TRIZCON2016
Held by Altshuller Institute for TRIZ Studies
at Tulane Univ., New Orleans, LA, USA
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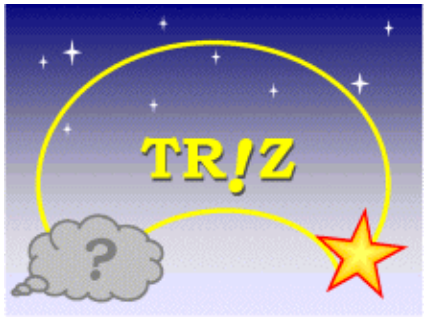
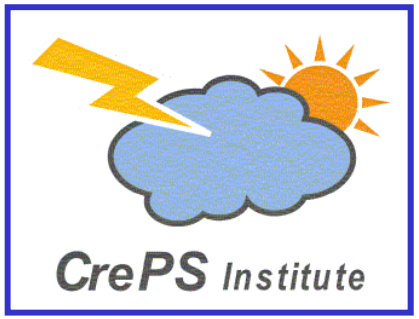


CrePS (General Methodology of Creative Problem Solving) beyond TRIZ: What, Why, and How?

Toru Nakagawa

Osaka Gakuin University
& CrePS Institute, Japan



Video presentation recorded on Feb. 27, 2016 at Kashiwa

Introduction

How to think creatively ?

Important but difficult to learn 'how to think'.
The subject is so broad, big and vague.

How to think **to solve problems** ?
How to think to solve problems **and to achieve tasks** ?
How to think to solve problems and to achieve tasks **creatively** ?

How to solve problems creatively?

=> Method(s) of creative problem solving

There exist many, different methods and practices.

What is the essence which can integrate all these methods ?

What is the general methodology of creative problem solving ?

(Good, creative) Methods of problem solving are wanted everywhere.

Because there are so many, big problems yet un-solved,
in every country, in every organization, for every person,
in various areas
including social, human, and technical areas.

Various existing methods (including TRIZ), however,
seem not used widely,
mostly because of being not understood well by such people.

What need to be understood by people ?

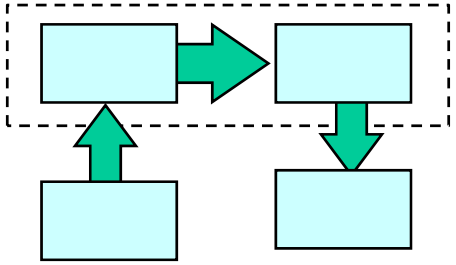
What should be taught to children, students, and people ?
Different specific methods --> unsuccessful.
==> **Essence of (general) method**
(and appropriate specific methods, later)

What is the essence of (general) methods of creative problem solving ?

This has not been answered well so far
in science and technology (including TRIZ).

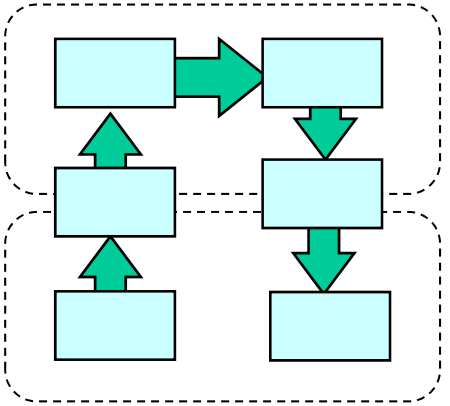
Such an essence should form the paradigm (or basic scheme)
of creative problem solving.

Conventional answer in science and technology is 'Four-Box Scheme' of abstract thinking.



But is weak in the abstraction step and
in the concretization step.

'Six-Box Scheme' is our new answer !



This is the paradigm of our newly-found
'General Methodology of Creative Problem Solving' (CrePS).

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)

Outline of my talk: 3 Basic Questions

What? CrePS: General Methodology of Creative Problem Solving
Six-Box Scheme: Paradigm (or framework) of CrePS

Why? For fulfilling people's demands for problem solving,
by the establishment of a general methodology CrePS,
which integrates different existent methods
under the new paradigm
to form an effective and easy-to-understand PS process.

How ? Under the Six-Box Scheme
various problem solving methods can be incorporated properly.

Using USIT (Unified Structured Inventive Thinking) **as a prototype.**
USIT is a concise, general-purpose process
executing the Six-Box Scheme, and is already developed well.

By the collaboration with many people using different methods:
Problem definition step and solution implementation step
in the Real World need to be studied much more.

Part 1. What
shall we establish ?

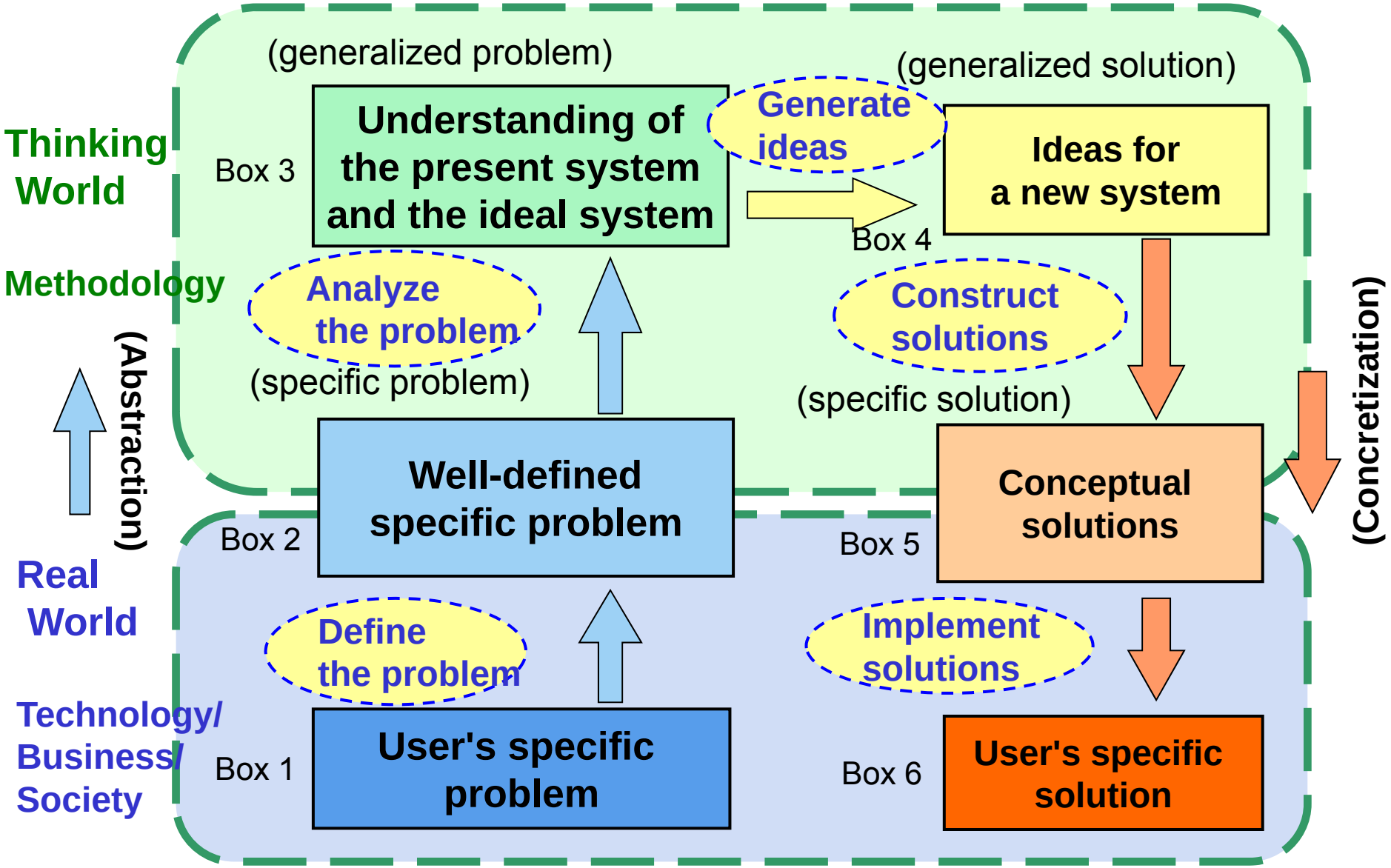
General Methodology
of Creative Problem Solving

We call it **CrePS.**

Paradigm (or basic scheme) of the methodology

We have found **'Six-Box Scheme'** is the one.

Six-Box Scheme: the New Paradigm of
General Methodology of Creative Problem Solving (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, functions, etc., and
the ideal system is also understood in its image.

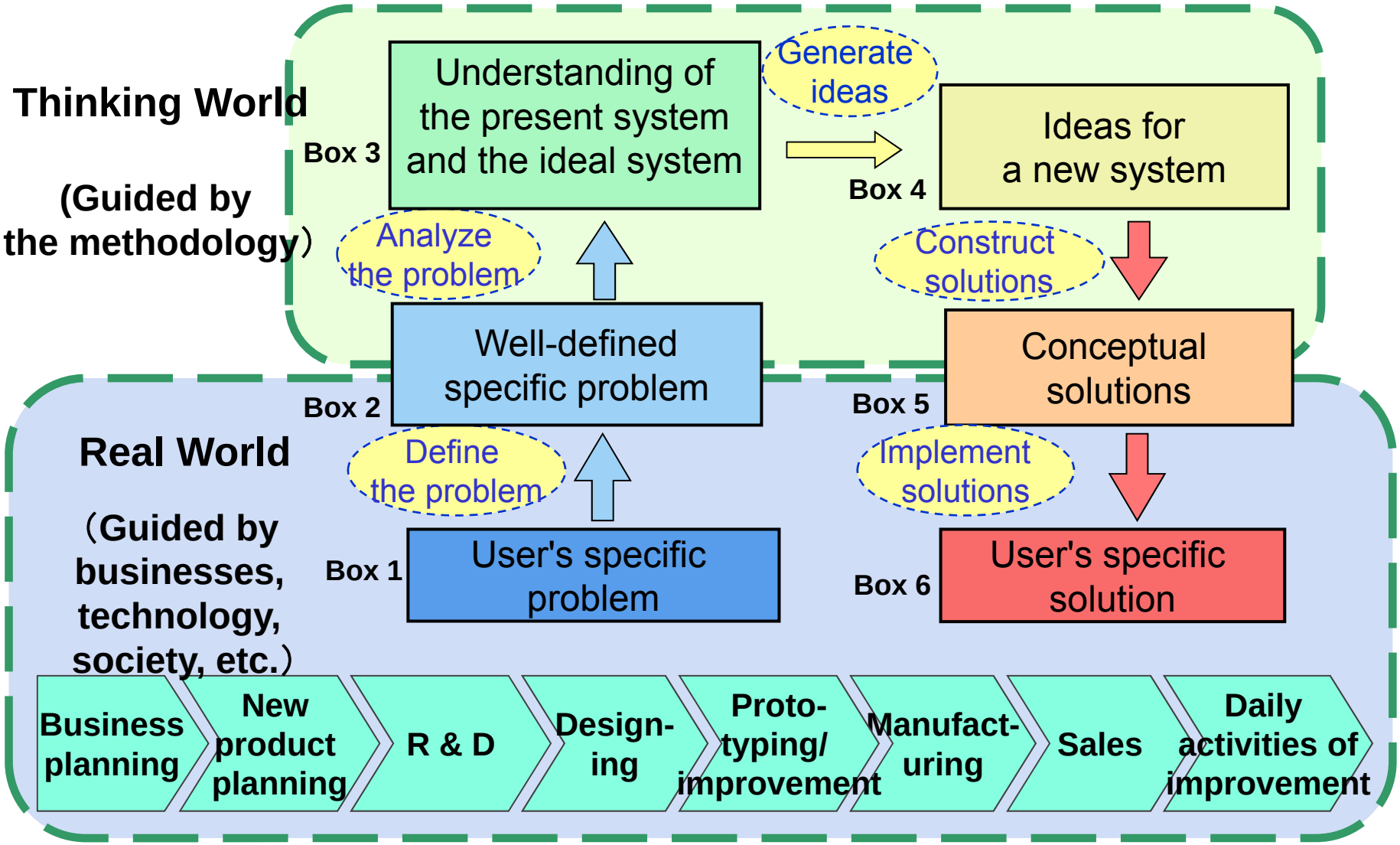
(e) Ideas for a new system (Box 4), exceeding the stage of hints,
are often obtained quite smoothly from the understandings in Box 3;
Various techniques may also be used for assisting the idea generation.

(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.

Position of CrePS in a Real World

In case of Industry



There can be other types of Real World depending on the problems and areas.

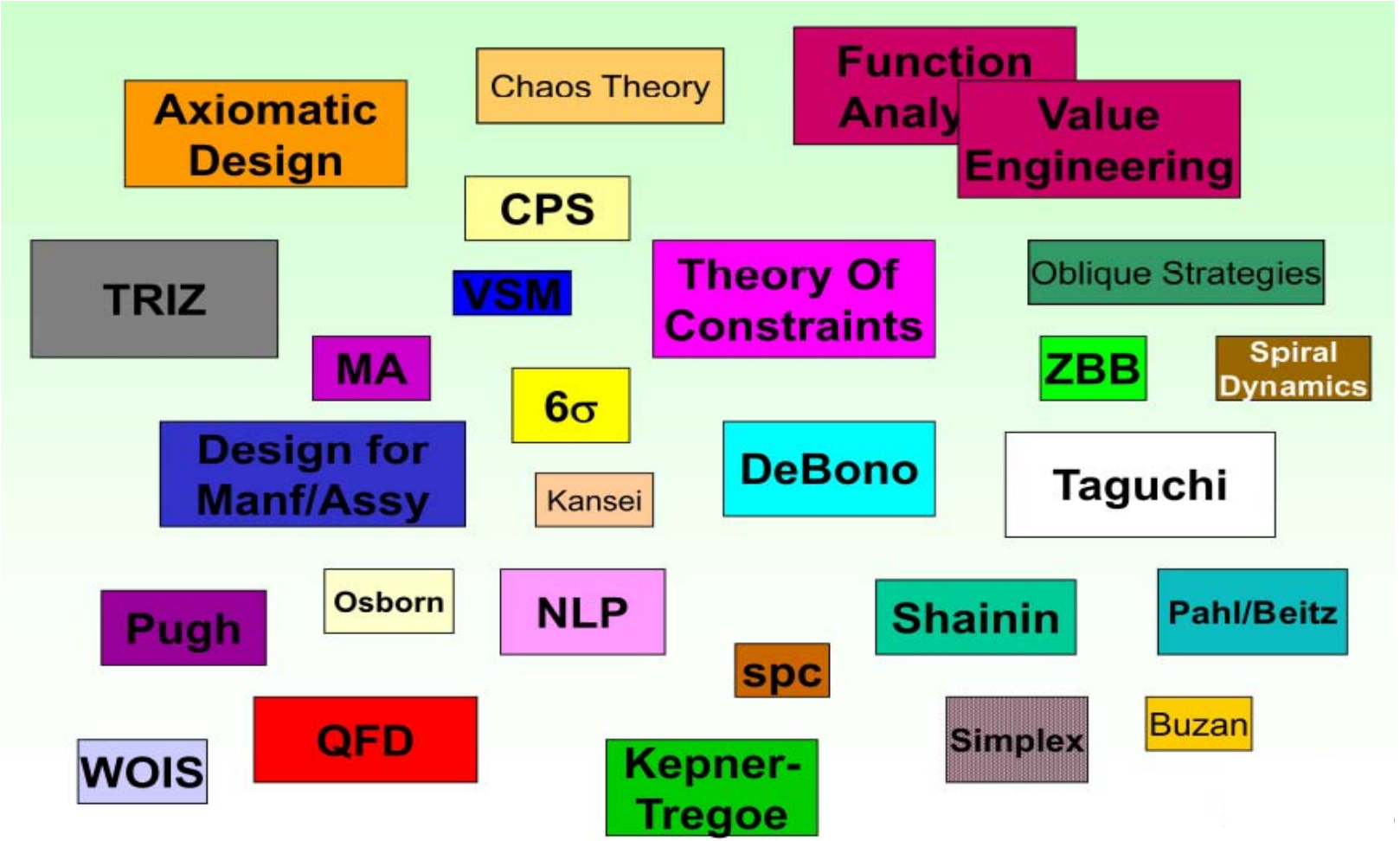
Part 2. Why
do we need to establish it ?

Because conventional methods of problem solving
lack a good paradigm for integrating them,
and do not meet the society's demands.

Thus we need to make
an general methodology (with a new paradigm)
which can integrate different existing methods
and can solve many real problems in the society.

Examples of conventional methods of creative problem solving:

[Darrell Mann (ICSI 2015): Methods of Systematic Innovation]



Use these methods selectively. (Mann)
It is a too-much requirement for users, without unifying them. (Nakagawa)

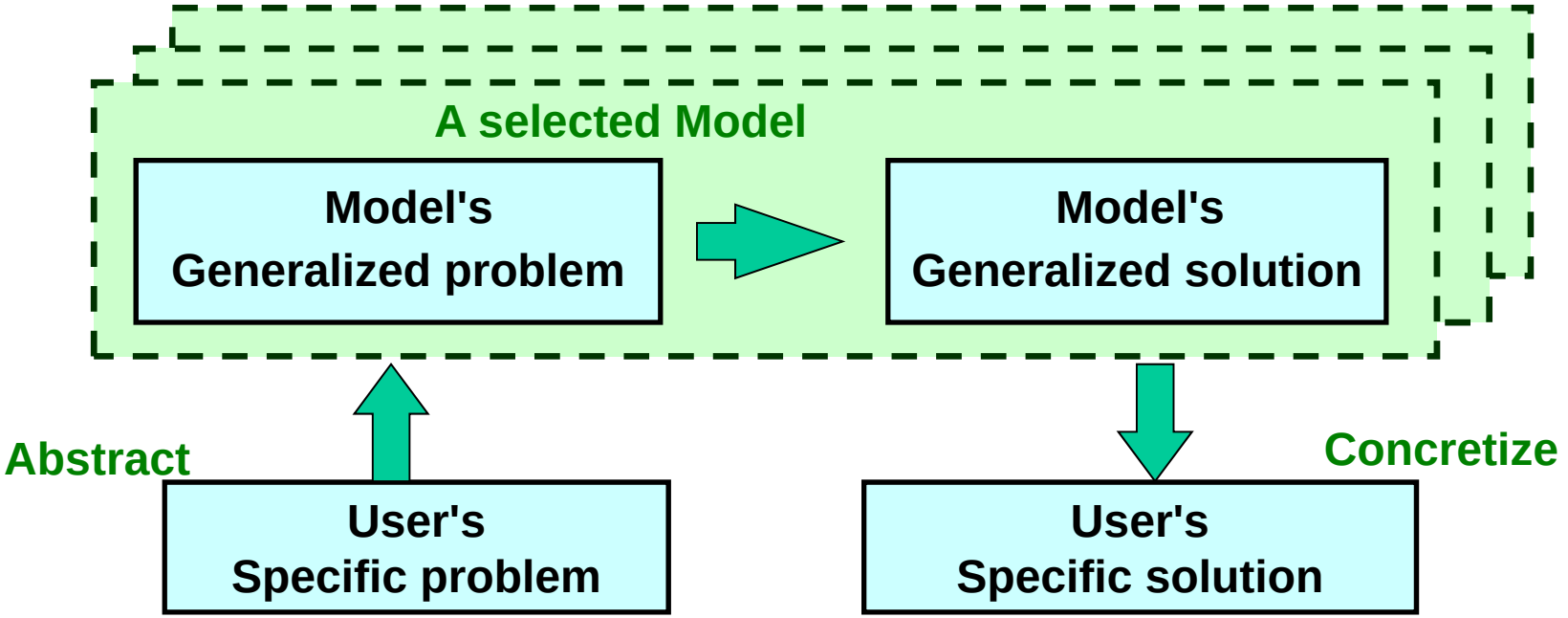
Approaches of various methods for creative problem solving

Approaches	Examples in conventional methods	Examples in TRIZ/USIT
(a) Basics in Science & Technology	Principles, theories & models in each discipline; knowledge bases	Knowledge bases of physical effects
(b) Learning from cases	Analogical thinking, Collections of hints, Equivalent transformation thinking	Active use of patent databases
(c) 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
(d) Supporting idea generation	Brain storming, Brain writing, SCAMPER	40 Inventive Principles, 76 Inventive standards, Contradiction matrix, USIT operators
(e) 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
(f) Realizing the ideas	Design methods in each discipline, Pugh's method, CAD/CAE, Taguchi method	Technical knowledge bases
(g) Foreseeing the future	Using various statistics, Delphi method, Scenario writing	9 Windows method, Trends of technical evolution, S-curve analysis, DE (Directed evolution)
(h) Towards a general methodology	Four -box scheme of abstraction, analogical thinking, ET thinking	Four-box scheme, ARIZ, Six-box scheme of USIT

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

Science & Technologies (Many models, specialized in areas)

Many models in the Knowledge Base

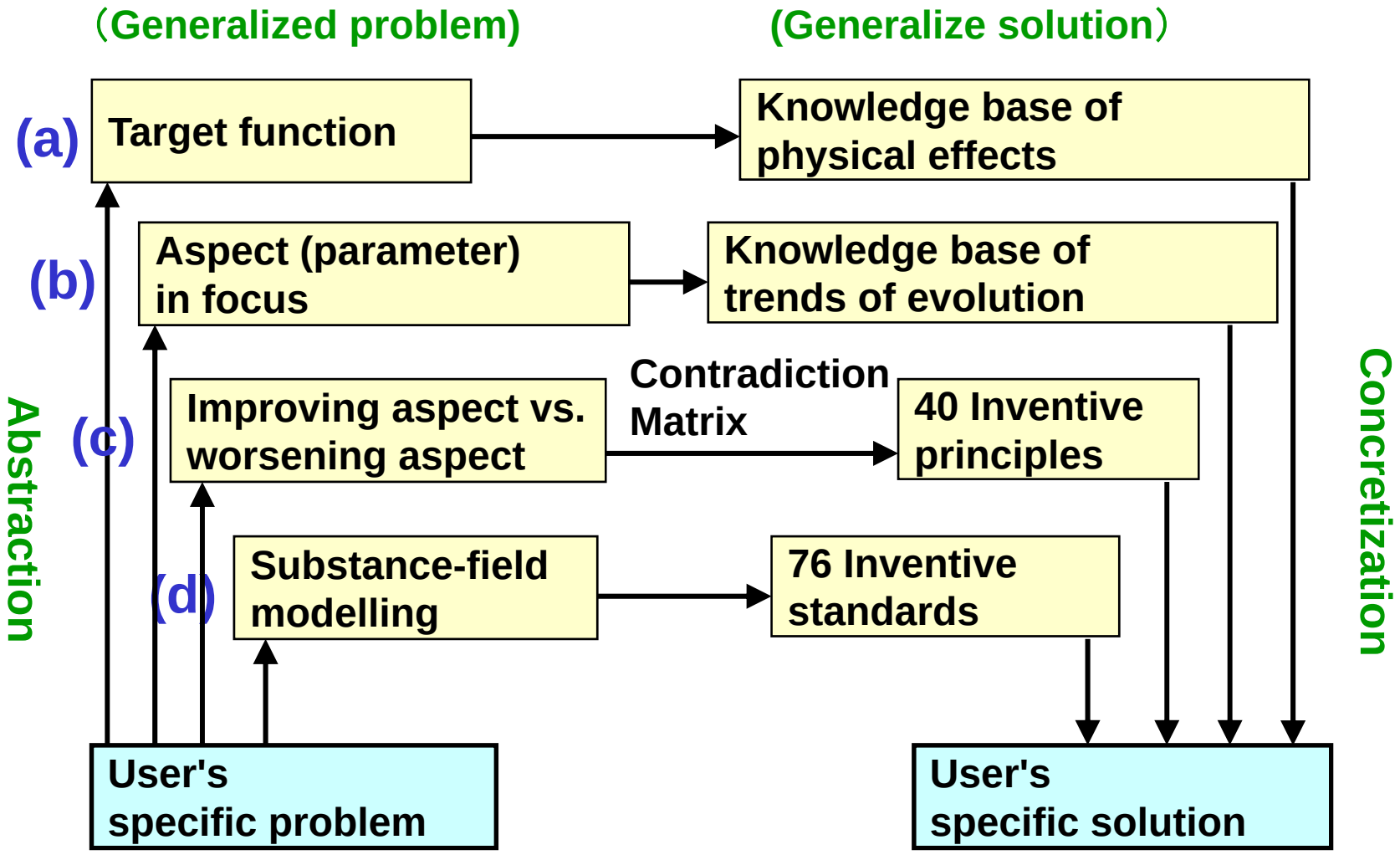


Pitfalls: Problem is mapped onto a model, and the general solution is shown just as hints to be concretized in analogical thinking.

The contents of the boxes depend on the fields, models, and problems and cannot be explained any further in general terms.

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

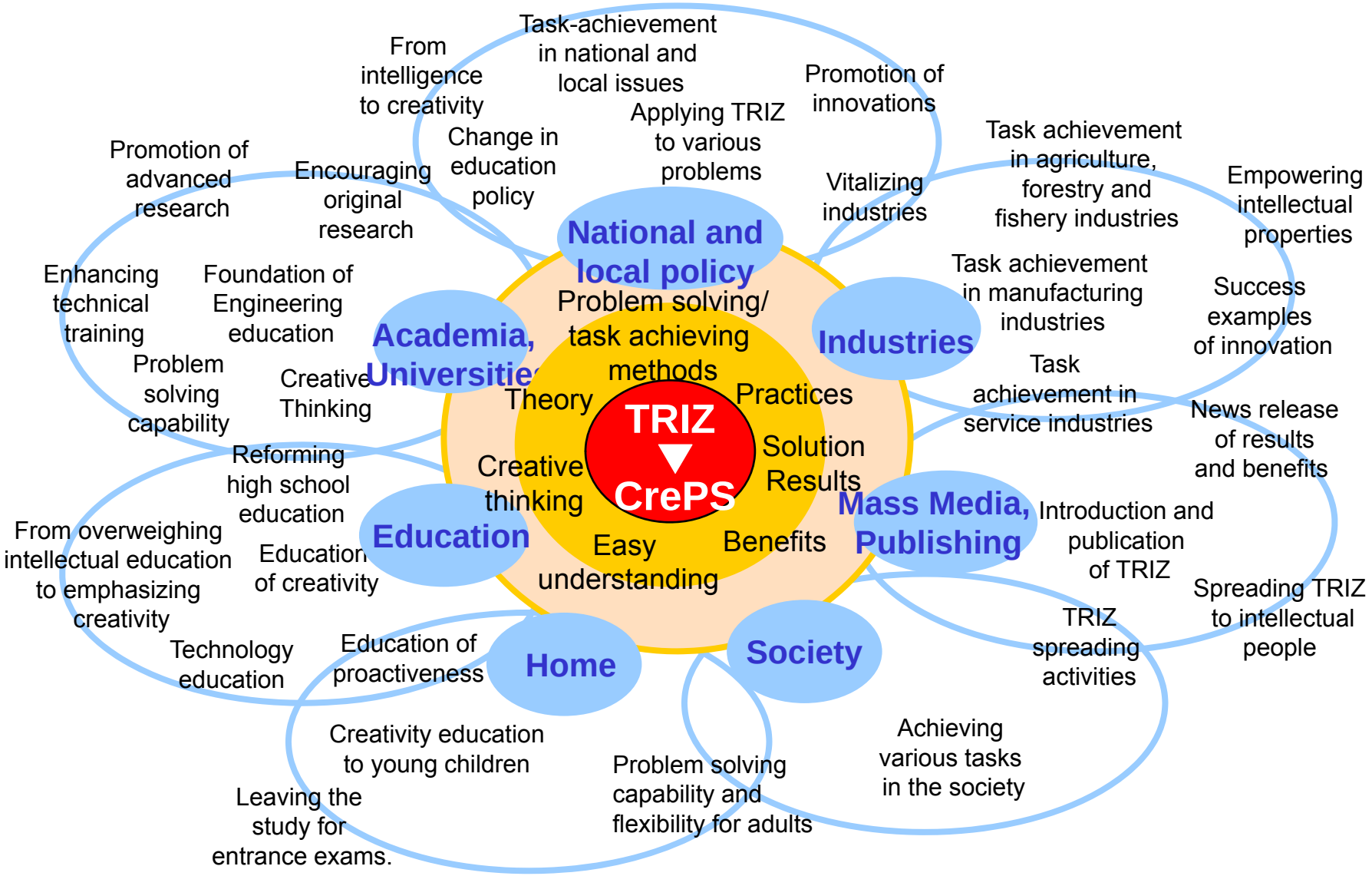
Main Tools of TRIZ (Based on the Four-Box Scheme)



TRIZ 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 becomes complex (e.g., ARIZ).

Expected Areas of Applying TRIZ / CrePS

Toru Nakagawa
(May, 2012)



In the center we put TRIZ, first, but need a more general method (CrePS)!

Part 3. How can we establish it?

Under the Six-Box Scheme as the new paradigm,

using USIT as a prototype (of the steps in the Thinking World),

and by the collaboration of many people,

we can integrate many different methods into CrePS.

The steps in the Real World need to be studied much more
(i.e., problem definition and solution implementation) .

Nakagawa's Understanding of the Recent Development of Creative Problem Solving Methods Up To CrePS

(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

Classical TRIZ and modernized TRIZ tools
using knowledge bases of Sci. & Tech. applicable across the fields
(Four-Box Scheme)

(3) Contributions of USIT [Ed Sickafus --> Toru Nakagawa]

A concise whole process of creative problem solving
Integration of various TRIZ methods into USIT Operators (2002),
'Six-Box Scheme' (2004)

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

Concept of General Methodology based on 'Six-Box Scheme' (2012),
Vision of integrating/unifying various methods into CrePS.
USIT is a concise whole process executing CrePS.

A Simple Case Study of USIT

T. Shimoda and T. Nakagawa (2006)

Everyday-life Case Study in USIT:

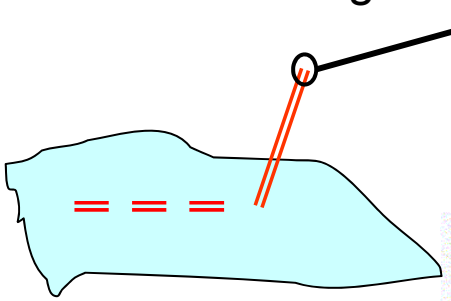
How to fix a string shorter than the needle at the end of sewi

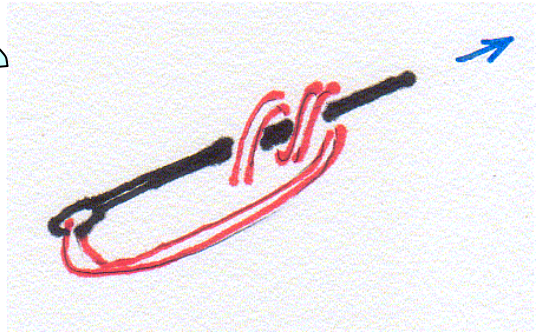
Define the Problem: [Box-1 ==> Box-2]

(a) An Unwanted effect: The string is shorter than the needle and prohibit applying the standard way of making a knot.

(b) Task statement: Devise methods for fixing the string left shorter than the needle.

(c) Sketch:





(d) Plausible root causes:

The standard way of making a knot is applicable only when the string left is longer than the needle.

(e) Minimum set of relevant objects:

Cloths, string (already sewn), string (left), the needle

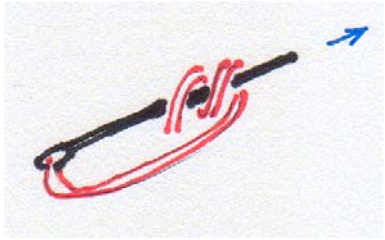
Problem Analysis (A): Understanding the present system

[Box-2 ==> Box-3]

(1) Functional analysis: What is the function of the Needle?

A base for making a loop of the string;

A guide for passing the end of the string through the loop

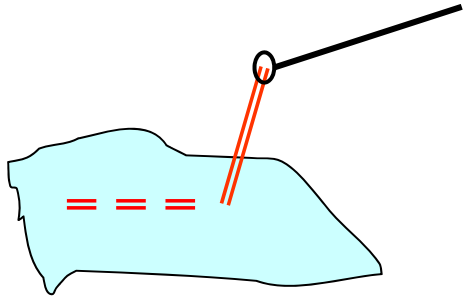


(2) Attribute analysis: Properties taken for granted form the Constraints:

The string does not expand = Its length does not change.

The needle is hard = No change in shape and length.

When any of these constraints is lifted,
there appears a novel solution.



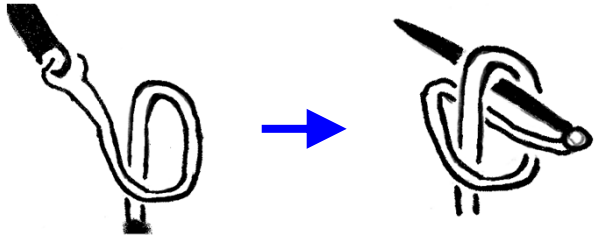
(3) Analysis of time characteristics: Processes of sewing:

Solutions at the final stage and solutions at any earlier stage.

(4) Analysis of space characteristics: A knot makes the string thick at the end.

Watch out about the topology in making a knot and in the 'hole and string' .

Several known solutions:



A well-known technique.
Difficult to make the loop
of string in the space;
need some practices

The hole of the needle has a slit;
thus the string can be passed and
removed without cutting the loop of the
string.
(a commercial product)

Problem Analysis (B): Understanding the Ideal system

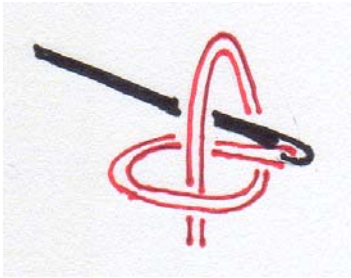
[Box-2 ==> Box-3]

Ideal arrangement of a sting in space
for making a knot

It should be nice if we could hold
the string in this arrangement
in the space.

Solution Generation: Generate Ideas and Construct Solutions

[Box-3 ==> Box-4] [Box-4 ==> Box-5]

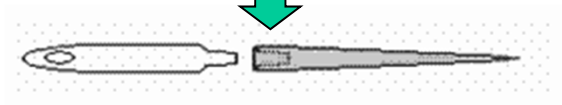


Known technique

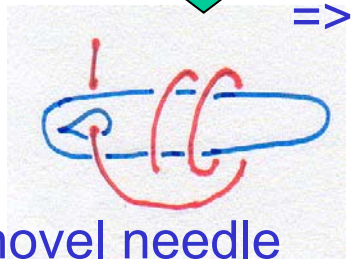
Image of
Ideal situation

'Let's break the needle!'

A ridiculous idea !?



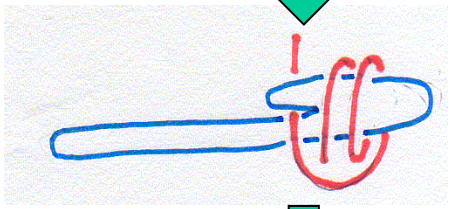
What does this mean?
=> No need to sew any further.



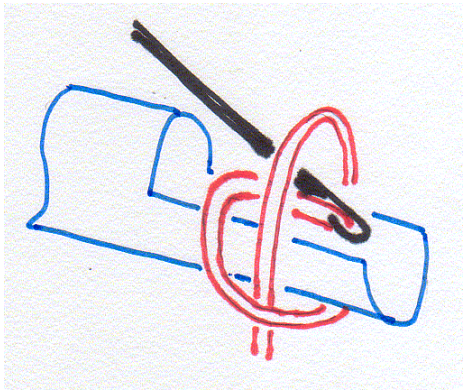
A novel needle
specialized for
making a knot

improve

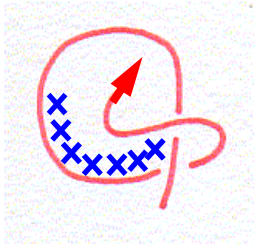
improve



improve



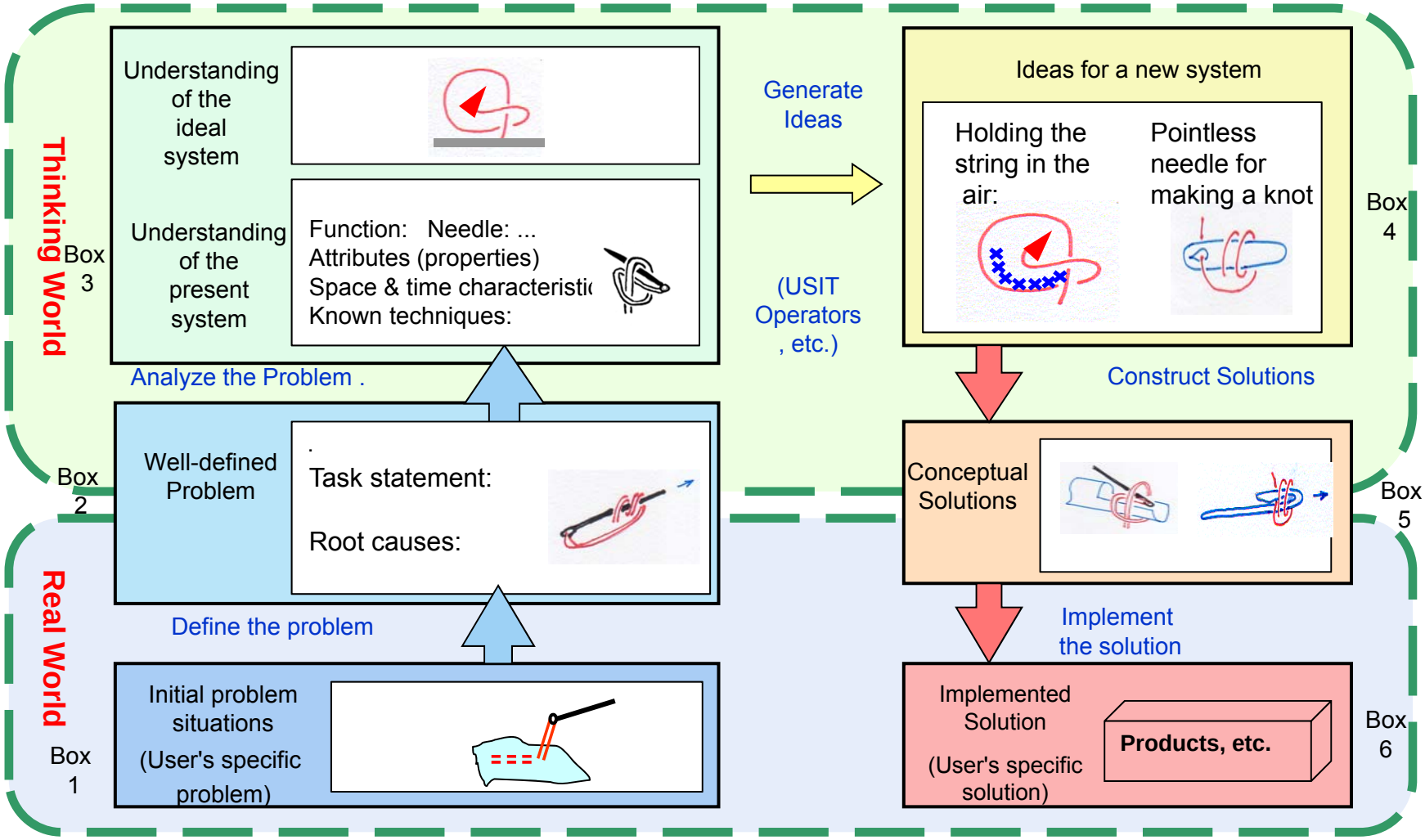
A novel tool
made of a straw



USIT Case Study 1 [Sewing] (Overview): How to fix a string shorter than the needle

Whole USIT Process is well illustrated for a familiar problem

Toru Nakagawa and Tsubasa Shimoda (2006)



"USIT Operators": A system of solution generation methods

Obtained by re-organizing all the solution methods in TRIZ

T. Nakagawa, H. Kosha, and Y. Mihara (ETRIA TFC 2002)

TRIZ methods for Solution Generation

USIT Operators (5 Main-, 32 sub-methods)

40 Inventive Principles

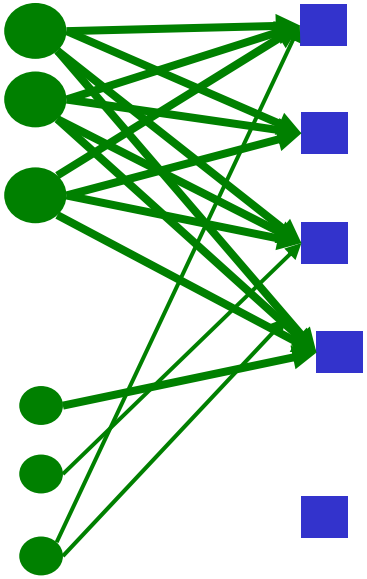
76 Inventive Standards

35 Trends of System Evolution

Separation Principle

Self-X Principle

Trimming



Object Pluralization

Attribute Dimensionality

Function Distribution

Solution Combination

Solution Generalization

USIT Operators are further classified in a hierarchical way.

USIT Operators

Nakagawa, Kosha, Mihara (2002)

(1) Object Pluralization Method

a. Eliminate
b. Multiply into 2, 3, ..., ∞
c. Divide into 1/2, 1/3, ..., 1/∞
d. Unify
e. Introduce or modify ⟺ KB
f. Introduce from the Environment.
g. From solid to powder/liquid/gas

(2) Attribute Dimensionality Method

a. Deactivate a harmful attribute
b. Activate a useful attribute ⟺ KB
c. Enhance a useful or suppress a harmful attribute
d. Introduce a spatial attribute or vary in space
e. Introduce a temporal attribute or vary in time
f. Change the phase or the inner-structure
g. Attributes at the micro level
h. Properties of the system as a whole

(3) Function Distribution Method

a. Reassign to a different Object
b. Divide the compound Functions and assign them separately
c. Unify multiple Functions
d. Introduce a new Function ⟺ KB
e. Vary the Function in space, use space-related Functions.
f. Vary the Function in time.
g. Detection/measurement Function.
h. Enhance adapting/coordination/control
i. With a different physical principle

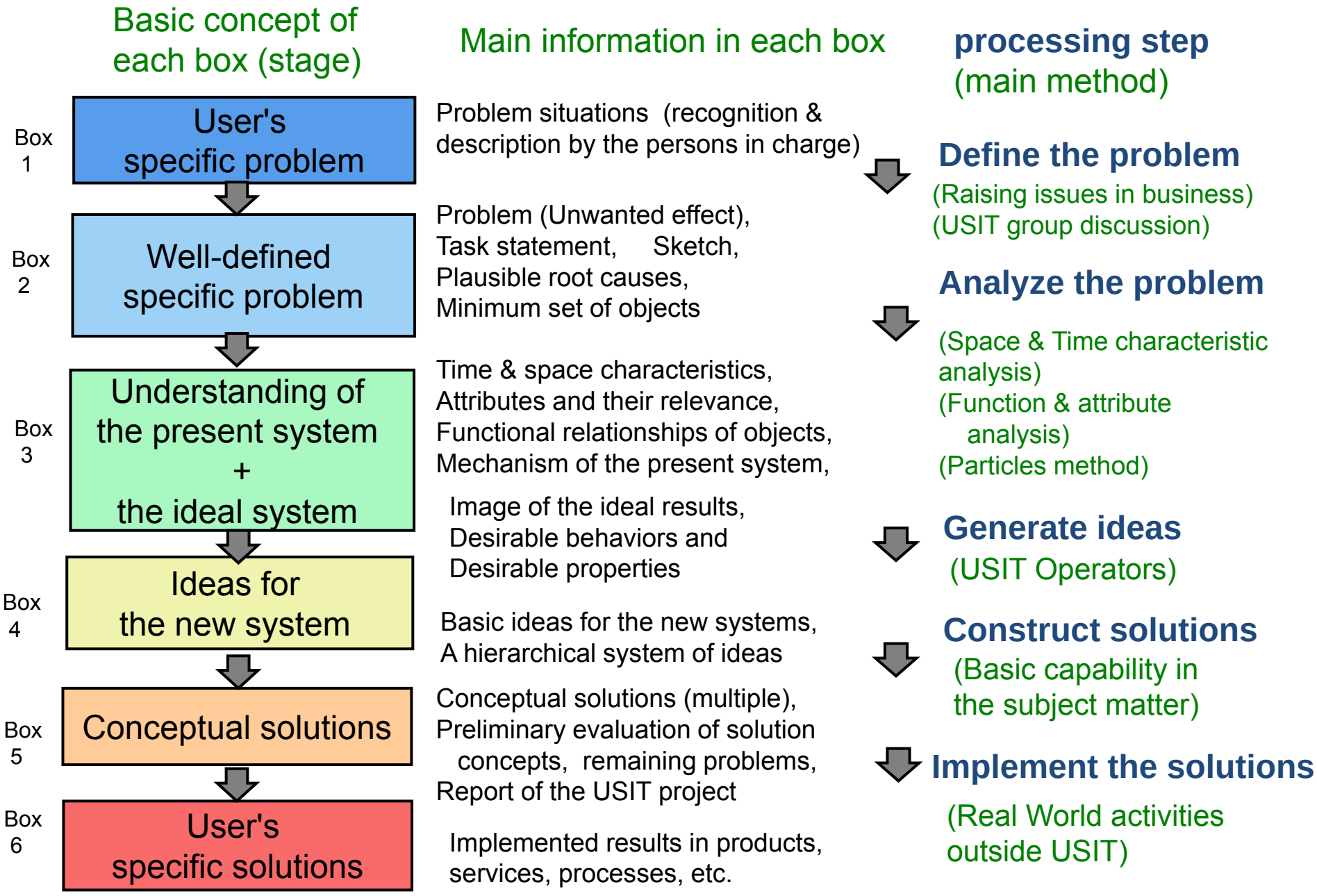
(4) Solution Combination Method

a. Combine functionally
b. Combine spatially
c. Combine temporally
d. Combine structurally
e. Combine at the principle level.
f. Combine at the super-system level

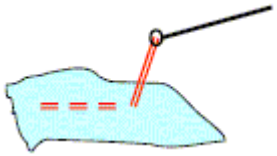
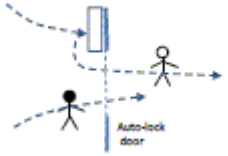
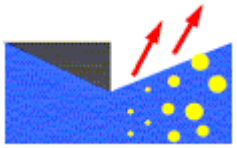
(5) Solution Generalization Method

a. Generalize/specify
b. Hierarchical system of solutions

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



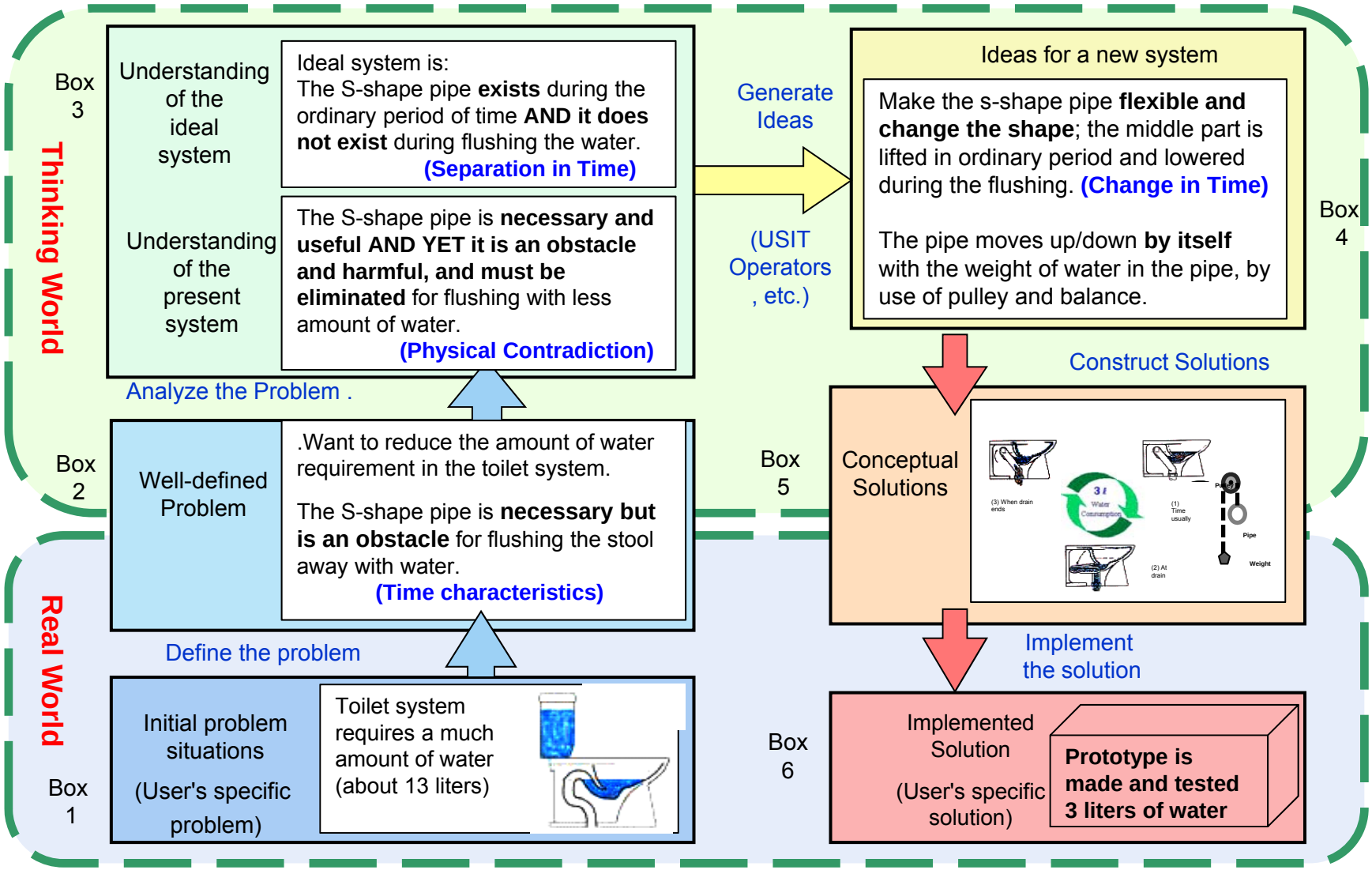
USIT Case Studies （In accordance with the USIT Manual）

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 3 [Toilet] (overview). Saving Water for a Toilet System

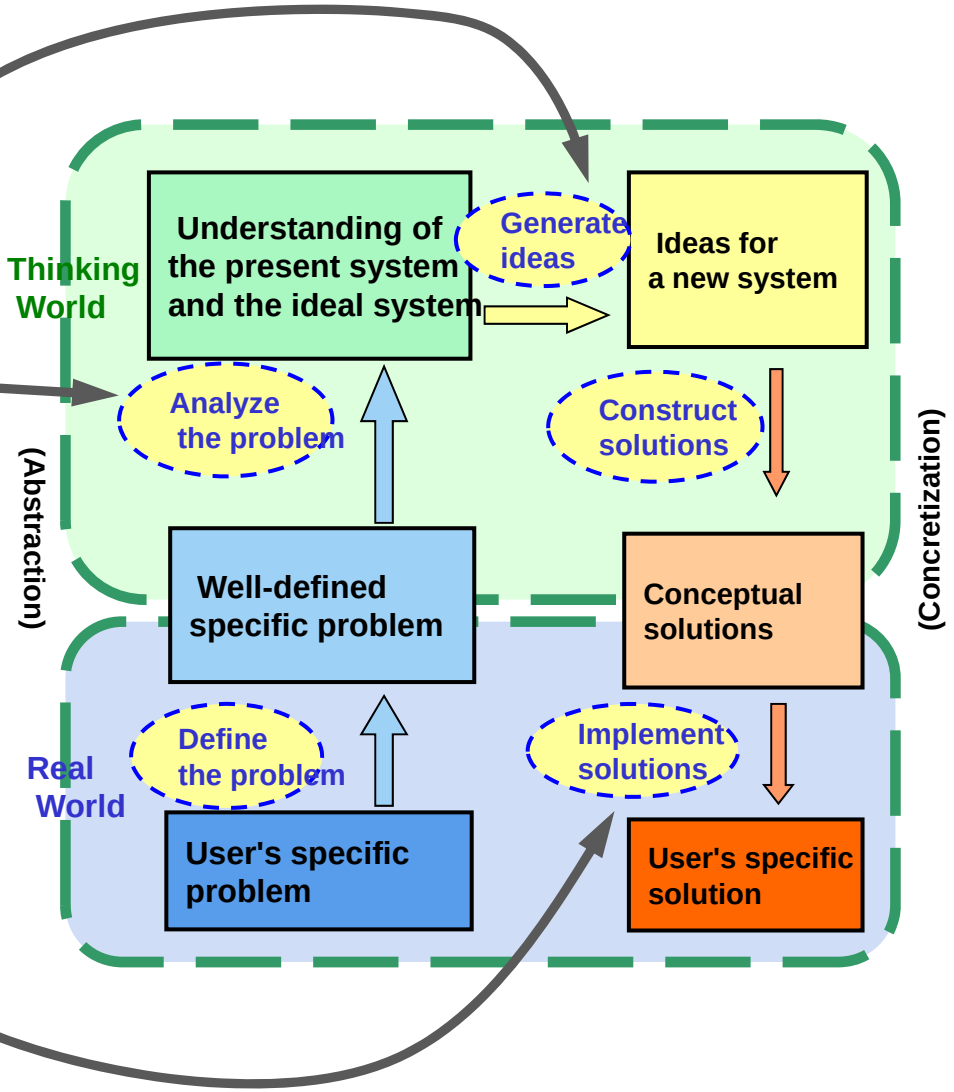
A familiar, important problem was solved nicely with the concept of Physical Contradiction in TRIZ.

H.S.Lee and K.W. Lee (Korea) (2003)

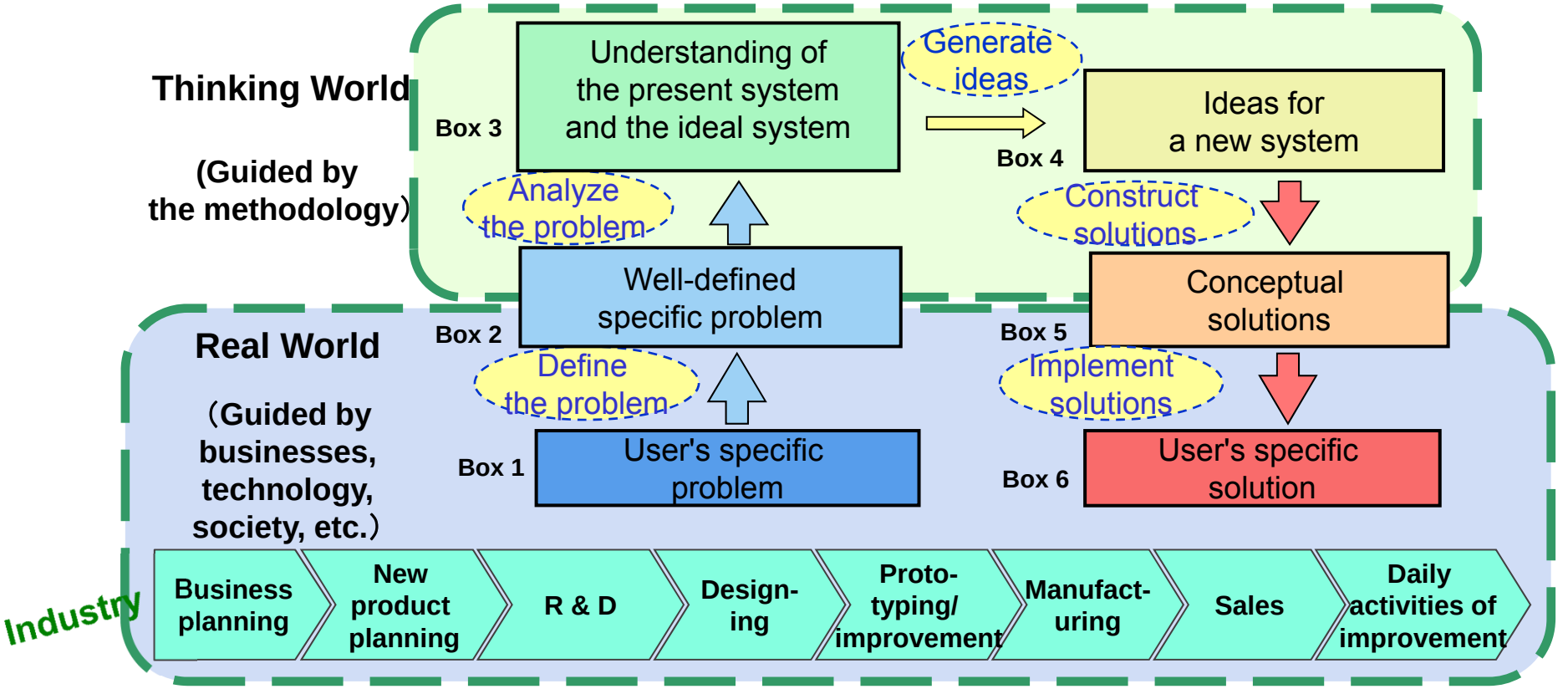


Outline of integrating various methods into CrePS with Six-Box Scheme

Approaches	Examples
(a) Basics in Science &Technology	Principles, th knowledge b
(b) Learning from cases	Analogical th Equivalent tr
(c) Analyzing problems/ tasks	Mind mappi Quality functi Root cause a Functional ar
(d) Supporting idea generation	Brain stormir
(e) Taking care of environment and mental aspects	Brain stormir NM method,
(f) Realizing the ideas	Design meth method, CAI
(g) Foreseeing the future	Using variou writing
(h) Towards a general methodology	Four -box sch thinking, ET t



Tasks for Integrating Various Methods into CrePS: Understand, Categorize, and Put It in the CrePS Framework.



Which application field?
What type of Real World?
What stage of activity?
What purpose of problem solving?

How to analyze the problem, generate ideas, and construct solutions in the Thinking World?

How to define the problem in the Real World?

How to implement the solutions in the Real World?

Concluding Remarks

Our target at a higher level beyond TRIZ:

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

to spread it widely, and

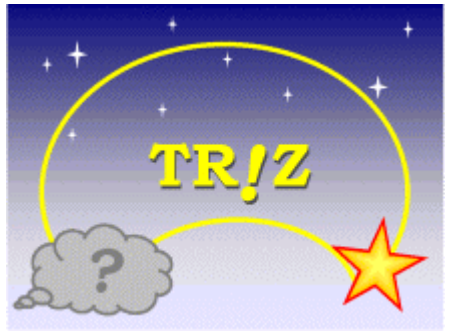
to apply it
to problem-solving and task-achieving jobs
in various domains
in the whole country (and the world).

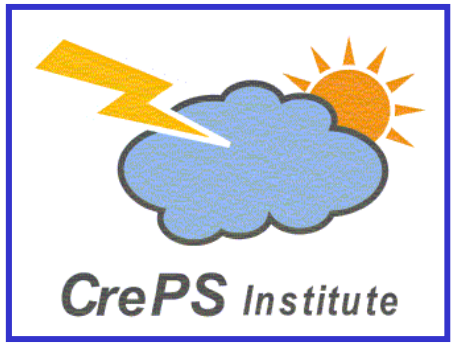
We should clarify and share the vision of CrePS,
and collaborate to integrate various methods of
creative problem solving into the general methodology.

Wishing a big success of TRIZCON2016,

and missing you all in seeing personally.

Please communicate with me via email.





Thank you for your attention

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