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General Methodology of Creative Problem Solving & Task Achieving (CrePS):

Reorganizing Various Application Cases and Their Methods in the 'Six-Box Scheme'

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Introduction:

Solving problems (or undesirables) creatively and
Achieving tasks (or desirables) creatively

have been tried, practiced, and carried out successfully

for the humans to establish the culture for millions of years
in every area (e.g., society, business, technology, science, etc.)

in every era and in every region of the world.

Hence, examples of creative problem solving & task achieving are everywhere, and processes for it are abundant.

Thus we should collect and integrate such successful methods in some general and yet effective and feasible schemes.

This is the intention of my proposing

'the General Methodology for Creative Problem Solving and Task Achieving' (CrePS).

Reflection of the present situations on TRIZ has guided us

to a new target at a higher level (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 called as 'CrePS' (April 2013, Toru Nakagawa)

Such a general methodology has been worked most consciously in the fields of (natural) science and technology.

The basic scheme (i.e., paradigm) established so far is the 'Four-Box Scheme' where the problems are to be solved in a generalized/abstract level.

Generalized theories, models, and knowledge bases have been built, accumulated, and utilized extensively in different and specialized areas of science and technology.

TRIZ (Theory of Inventive Problem Solving) has contributed much to establish multiple sets of generalized models, techniques, and knowledge bases for problem solving applicable across all fields of science and technology.

However, using the Four-Box Scheme
with multiple models depending on fields or on TRIZ tools
has the pitfalls that
the problems are apt to be fit to the model problem
from some partial viewpoints
in place of full understanding/abstraction
and generalized solutions are shown just as hints/suggestions.

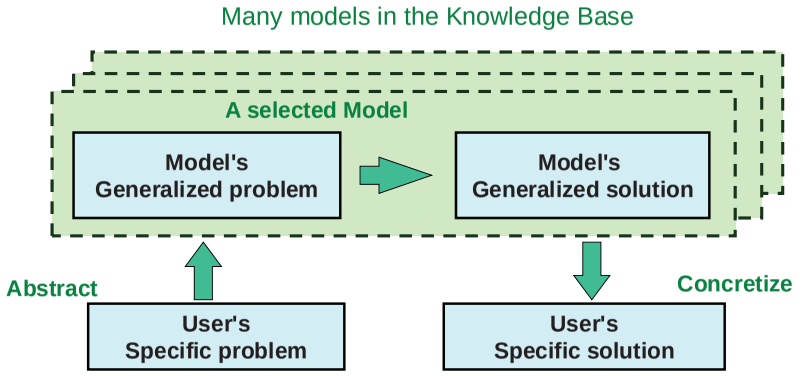
For overcoming this basic pitfalls I have been proposing
the **'Six-Box Scheme',**
as a new paradigm for creative problem solving.

Using the Six-Box Scheme as the basic paradigm,
we will be able to merge, integrate, and reorganize
many different methods/models including TRIZ
into a General Methodology of Creative Problem Solving (CrePS).
USIT is an example of compact & full process of CrePS.

In the present paper, I am reporting on the current/intermediate stage
of establishing/improving the Six-Box Scheme, CrePS, USIT, etc.

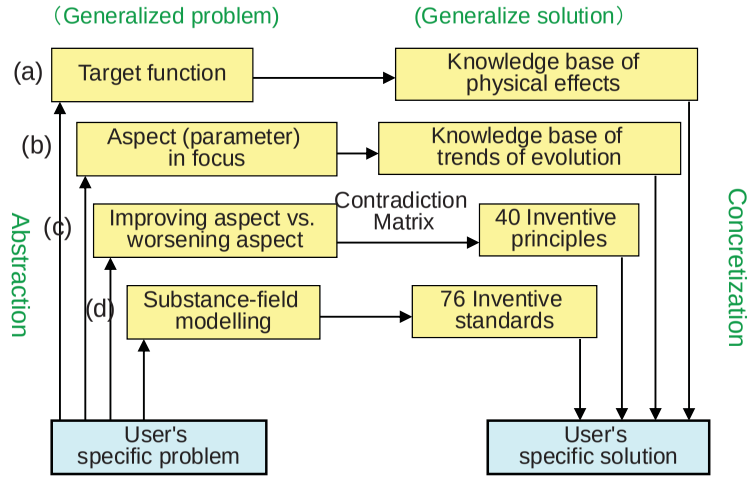
Conventional basic scheme for Creative Problem Solving (Four-Box Scheme of abstraction)

Science & Technologies (Many models, specialized in areas)



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.

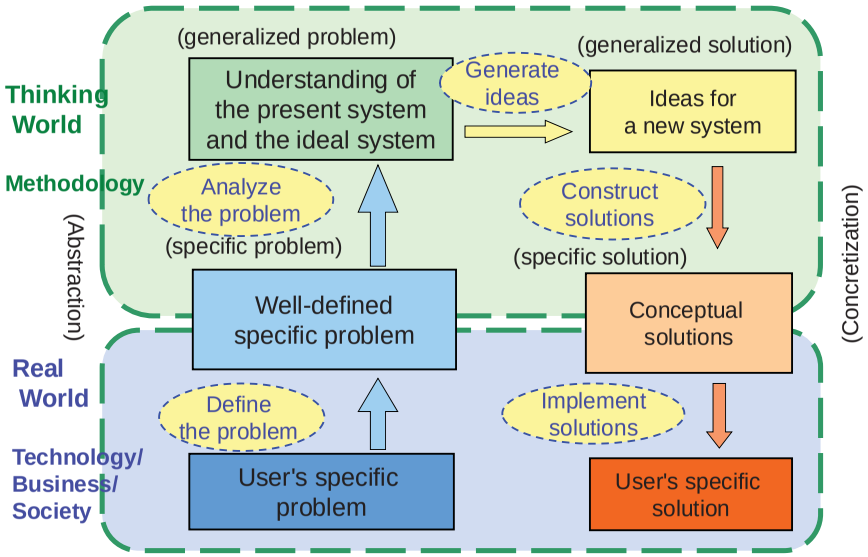
Multiple tool sets of TRIZ (on the basis of the Four-Box Scheme)



Many tools and huge knowledge bases, applicable across technical fields.

Parallel structure of multiple tools ==> Partialness in each method

New Paradigm of Creative Problem Solving (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.

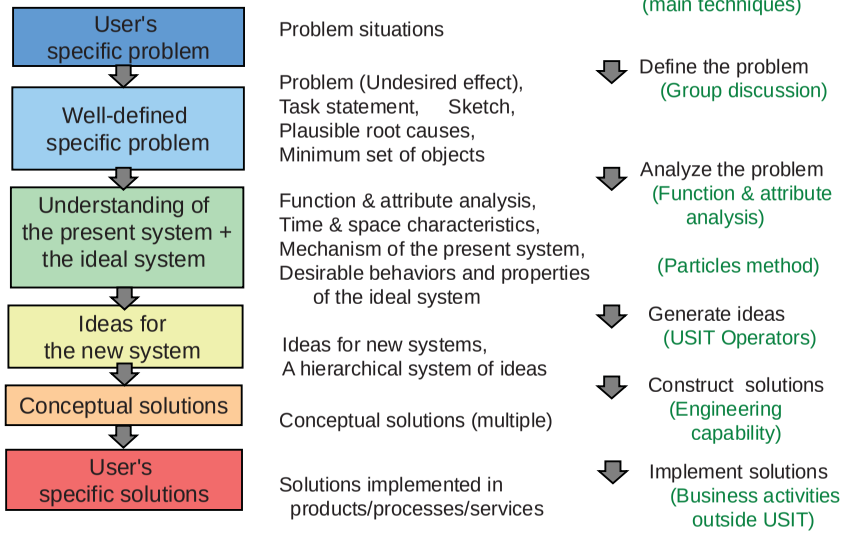
(f) Actual solutions (Box 6)
need to be implemented by the business activities in the Real World.

Target of Our New Methodology CrePS

"A General Methodology for Creative Problem Solving & Task Achieving"

- Help to solve problems (i.e., undesirables) and to achieve tasks (i.e., desirables).
- Capable to guide to new creative solutions and measures even for the problems/tasks conventionally thought difficult/impossible.
- Applicable generally and universally to different fields/areas
- Having integrated different preceding methods and different studies
- Delivering a methodology (a system of methods) which integrates various thinking methods, techniques, tools, etc.
- Easy to learn, easy to apply, and effective in actual jobs of application.

USIT: An example of compact full process of problem solving in the Six-Box Scheme of CrePS



Current research and practice activities for developing Six-Box Scheme / CrePS / USIT.

(1) Various application cases (in publications) of Creative Problem Solving
are formulated in the Six-Box Scheme.
They will form course materials of CrePS case studies.

(2) Different methods (including TRIZ) used for Creative Problem Solving
are to be understood and described in the Six-Box Scheme.
Components of CrePS (or contents of the six boxes) are to be described
in a general terminology.

(3) Necessary activities in the Real World for CrePS are to be surveyed
in order to clarify how the CrePS in the Thinking World
can contribute effectively to the Real World.

(4) Possible applications of CrePS are to be classified with their aims,
in order to recommend concise processes of CrePS application
suitable for each purpose of application.
Evaluation and selection of individual techniques in CrePS are necessary.

(1) To make Course Materials of CrePS Case Studies

Published TRIZ/USIT case studies are to be described in the Six-Box Scheme.

	Theme	Description
1	How to fix the string found shorter than the needle	Using a familiar problem, the full process of USIT is demonstrated clearly.
2	How to prevent the staples from being crashed for binding more papers	For a familiar problem, a root cause of the difficulty is found and the problem is solved with the SLP (Smart Little People) method.
3	How to reduce the necessary water for toilets.	An important everyday life problem was recognized as a case of Physical Contradiction and solved wisely with TRIZ.
4	Picture hanging kit problem: how to prevent from tilting	For a familiar problem, the USIT method is applied intensively. Originally a textbook problem described by Ed Sickafus.
5	How to Increase the foam ratio in forming a porous sheet from gas-solved molten polymer	A technical problem in the chemical engineering process; the Particles Method in USIT is applied.

A Simple Case Study of USIT

T. Shimoda and T. Nakagawa (2006)

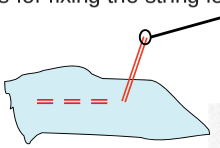
Everyday-life Case Study in USIT:
How to fix a string shorter than the needle at the end of sewing

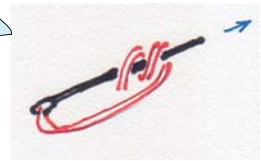
Define the Problem: [Box-1 ==> Box-2]

(a) Undesirable 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 (1): Understanding the present system

[Box-2 ==> Box-3]

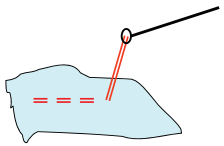
(1) Functional analysis: What is the function of the Needle?

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.

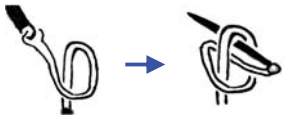
When any of these constraints is lifted,
there appears a novel solution.



(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 (2) : Understanding the Ideal system

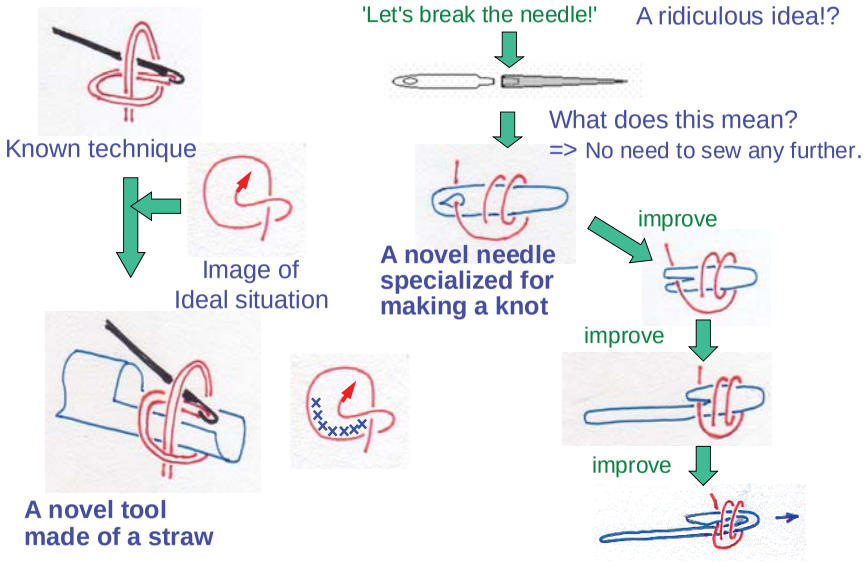
[Box-2 ==> Box-3]

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.

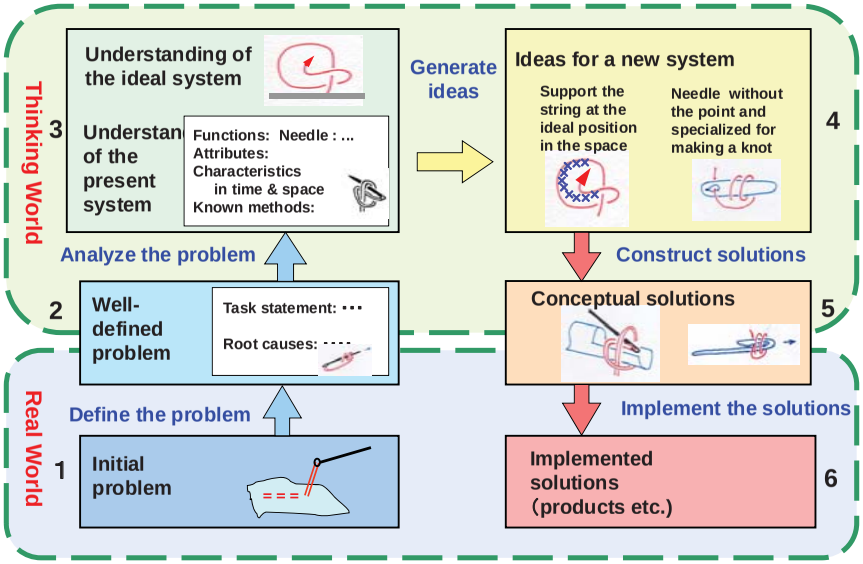
Solution Generation: Generate Ideas and Construct Solutions

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



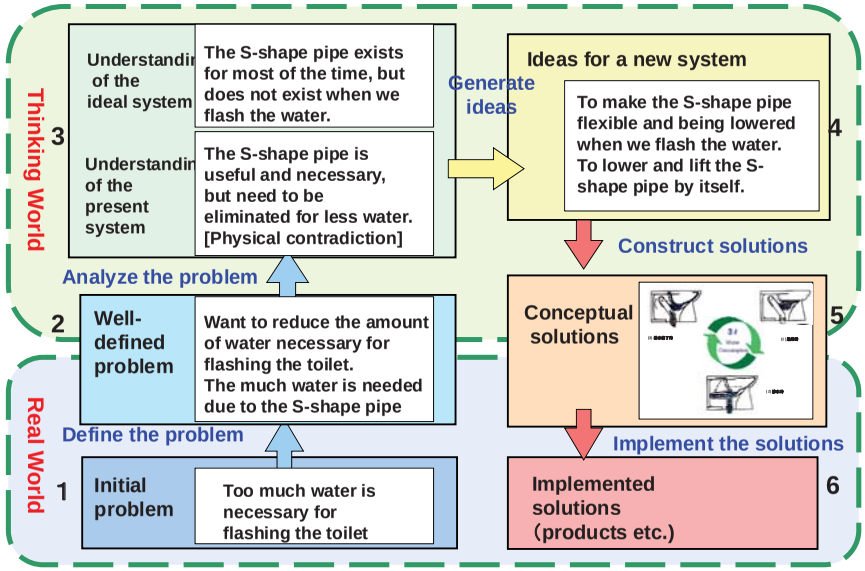
Case study in the Six-Box Scheme: How to fix the string shorter than the needle

T. Shimoda and T. Nakagawa (2006)



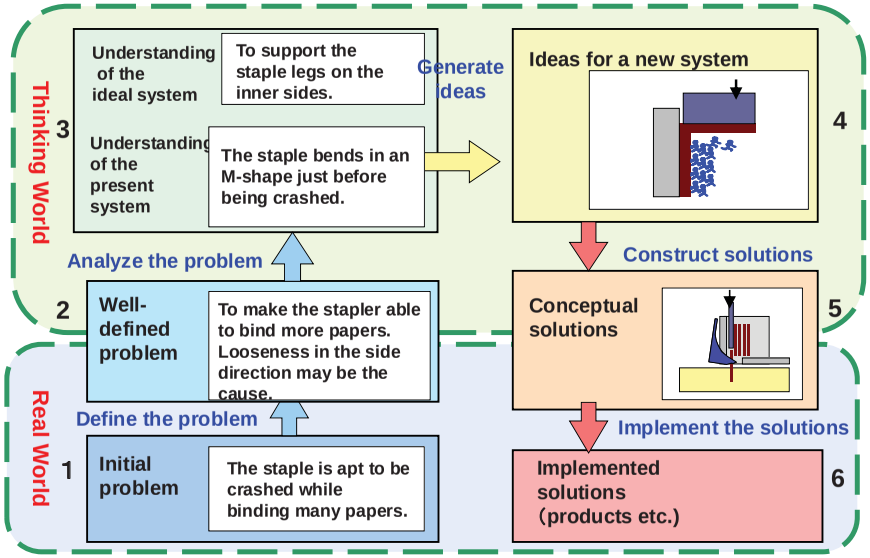
Case study in the Six-Box Scheme: Water-saving toilets

KyeongWon Lee et al. (2003)



Case study in the Six-Box Scheme: How to fix the string shorter than the needle

T. Nakagawa & K. Kamiya (2004)



(2) Different methods (including TRIZ) used for Creative Problem Solving are to be understood and described in the Six-Box Scheme. Components of CrePS (or contents of the six boxes) are to be described in a general terminology.

** Many and various methods are actually known in literature:
Some handbook describes, say '300 techniques'.

It is useless to list their names or component names in our scheme.

** We would like to record the individual methods with the description of their purpose, stage of usage, input and used (e.g. stored in the knowledge basis) information, generated/obtained and output information, etc.

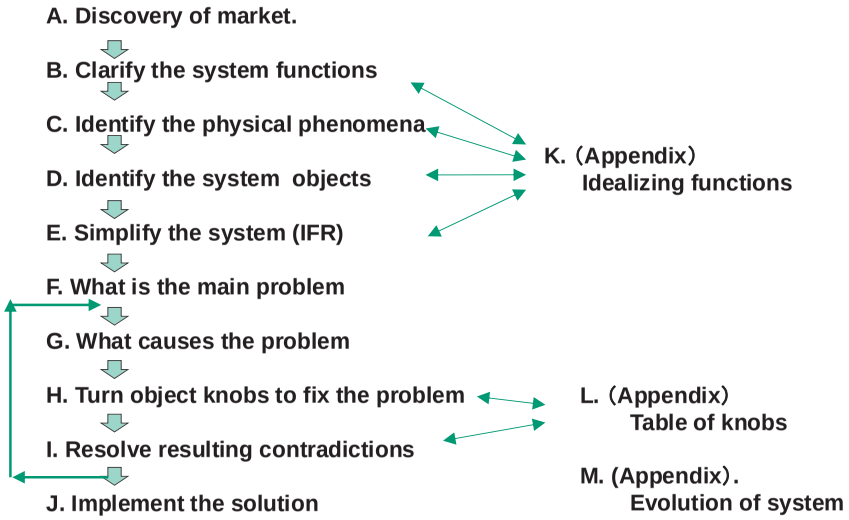
** We need to establish some general frameworks which can characterize and position such methods in such different aspects

Various methods for creative problem solving & task achieving

Approach	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, 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, Equivalent transformation thinking	Four-box scheme, ARIZ, Six-box scheme of USIT

(Example) Larry Ball's Hierarchical TRIZ Algorithm

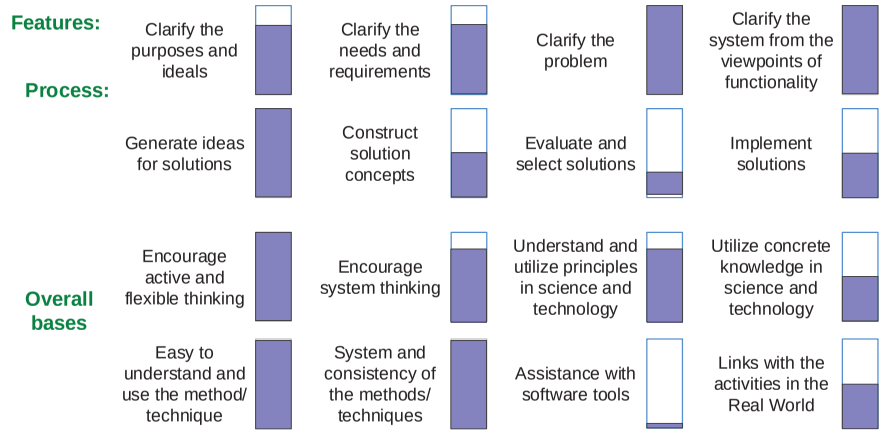
Ref: "TRIZ Practices and Benefits", Vol. 3, Published by CrePS Institute, 2014.



Method: Hierarchical TRIZ Algorithm

Ref: Larry Ball, in "TRIZ Practices and Benefits", Vol. 3, Published by CrePS Institute, 2014.

Outline: A full process for creative problem solving, consisting of the steps: Discovery of market, Idealizing functions, Clarifying the causes of the problem, Recognizing physical contradictions, Solving contradictions by use of separation principles, and Implementing solutions. Containing and reorganizing all the TRIZ methods into this full process. The process of solving physical contradictions is particularly deep and rich.



(3) Necessary activities in the Real World for CrePS are to be surveyed in order to clarify how the CrePS in the Thinking World can contribute effectively to the Real World.

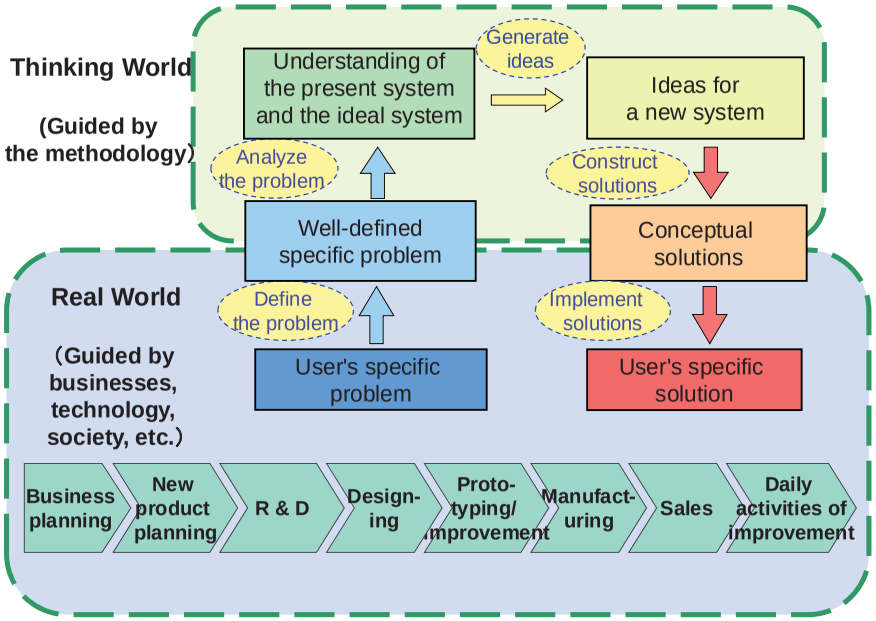
This is related to a wide range of activities, say for an industry,
e.g., Business planning, New product planning,
Research and development, Designing,
Prototyping and improvement, Manufacturing, Marketing,
Daily activities of improvement, etc.

Every stage of activities in the Real World
has to solve problems and achieve tasks, and hence
has opportunities and necessities of applying
the general methodology CrePS.

Activities in the Real World are carried out in big streams, and
CrePS may be needed and used from time to time
when/whenever appropriate and effective.

(Note: TRIZ /CrePS should not try to 'contain' or 'cover' the Real World.)

Position of CrePS and its Six-Box Scheme



(4) Possible applications of CrePS are to be classified with their aims, in order to recommend concise processes of CrePS application suitable for each purpose of application.
Evaluation and selection of individual techniques in CrePS are necessary.

Example of classifying the purposes:
Ref. Hajime Kasai, Japan TRIZ Symposium 2013

Application for 'Problem solving' (in a narrow sense)
Application for 'Improving performance'
Application for 'Developing a new scheme'
Application for 'Cost reduction'
Application for 'Smaller and less weight'
Application for 'New product planning'

Concluding Remarks:

The present research proposes the following target of CrePS:

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).

CrePS is feasible on the basis of the new paradigm of the 'Six-Box Scheme'.
Integrate and reorganize TRIZ and many other methods into CrePS.
USIT is an example of concise full process of practicing Six-Box Scheme of CrePS.

For the above target, the author is now working:
(1) To make a collection of CrePS application case-studies,
(2) To describe various methods (including TRIZ) in the CrePS scheme,
(3) To link CrePS to various activities in the Real World,
(4) To classify the CrePS application purposes for proposing concise processes suitable for each purpose.

I wish you, researchers and practitioners, to cooperate for achieving this target.

Thank you
for your attention

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