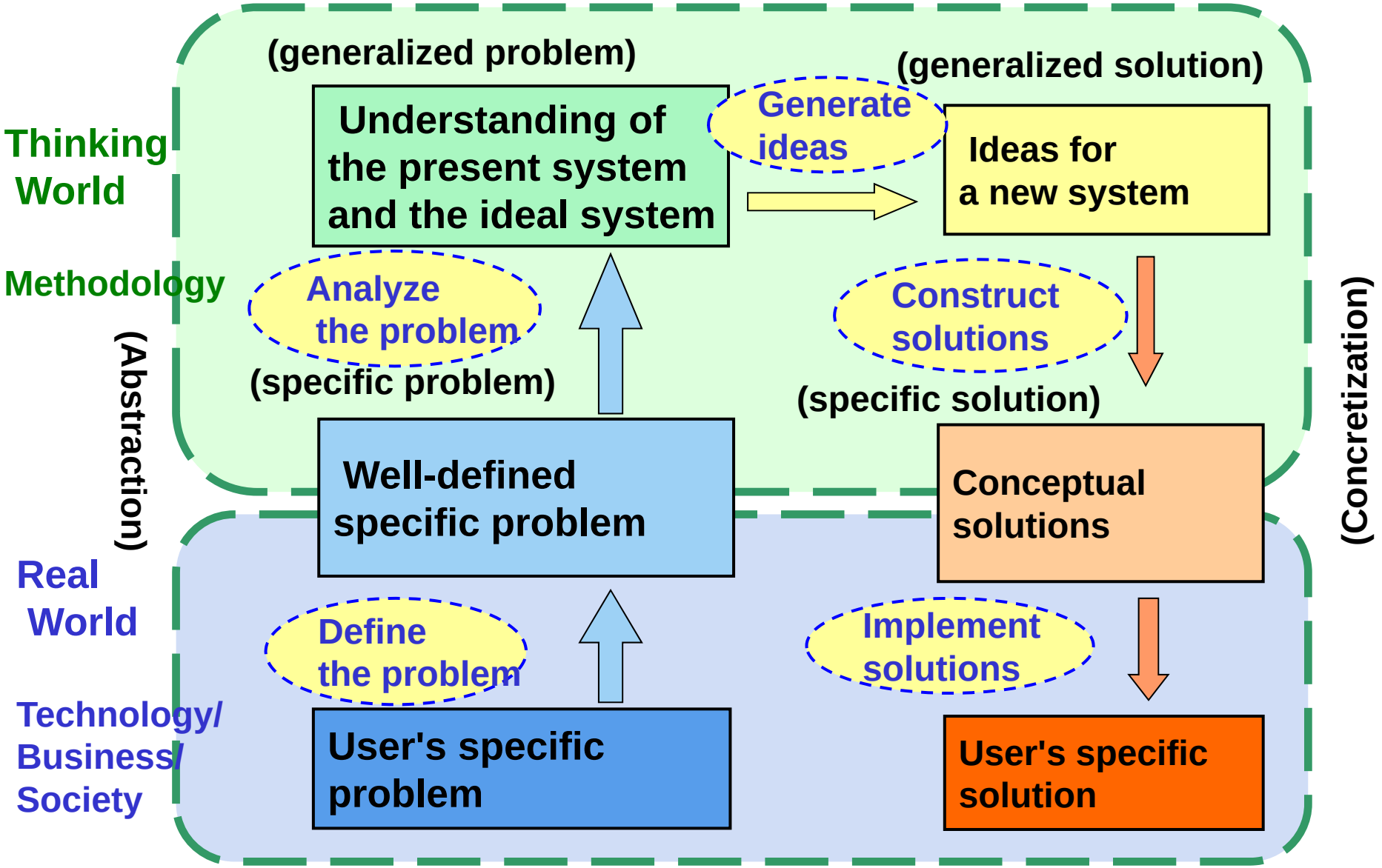
Concluding Remarks

For establishing the general methodology CrePS

Proposal of Global Network of Public Web Sites on TRIZ

New Paradigm of Creative Problem Solving

(Six-Box Scheme of USIT) ==> (Six-Box Scheme of CrePS)



'Six-Box Scheme' (the Paradigm of CrePS)

(a) 'Real World' and 'Thinking World' are separated, for clarifying their roles.

(b) Recognition of the problem situations (Box 1)
must be done in the 'real World' (or in the business activities)

(c) Problems and tasks to be addressed (Box 2)
is defined in the Real World and is handed to the Thinking World.

(d) (In Box 3) The present system is understood with standard analysis methods
in the aspects of space, time, components, attributes, and functions, and
the ideal system is also understood in its image.

(e) Ideas for a new system (Box 4), exceeding the stage of hints,
are often obtained quite smoothly from the understandings in Box 3,
without explicit use of various techniques for assisting the idea generation.

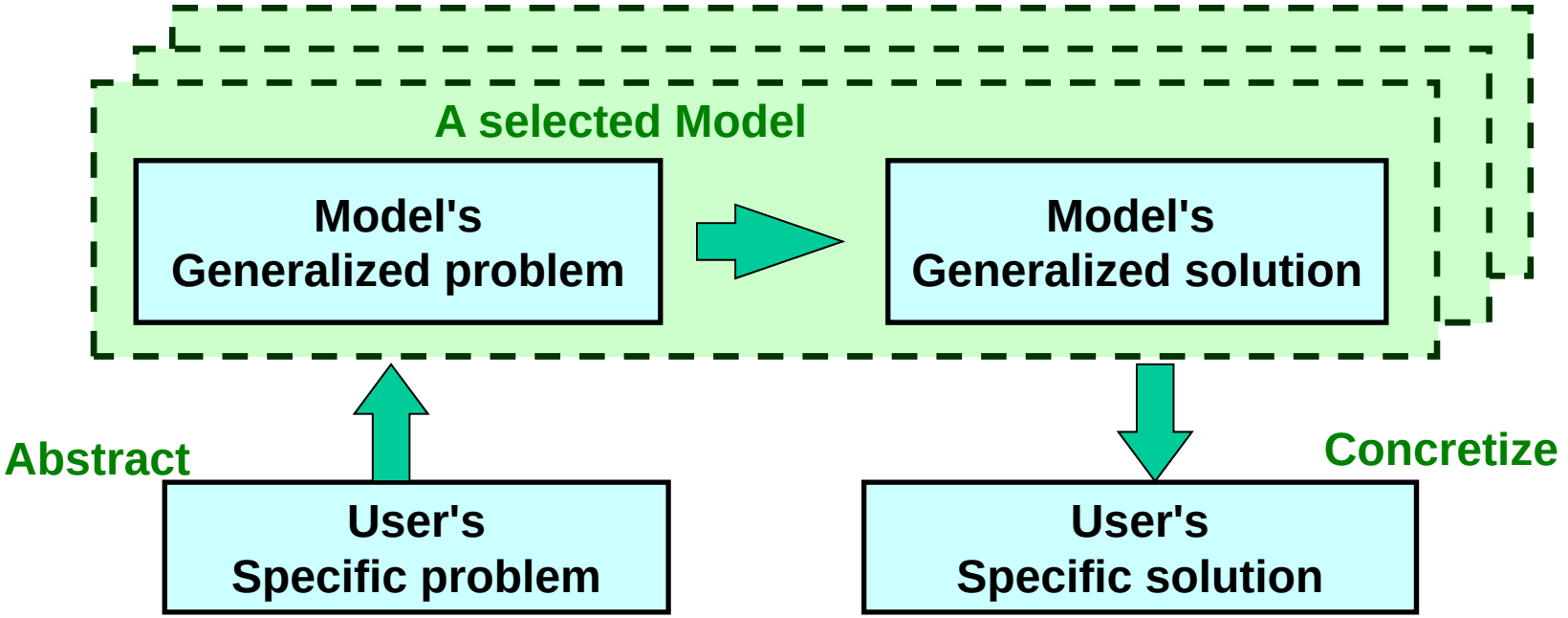
(f) Conceptual solutions (Box 5)
need to be constructed around the core ideas,
by using basic capability in the relevant (technological) fields.

(f) Actual solutions (Box 6)
need to be implemented by the business activities in the Real World.

Conventional basic scheme for Creative Problem Solving (Four-Box Scheme of abstraction)

Science & Technologies (Many models, specialized in areas)

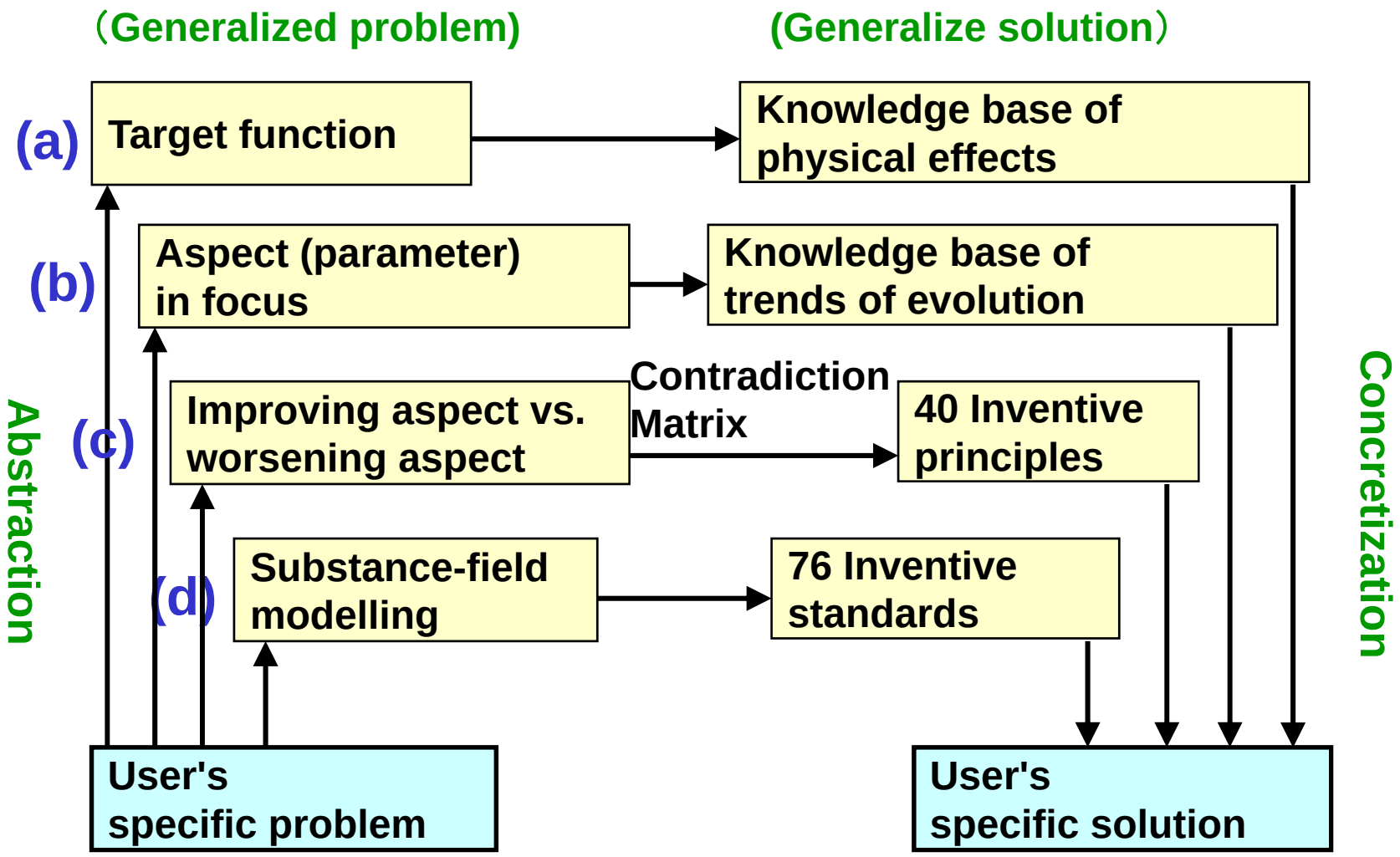
Many models in the Knowledge Base



Pitfalls: The contents of the boxes depend on the fields, models, and problems and cannot be explained any further in general terms.
Problem is mapped onto a model, and the general solution is shown just as hints to be concretized in analogical thinking.

***** TRIZ made multiple models applicable across areas**

Tools of TRIZ (Based on the Four-Box Scheme)

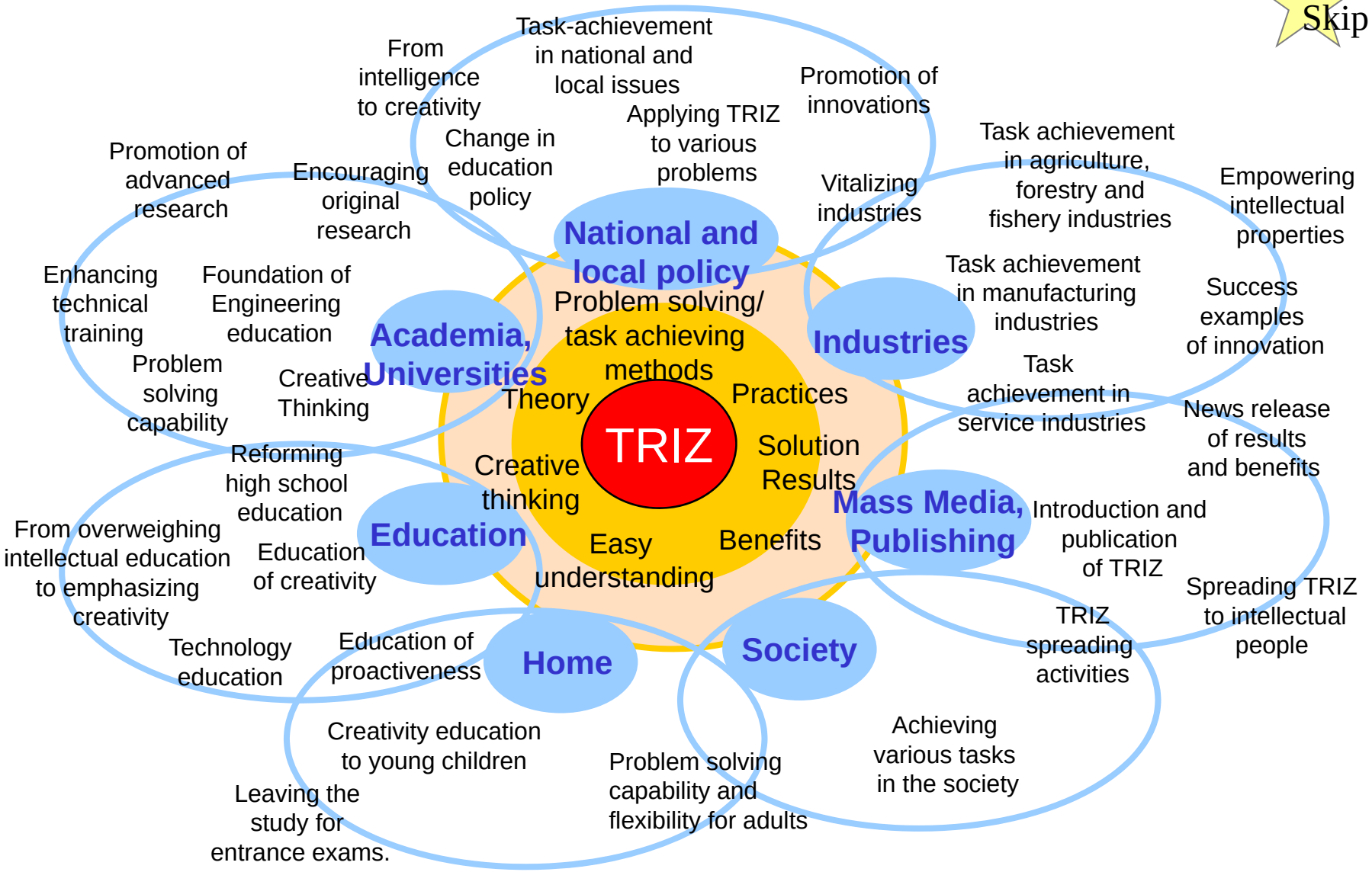


Several big tools with huge knowledge bases are applicable across technical fields.
But parallel structure of multiple tools means partialness in each method.
Thus the overall process in TRIZ is complex (e.g., ARIZ).

Expected Areas of Applying TRIZ

Toru Nakagawa (May, 2012)

Skip



We put TRIZ in the center. But we need a more general method !

Reflection of the present situations around us and TRIZ

(1) Problem solving & task achieving is a job people want to do everywhere.

(2) A huge variety of studies and methods exist for helping the jobs,
but they are short in filling the demands. Why?
Because: Being fragmental without a good general framework.

(3) TRIZ has contributed good thoughts and many tools applicable widely,
but it is not easy to learn and use by people. Why?
Because: Being specific and complex without a good framework.

(4) We have two directions:

- Customize TRIZ well for the (narrow range of) target persons.
- Generalize TRIZ well for the (wider range of) target persons
  ==> General methodology of creative problem solving. (CrePS)

(5) General methodology CrePS should be a super-system of TRIZ
integrating various existing methods. How possible?
==> With the Six-Box Scheme as the new framework/paradigm.

Reflection of the present situations on TRIZ has guided us

to a new target at a higher level **Beyond TRIZ**

(May 2012, Toru Nakagawa)

a new target at a higher level.

To establish a general methodology of
creative problem-solving / task-achieving,

to spread it widely, and

to apply it
to problem-solving and task-achieving jobs
in various domains
in the whole country (and the world).

The methodology is named as **'CrePS'** (April 2013, Toru Nakagawa)

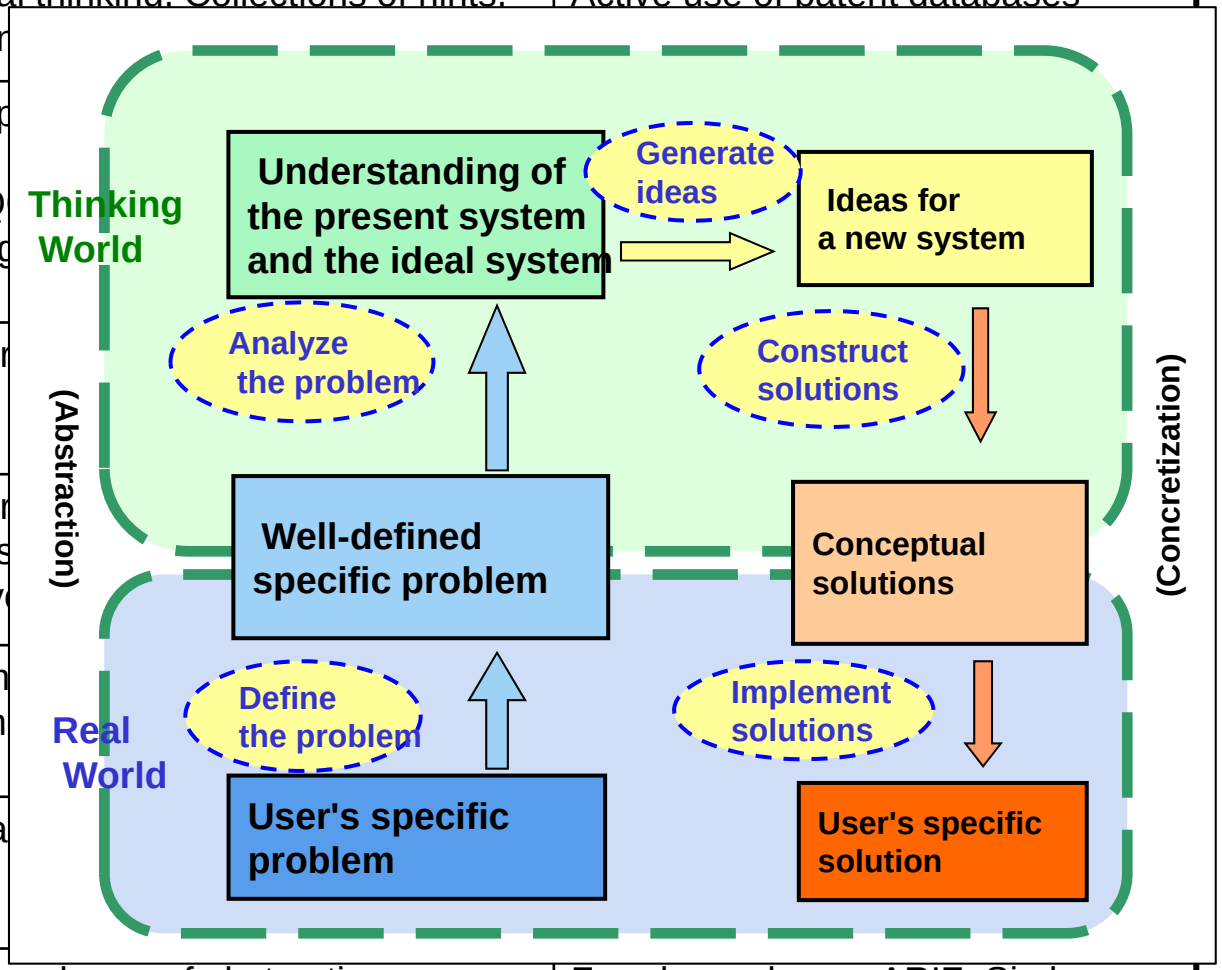
Various methods for creative problem solving & task achieving

Approaches	Examples in conventional methods	Examples in TRIZ/USIT Skip
Basics in Science & Technology	Principles, theories & models in each discipline; knowledge bases	Knowledge bases of physical effects
Learning from cases	Analogical thinking, Collections of hints, Equivalent transformation thinking	Active use of patent databases
Analyzing problems/ tasks	Mind mapping, KJ method (Affinity method), Quality function deployment (QFD), QC tools, Root cause analysis, Value engineering (VE), Functional analysis	Problem definition, Root cause analysis, Function & attribute analysis, Formulating contradictions, Substance-field modeling
Supporting idea generation	Brain storming, Brain writing, SCAMPER	40 Inventive Principles, 76 Inventive standards, Contradiction matrix, USIT operators
Taking care of environment and mental aspects	Brain storming, Facilitation methods, Cynectics, NM method, 'The 3rd alternatives'	Size-Time-Cost (STC) operators, Smart little people (SLP) modeling, Particles method
Realizing the ideas	Design methods in each discipline, Pugh's method, CAD/CAE, Taguchi method	Technical knowledge bases
Foreseeing the future	Using various statistics, Delphi method, Scenario writing	9 Windows method, Trends of technical evolution, S-curve analysis, DE (Directed evolution)
Towards a general methodology	Four -box scheme of abstraction, analogical thinking, ET thinking	Four-box scheme, ARIZ, Six-box scheme of USIT

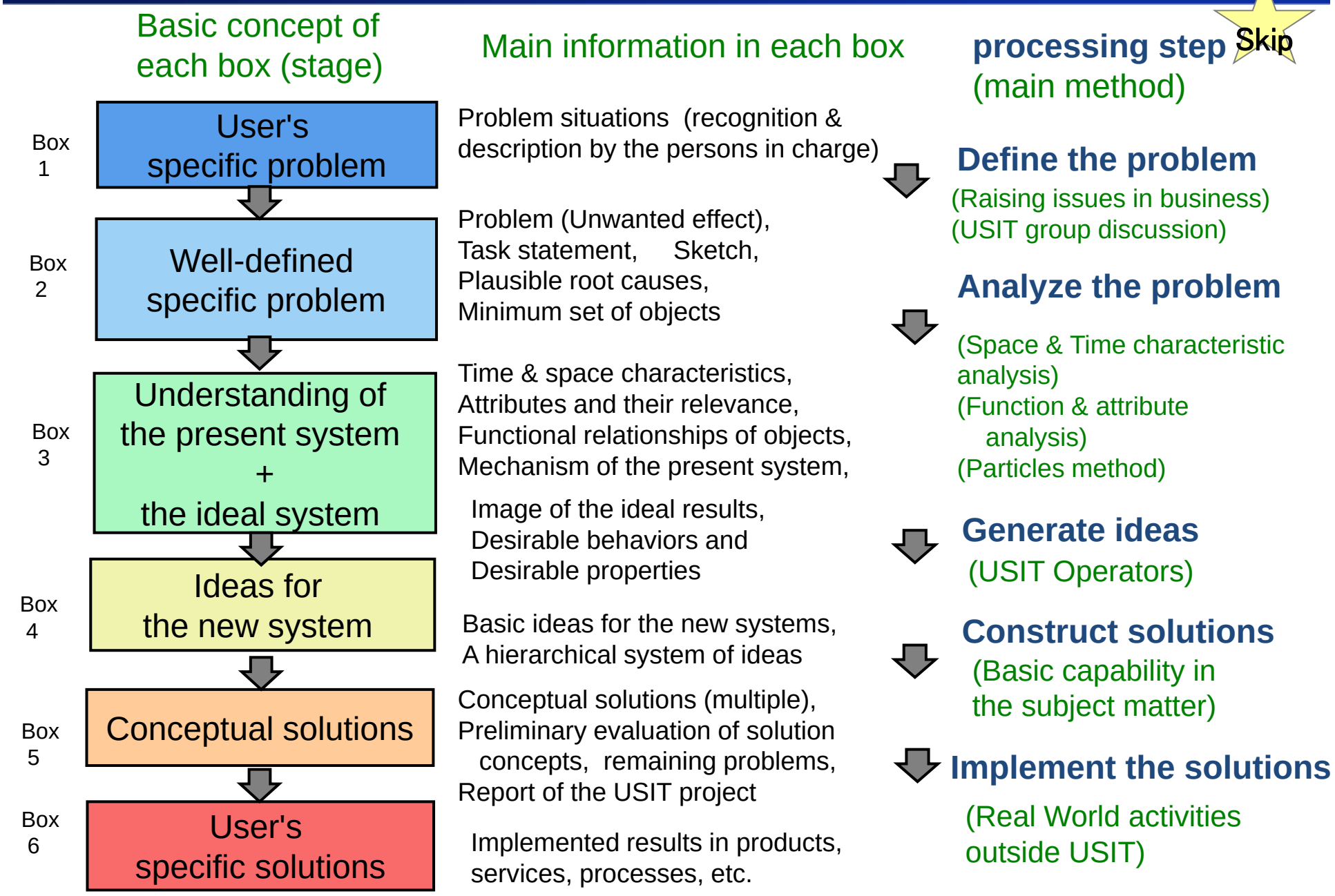
Various methods for creative problem solving & task achieving

Approaches	Examples in conventional methods	Examples in TRIZ/USIT
Basics in Science & Technology	Principles, theories & models in each discipline; knowledge bases	Knowledge bases of physical effects
Learning from cases	Analogical thinking, Collections of hints, Equivaler	Active use of patent databases
Analyzing problems/ tasks	Mind map method), (QFD), Q Value eng analysis	
Supporting idea generation	Brain stor	
Taking care of environment and mental aspects	Brain stor Cynectics alternativ	
Realizing the ideas	Design m Pugh's m method	
Foreseeing the future	Using va Scenario	
Towards a general methodology	Four -box scheme of abstraction, analogical thinking, ET thinking	Four-box scheme, ARIZ, Six-box scheme of USIT

Skip



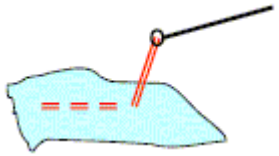
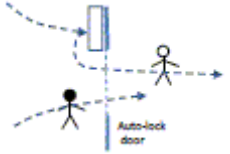
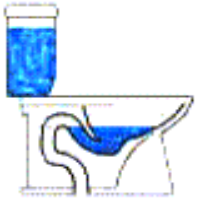
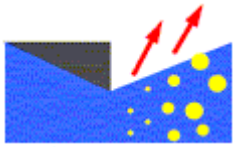
Overall View of USIT process (in 'Six-Box Scheme')



USIT Manual: Table of Contents

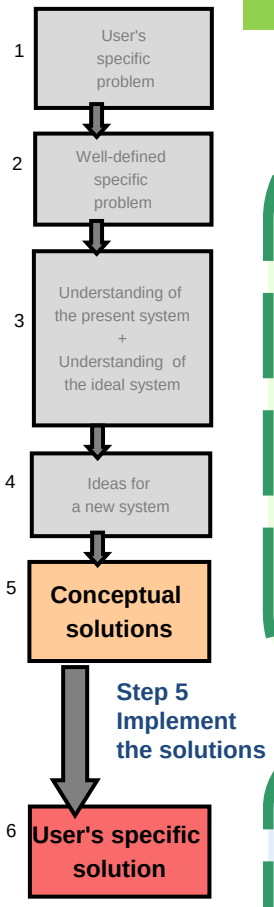
- **Preface:** Purposes, Targets, and Means
- **Introduction:** Purposes to learn and apply USIT; What is USIT?; Characteristic features of USIT; How to use USIT
- **Overall View of the USIT Process:** 'Six-Box Scheme'; Description of the 'Six-Box Scheme'
- **Execution steps of the USIT process:**
  - **Step 1: Define the Problem:** (1) Preparation: Forming the USIT project; (2) Clarify the problem situations and focus the scope
  - **Step 2: Analyze the Problem**
    - (A) Understand the present system: (1) Understand the space characteristics; (2) Understand the time characteristics; (3) Understand the attributes; (4) Understand the functional relationships
    - (B) Make an image of the ideal system : (1) Particles method (part 1 and part 2)
  - **Step 3: Generate ideas:** (1) Write down the ideas stimulated by the analyses; (2) Extend ideas with USIT operators
  - **Step 4: Construct solutions:** (1) Evaluate and select ideas; (2) Construct the conceptual solutions; (3) Report the results of the USIT project
  - **Step 5: Implement the solutions:** (Real activities in the 'Real World') ; Summary of the case study
- **USIT Case Studies:** About the Collection of USIT Case
- **Appendix 1. The System of USIT Operators**
- **Appendix 2. A Collection of USIT Case Studies**

USIT Case Studies （In accordance with the USIT Manual）

1	How to fix a string shorter than the needle		6	A Mom’s Bicycle for Safely Carrying Two Children	
2	How to prevent a staple from being crashed		7	How to Prevent Unauthorized Persons from Entering the Auto-locking Door of Apartment Building	
3	Saving Water for a Toilet System		8	A System for Preventing from Our Leaving Things Behind	
4	Picture Hanging Kit Problem		9	How to Prevent Cords and Cables from Getting Entangled	
5	Increase the Foam Ratio of Porous Polymer Sheet		10	A Large Variety of Writing Instruments: Studying the Evolution of Technologies	

USIT Case Study 4 (Overview) : Picture Hanging Kit Problem

Example of using the USIT Process fully to solve a familiar problem creatively



Ed Sickafus and Toru Nakagawa (1997-2005)

Thinking World

Box 3

Understanding of the ideal system

During adjusting, the string should move smoothly on the nail, but afterwards it must not move on the nail.

Understanding of the present system

The nail serves to decide the lengths of two parts of the string and hence the tilt angle of the frame.
When the string slips on the nail, the frame is tilted.

Analyze the Problem .

Box 2

Well-defined Problem

Improve the picture hanging kit so that the picture will not be tilted later.
Vibration of the wall causes the string to slip on the nail.

Define the problem

Real World

Box 1

Initial problem situations (User's specific problem)

The picture frame hung on the wall tends to be tilted without knowing

Generate Ideas

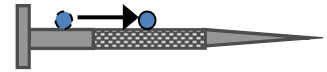
(USIT Operators , etc.)

Box 4

Ideas for a new system

A variety of ideas

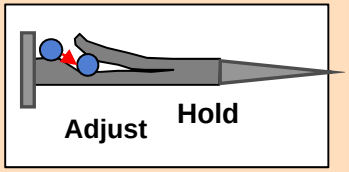
An example:



Construct Solutions

Box 5

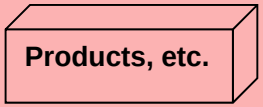
Conceptual Solutions



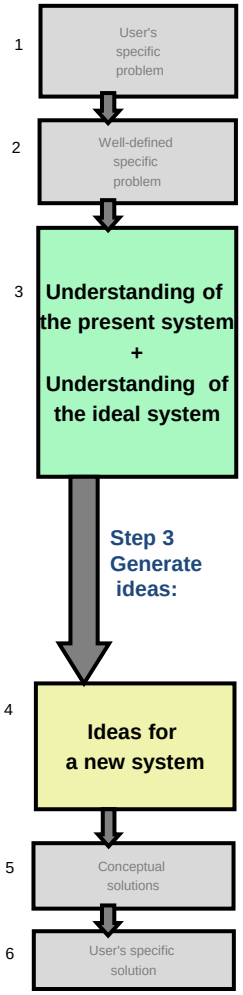
Implement the solution

Box 6

Implemented Solution (User's specific solution)



Step 3: Generate ideas: (1) Write down the ideas stimulated by the analyses



Generate ideas by the stimulation from various analyses, and write them down and build them into a hierarchical diagram.

The problem analysis from various aspects have stimulated us to generate many, different ideas (e.g., items to be examined further, improvement ideas, drastic change ideas, etc.).
Write them down on cards one by one, and extend them further in group discussion, and arrange them into a hierarchical system of ideas.

- (Root) Causes => Eliminate the causes.
- Time characteristics => Solution ideas during the critical time zones
- Space characteristics => Solution ideas to be applied to the places/parts in trouble.
- Functional analysis => Solutions to handle the objects having harmful/insufficient functions
- Attribute analysis => Suppress the problem-increasing attributes, and enhance the problem-decreasing attributes
- Images of Ideal results => Directions of solutions
- Differences in requirements in respect to time/space/conditions => 'Physical contradiction'
  => Combine partial solutions.
- Particles method: Desirable behaviors and properties
  => many ideas and a hierarchical system of ideas
- System of desirable behaviors
  => A hierarchical system of solution ideas

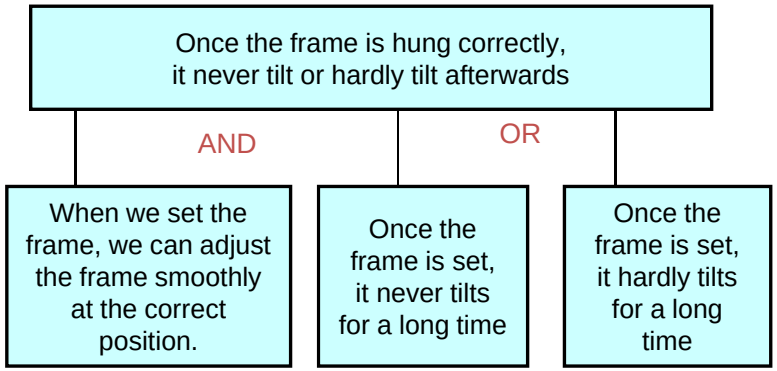
Generate various ideas as much as possible:

A lot of individual ideas: For instance,

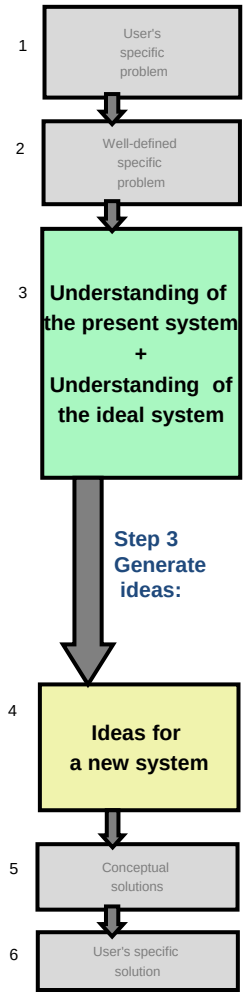
- Increase the friction between the nail and the string.
  (Make the nail surface rough; apply an adhesive; ..)
- Use two nails.
- When the adjustment is finished, apply some treatment for fixing or making hard to slip the string on the nail.
  (e.g., clip, press with a screw, apply an adhesive, etc.)
- Make the frame bottom edge not slip on the wall.
  (e.g., apply a cushion, fix with a double-faced adhesive tape)

Build them into a hierarchical system

The ideas are arranged in a hierarchical system as shown in the skeleton below:



Step 3: Generate ideas: (2) Extend ideas with USIT operators



Apply various USIT Operators intently to generate more ideas and extend/improve them further

The USIT Operators are the integrated and reorganized system of all the solution generation methods developed in TRIZ and USIT.

USIT Operators applicable to system elements:

- **'Multiplication'** of objects
- **'Dimensional change'** of attributes
- **'Re-distribution'** of functions

USIT Operators applicable to solution ideas:

- **'Combination'** of a pair of solution ideas
- **'Generalization'** of solutions

Please refer the System of USIT Operators (5 main- and 32 sub-operators) in a separate document.

You can understand them better when you re-consider which USIT Operators are used in individual solution ideas.

Apply a USIT Operator to any possible target (see above) somehow literally, and then think of an idea of making good use of it.

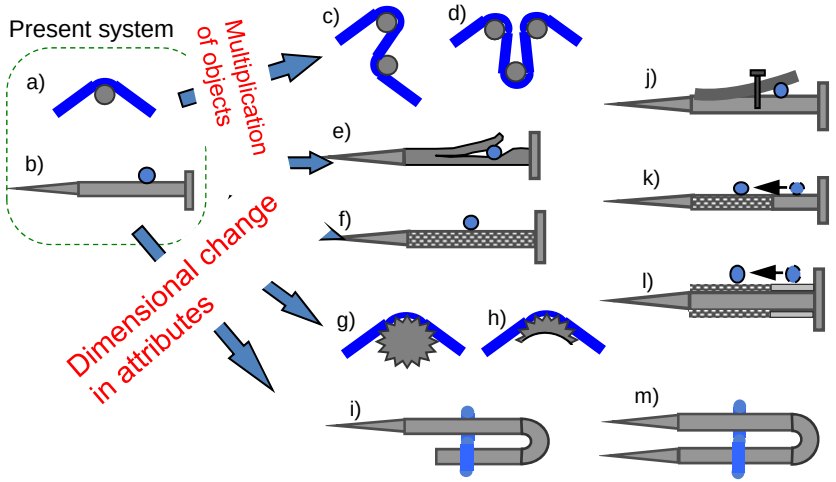
There can be various ways of good use.

You should think in a flexible manner.

There are a huge number of combinations of USIT sub operators and their possible targets; so you should not and need not try to exhaust the combinations.

USIT Operators are implicitly used everywhere in this Manual and in the USIT case studies.

Ideas obtained with various USIT Operators (Examples)



One idea can be derived with different USIT operators:

Adjust
Maintain

- Divide the nail into two parts, differ the surface properties and combine them again.
- Smoothness attribute of the nail was changed by places.
- The adjustment and maintenance functions of the nail are alocated to different parts of the nail.
- Solution of a smooth nail and solution of a rough nail are combined by the places
- The two solutions are combined in time..

If you are already familiar with the original TRIZ (or other) idea generation methods (e.g., 40 Inventive principles, Trends of evolution, Inventive standards, separation principles, etc.), you can use any of them here.

The current status of research on CrePS/TRIZ/USIT:

'General Methodology for Creative Problem-Solving/Task-Achieving' (CrePS)

CrePS is feasible by using the 'Six-Box Scheme' as the basic paradigm.

Different methods (including TRIZ) can be reorganized into CrePS.

USIT is a concise process for applying the Six-Box Scheme of CrePS.

On-going research activities for developing CrePS:

(1) To make course materials of CrePS case studies.
We should just use case studies already published.

(2) To understand different methods (including TRIZ)
and to describe them in the framework of CrePS.

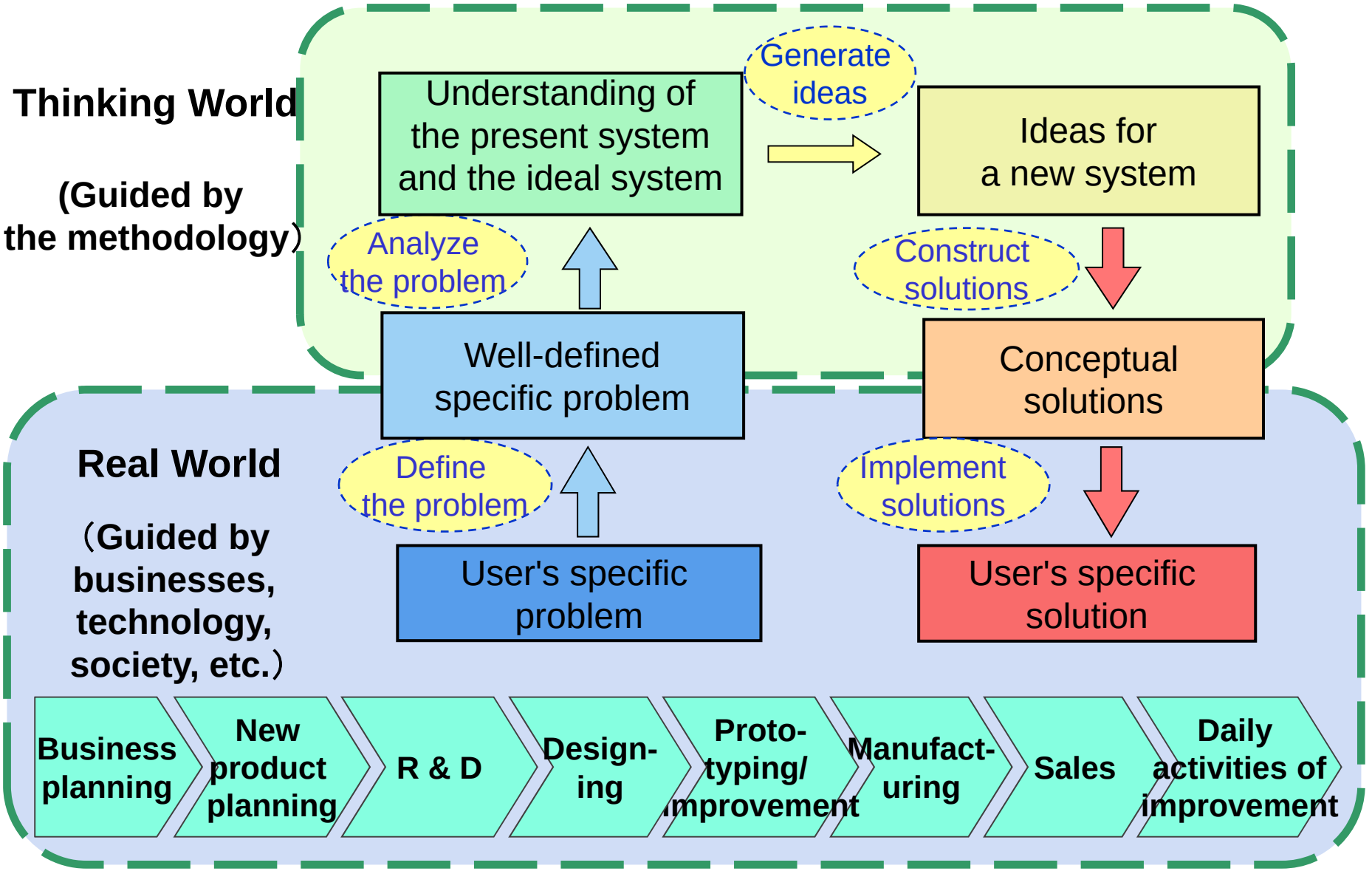
(3) To relate CrePS to various activities in the 'Real world'.

(4) To categorize various purposes of CrePS application,
and to recommend concise CrePS processes for each category.

(5) To proliferate the vision of CrePS.

(3) To relate CrePS to various activities in the 'Real world'.

Position of CrePS and its Six-Box Scheme



(5) To proliferate the vision of CrePS.

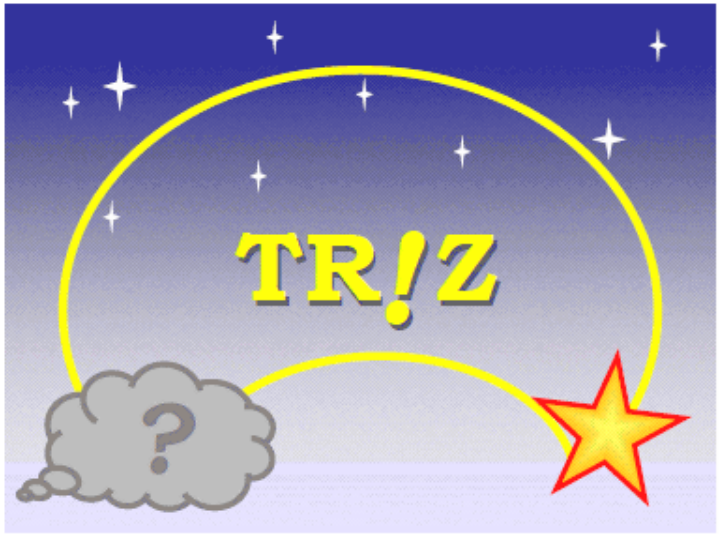
"TRIZ Home Page in Japan" --- Public Web site since Nov. 1998

Let's enjoy 'Think & Try' !
(for Children and Highschool students)
Editor: Toru Nakagawa
Last updated: Jun. 26, 2015

For solving problems creatively
(for Students and the General public)
Editor: Toru Nakagawa
Last updated: Aug. 25, 2015

Methods of creative problem solving
(for Engineers and Researchers novice to TRIZ)
Editor: Toru Nakagawa
Last updated: Aug. 25, 2015

Practices and methodologies of Creative problem solving
(for Practitioners and Experts)
Editor: Toru Nakagawa
Last updated: Aug. 25, 2015



This home page serves as an open forum of information exchange for better understanding and usage of Creative Problem Solving Methodologies, especially based in Japan. Readers' contributions are very welcome, including introductory articles, papers, case studies, news, questions, comments, etc

Pages under this directory are the English versions.
Click the hyper-linked keywords or the Engl. buttons.
The Jap. buttons guide you to the Japanese pages.
Most articles are posted in the two languages, but some are only in either of them.

TRIZホームページ

責任編集：大阪学院大学　中川 徹
Last Updated: October 18, 2015 Jap.
http://www.osaka-gu.ac.jp/php/nakagawa/TRIZ/

TRIZ Home Page in Japan

Editor: Toru Nakagawa
(Professor Emeritus, Osaka Gakuin Univ.)
Last Updated: October 18, 2015 Engl.
http://www.osaka-gu.ac.jp/php/nakagawa/TRIZ/eTRIZ/

Established on Nov. 1, 1998

039183 visits since Nov. 1, 2005

4 'Entrance Pages'

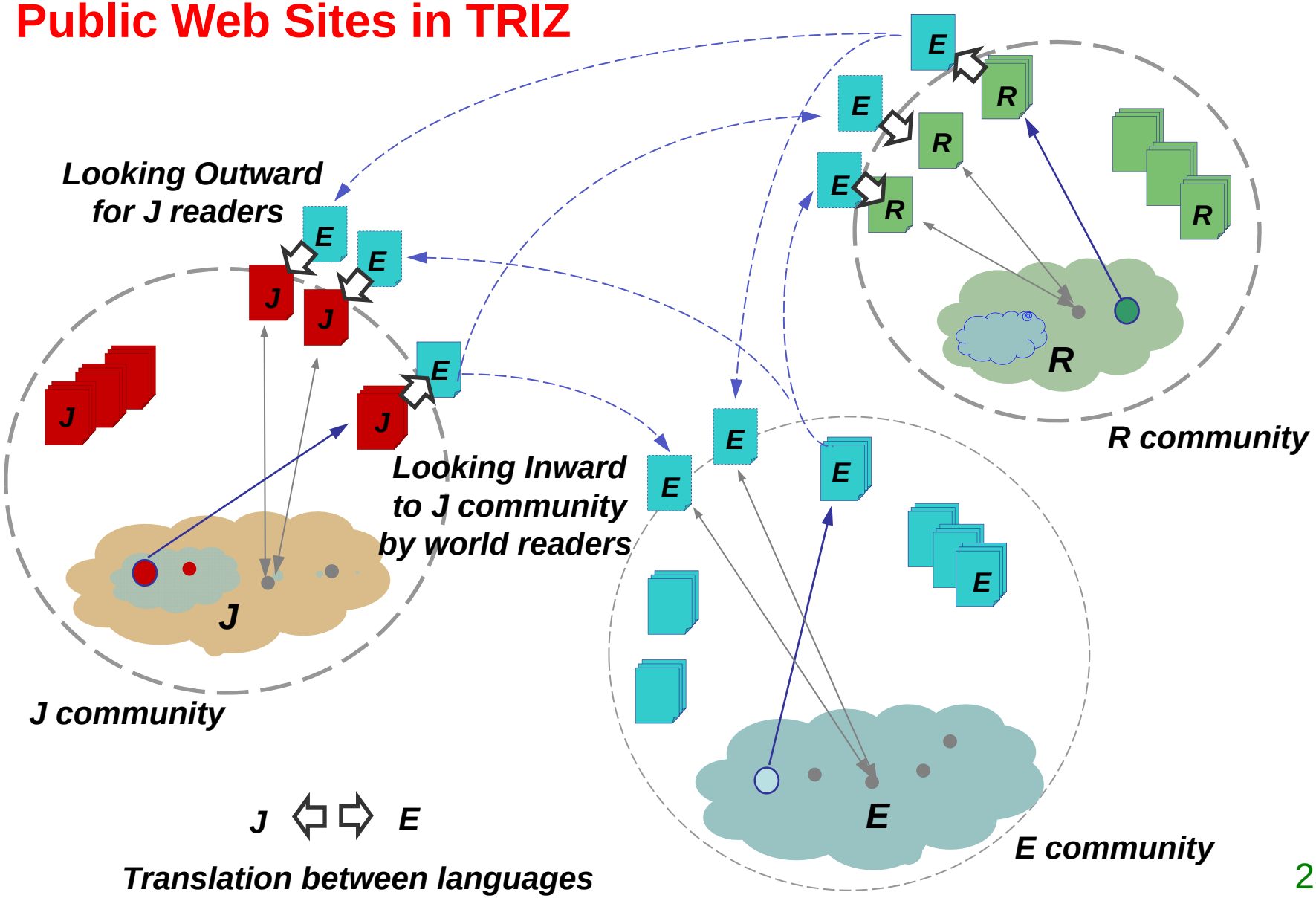
A Proposal of Global Network of Public Web Sites in TRIZ for Building A Global TRIZ Community

This has been proposed since 2008 on the basis of
my building TRIZ Links in the World (2008) and
the lessons learnt from my Web site "TRIZ Home Page in Japan".

1. **Let's build many Public Web Sites** (not private, not official)
   in different TRIZ communities,
2. **and set both Outward- and Inward-looking Windows**
   on them for overcoming the language/community barriers,
   (bi-directional translation and introduction)
3. **and form an Autonomous Global Network of them.**
   (Links will form recommendations, without official control)

Our vision: A Global TRIZ Community intermediated
by many Public Web sites for different TRIZ communities.

Let's establish Autonomous Global Network of Public Web Sites in TRIZ



Concluding Remarks:

A higher level target for us TRIZ community should be:

a new target at a higher level.

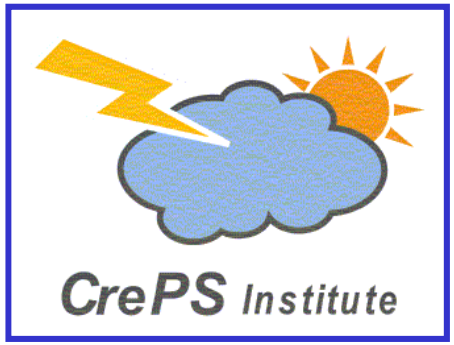
To establish a general methodology of
creative problem-solving / task-achieving (CrePS)

to spread it widely, and

to apply it
to problem-solving and task-achieving jobs
in various domains
in the whole country (and the world).

We can build CrePS on the basis of TRIZ / USIT
by using the Six-Box Scheme !

I wish you to share the vision and collaborate together !



Thank you
for your attention

Toru Nakagawa
(Osaka Gakuin University, Professor Emeritus)
nakagawa@ogu.ac.jp

Editor of "TRIZ Home Page in Japan" (in Japanese and in English)
http://www.osaka-gu.ac.jp/php/nakagawa/TRIZ/eTRIZ/ (English)

Director of CrePS Institute, Publisher of "TRIZ Practices and Benefits" series