The 9th TRIZ Symposium in Japan
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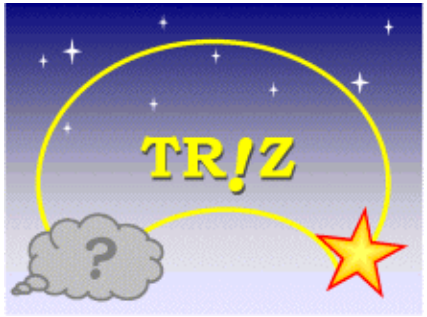

General Methodology for Creative Problem Solving and Task Achieving —Its Plan—

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Contents:

Part 1: Beyond TRIZ, A New Target at a higher level

Motivation: Why the creative problem solving method, TRIZ, does not penetrate more smoothly among people?

I built up a number of models to consider this problem.

Model of a person to learn TRIZ

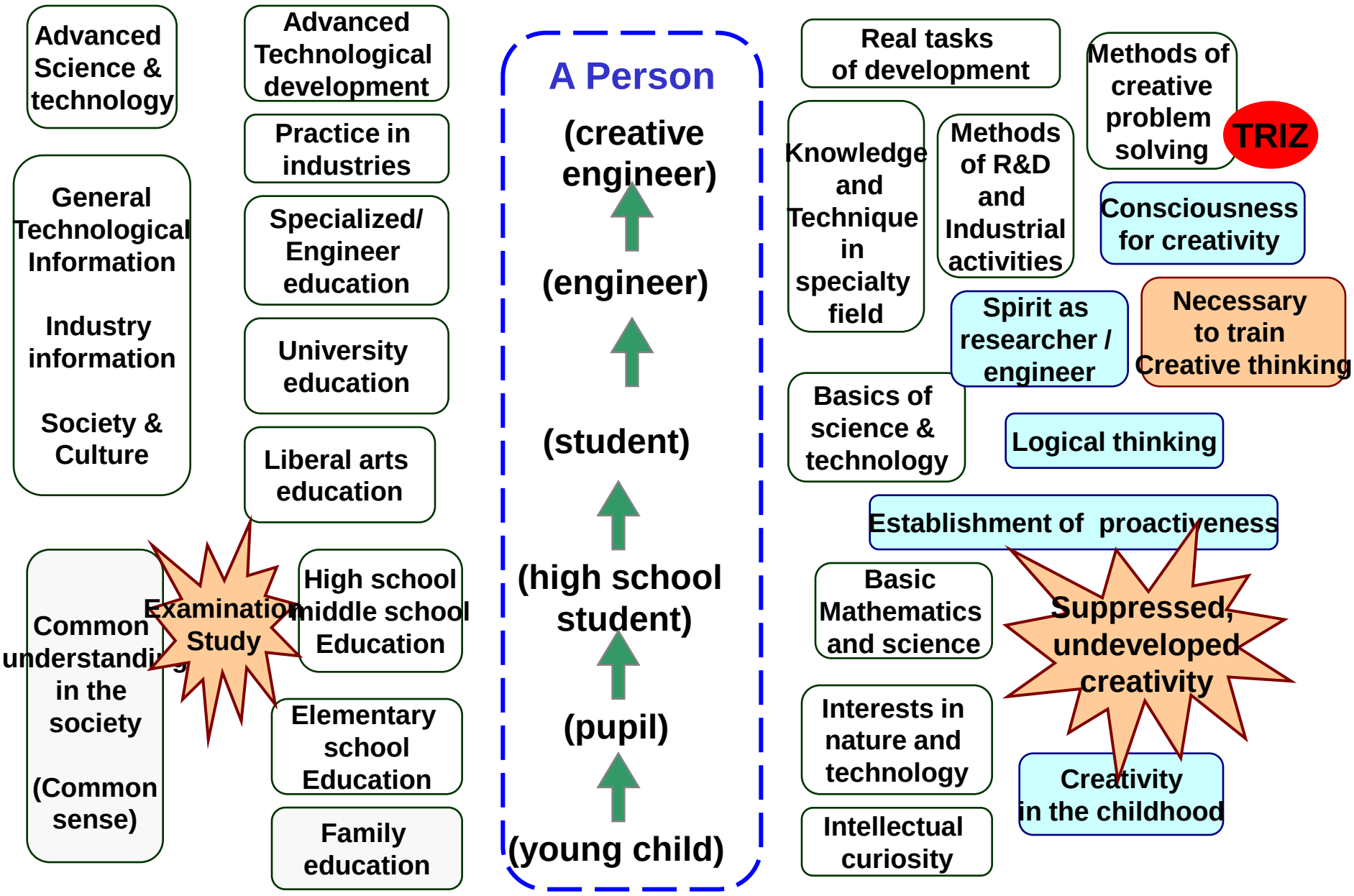
Model of an engineer and an industry to learn and accept TRIZ

Model of areas where the application of TRIZ is desired

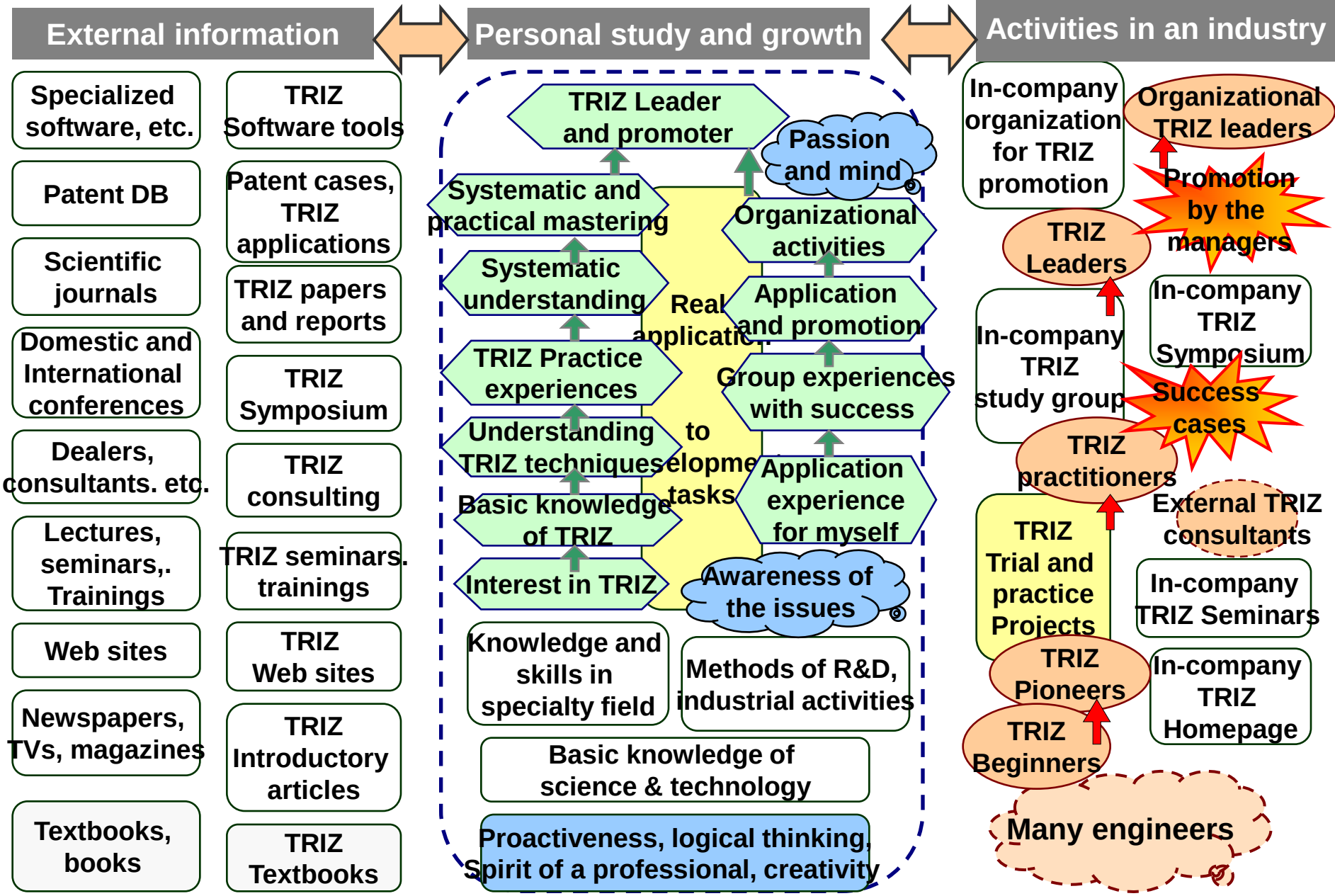
==> People in the wide range of application areas of TRIZ want not TRIZ itself but more general methodology effective for creative problem solving

(Nakagawa, Japan TRIZ Symposium 2012)

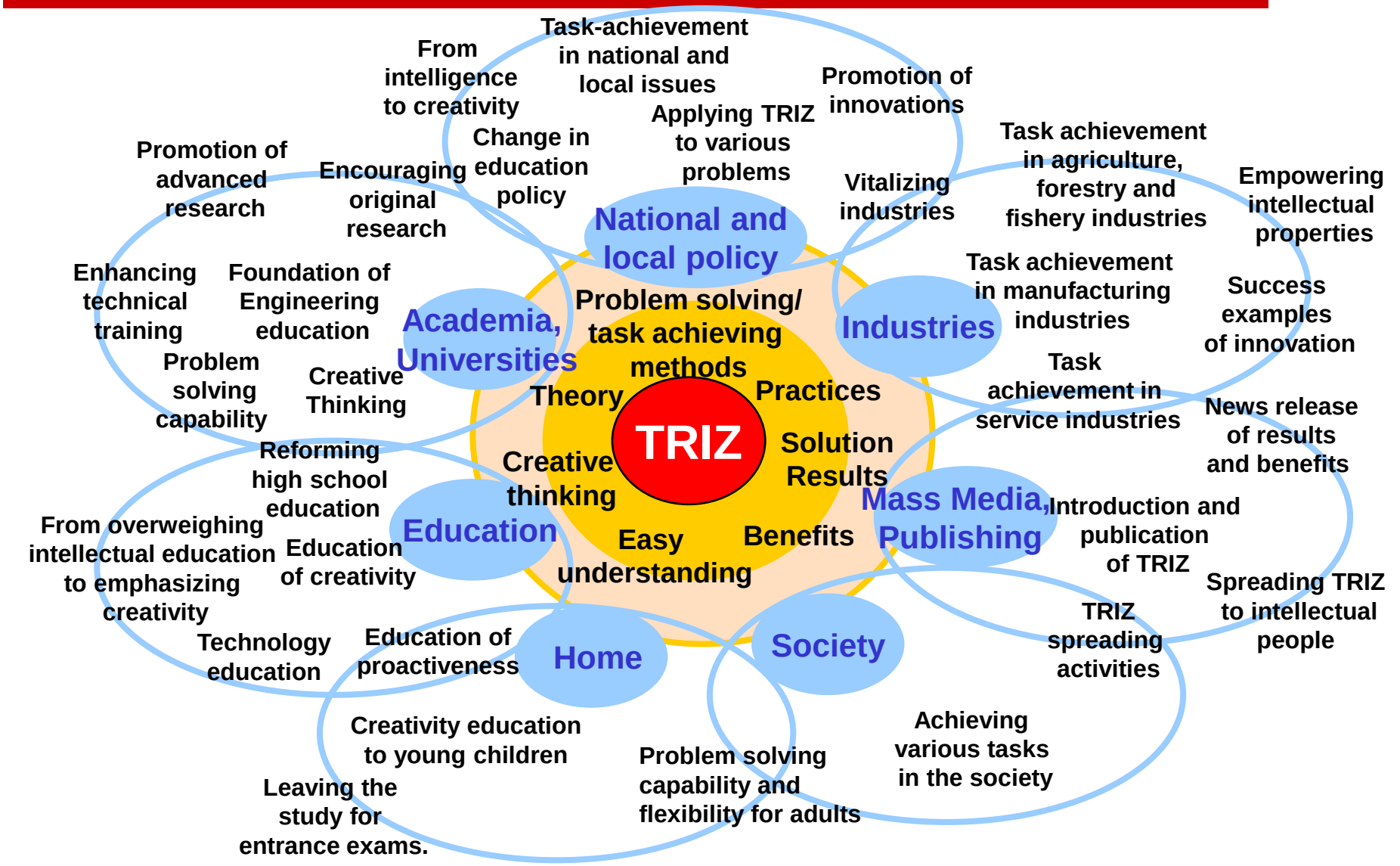
Model (a) of a person to learn and master a technique like TRIZ



Model (b) of activities for an engineer and a company to learn and master TRIZ



Model (d) of areas for TRIZ application ➔ Our new general target



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

Conclusions for Part 1

(1) Recognizing **'TRIZ is just one of many subjects** for a person to study', the contents of TRIZ should be either

well customized for the (narrow range of) target persons

or **well generalized** for the (wider range of) target persons.

(2) Individual persons can learn TRIZ from outside information and promotion, but **mainly from his/her personal learning and experiences.**

(3) For an industry to accept TRIZ, **personal growth of TRIZ practitioners/ leaders, application of TRIZ to real projects, and promotion by the management** need to go together.

(4) TRIZ is applicable in the technological as well as non-technological areas. Thus TRIZ has a very wide range of application areas.

However, **not TRIZ itself but a more general methodology is wanted.**

Thus we have been guided to a new target at a higher level.

The models have guided us
to a new target at a higher level.

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)".

Part 2:

Strategies for establishing the new target

Reviews of different approaches
for creative problem solving

Basic strategies for establishing
the new general methodology
for creative problem solving

Conventional methods for Creative Problem Solving & Task Achieving:

(a) Basic approach in science & technology: Principles, theories, application & design methods in each discipline.

(b) Approaches learning from cases: Building and using case bases and knowledge bases

(c) Approaches to analyze the problems and tasks: Cause-effect, system, mechanism, etc.

(d) Approaches to support idea generation: generating as widely and as freely as possible,

(e) Approaches to arrange environment and take care of mental aspects:

relaxed feeling, free atmosphere, thinking the ideals, etc.

(f) Approaches for realizing the idea: Selecting good ideas, designing & development, implementation, etc.: technologies in the discipline.

(g) Approaches for thinking the future and suggesting the directions:

(h) Approaches towards general methodologies for problem solving:

Integrating all the approaches above to build a methodology useful and practical.

A system of methods suitable for each type/field of problems and tasks, and also

a system of methods universally applicable to a wide range of types and fields.

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

Clarifying the Target of Our New Methodology

"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 preceding different 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.

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

Principal strategies for establishing it:

(A) As the paradigm (or basic scheme), we adopt the 'Six-Box Scheme'.

(<= Conventionally the 'Four-box scheme' in science & technology, and TRIZ)

(B) We build one for technology and another for no-technology, in parallel.

(C) Based mainly on the data-flow representation. (<= flow-chart)

Clarifying the input, intermediate, and output information.

Specifying the concepts and methods for representing information.

(D) The ways and processes for acquiring/deriving information may have multiple alternatives. (Allow different alternative processes.)

(E) Take care of mental/psychological aspects of problem solvers and stakeholders.

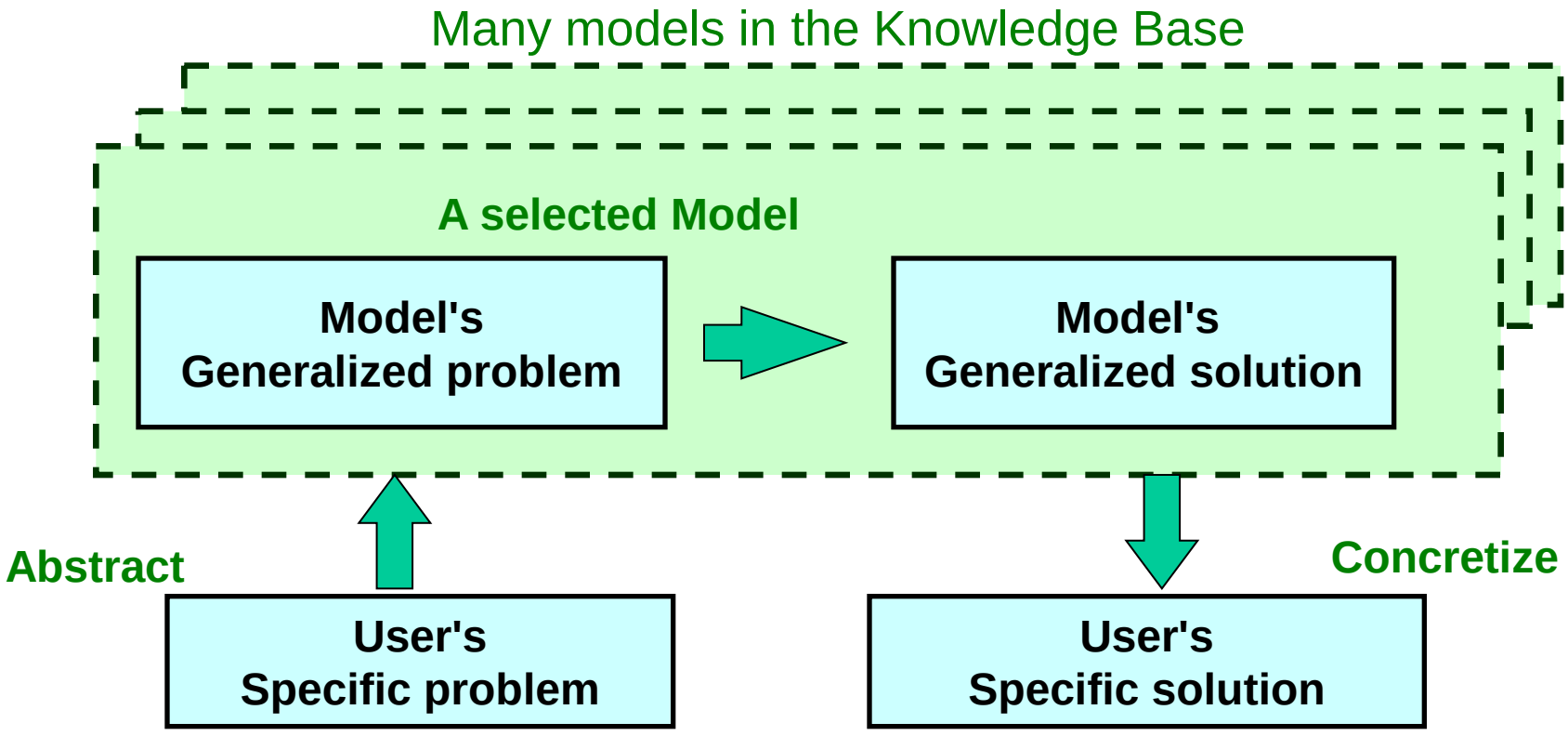
(F) Establish first the methods in the Thinking World in the Six-box scheme and then the connections to the pre/post methods in the Real World.

(G) We first analyze and describe the methods in TRIZ/USIT under these strategies, and then various other conventional methods.

On Strategy (A)

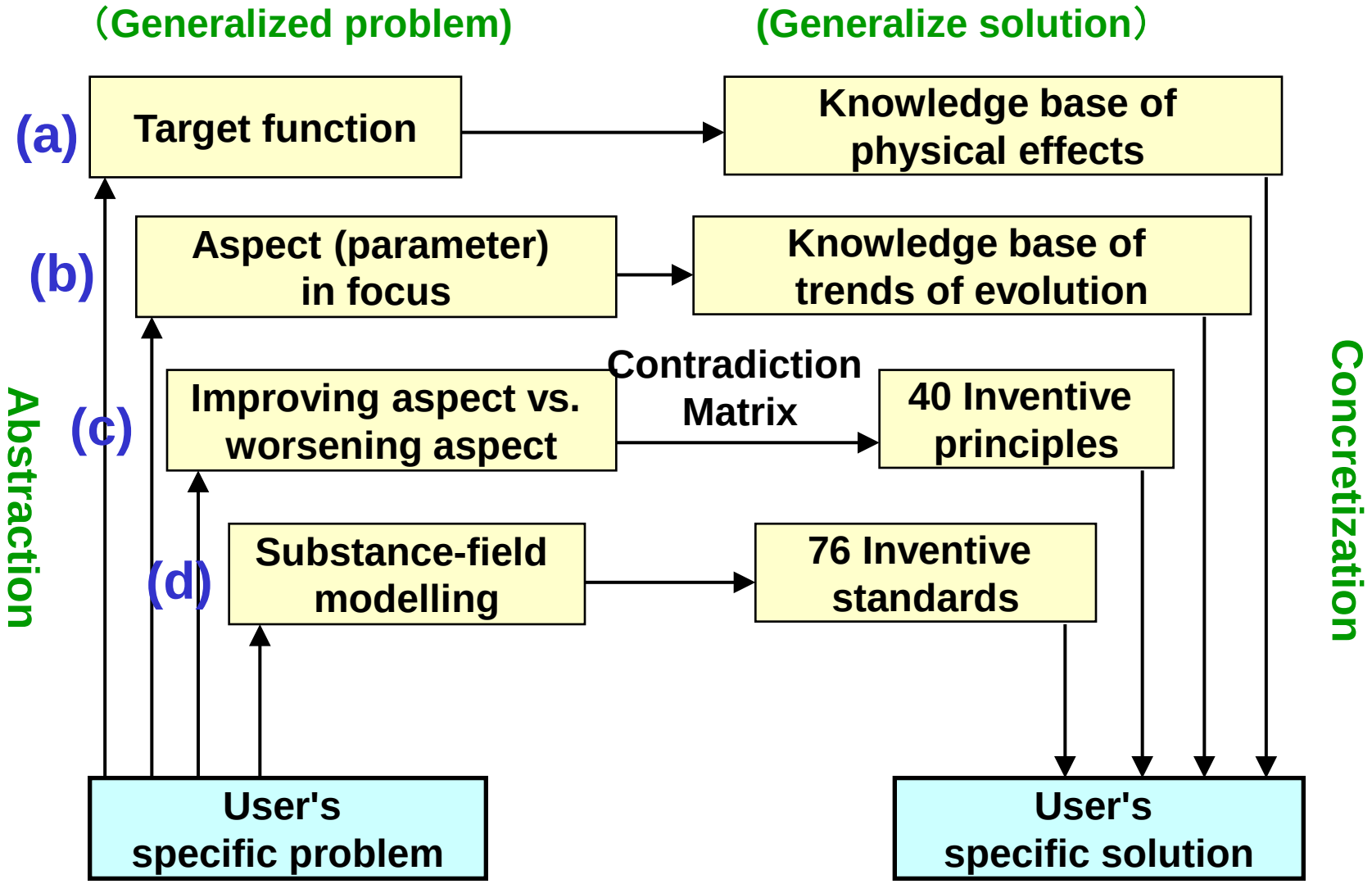
Basic scheme for Problem Solving
(Conventional: "Four-Box Scheme)

Science & Technologies (Many models, specialized in areas)



Contents in the boxes cannot be explained generally, depending on the models.
Mapping onto the model's problem, and use the model's solution as a hint.

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

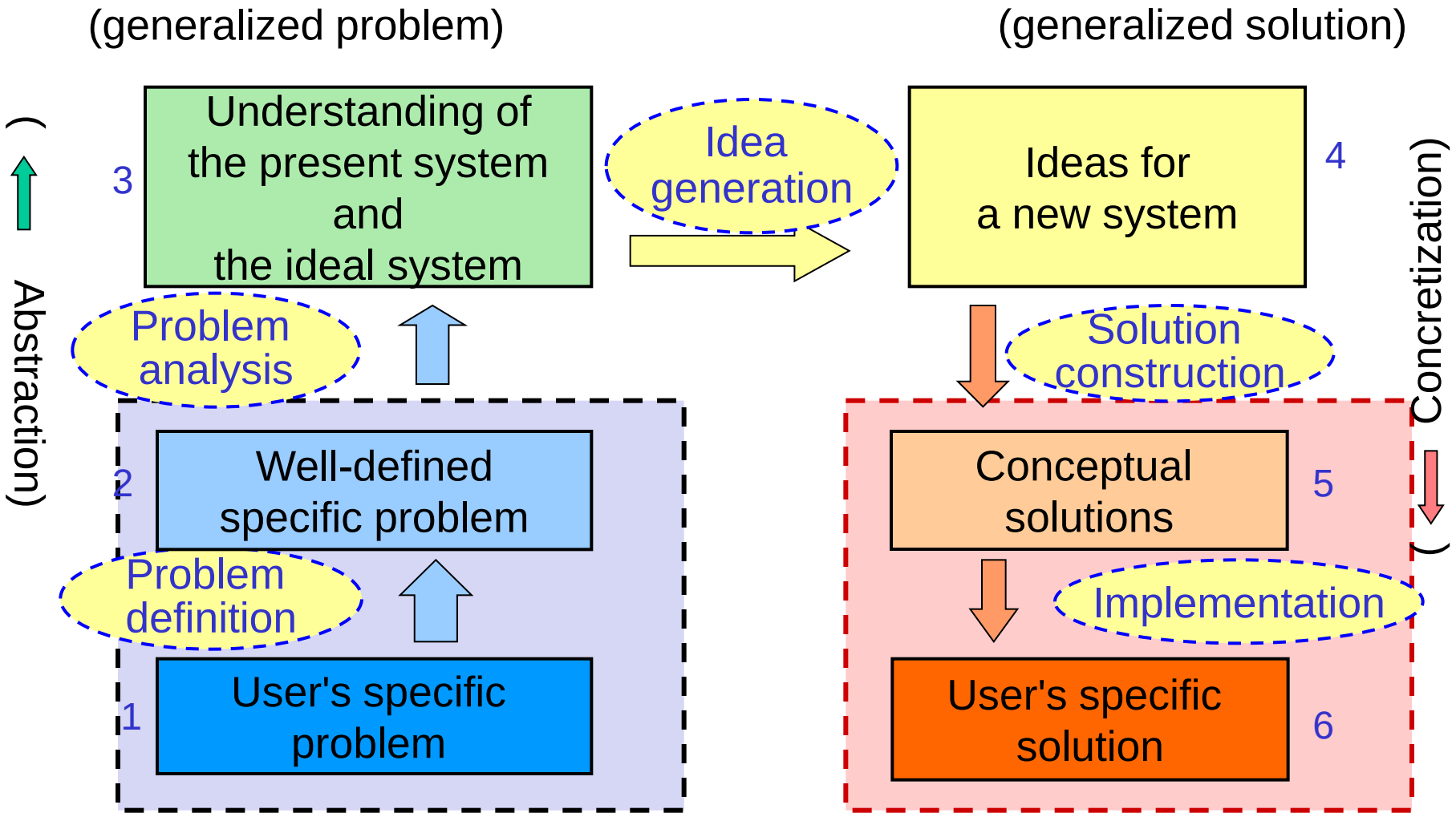


Essence: Many tools and huge knowledge bases are applicable across technical fields.
But parallel structure of multiple tools = partialness in each method

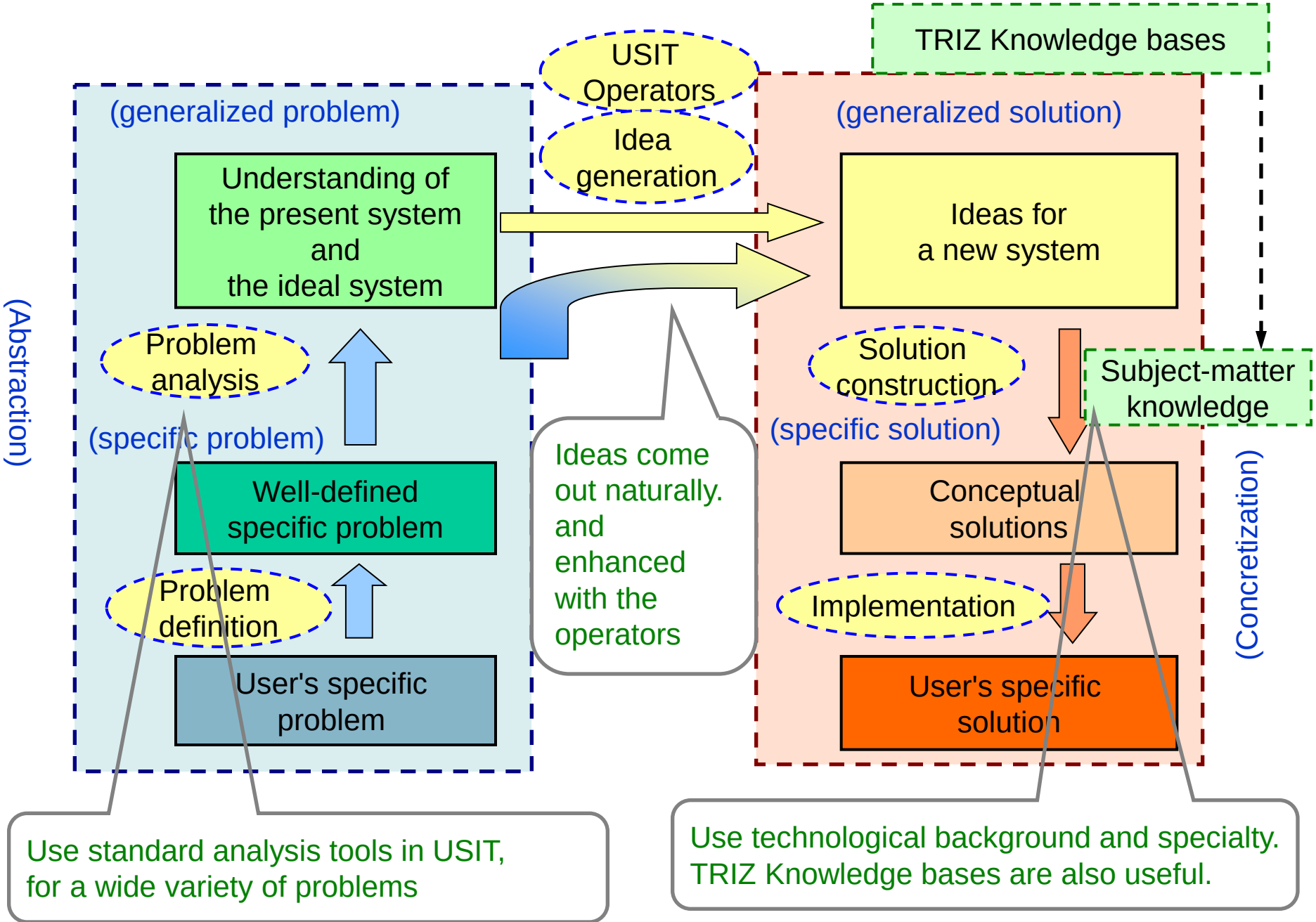
Six-Box Scheme of USIT:

New Paradigm for Creative Problem Solving

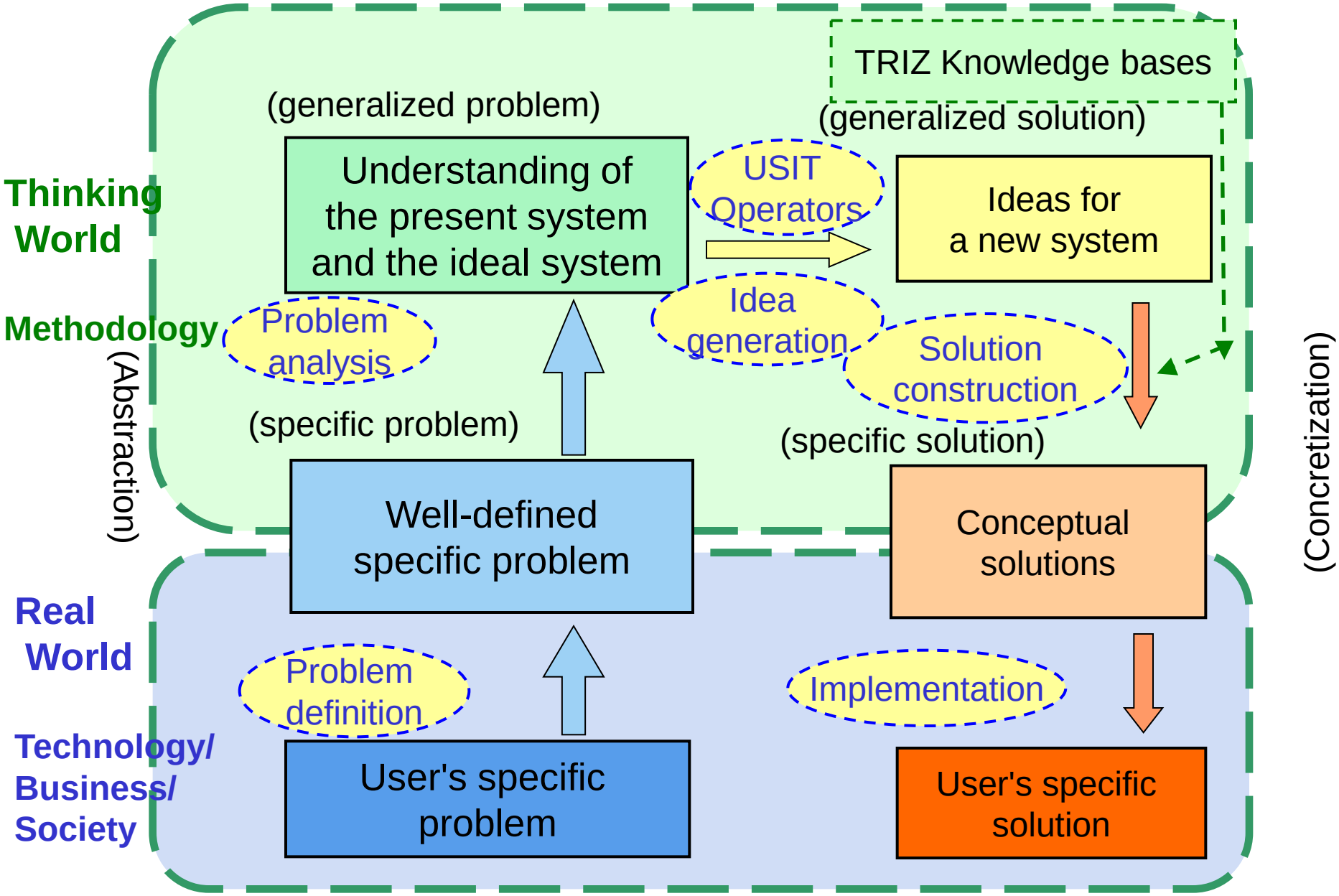
Toru Nakagawa (2005)



6-Box Scheme of Creative Problem Solving (USIT)



6-Box Scheme of Creative Problem Solving (USIT)



On Strategy (B)

General Methodology of Creative Problem-Solving (Outline)

For technological problems

(0) Whole procedure

(1) Finding the problem

(2) Understanding the present system

(3) Imaging the ideals

(4) Generating ideas

(5) Constructing solutions

For non-technological problems

(0) Whole procedure

(1) Finding the problem

(2) Understanding the present system

(3) Imaging the ideals & visions

(4) Generating ideas

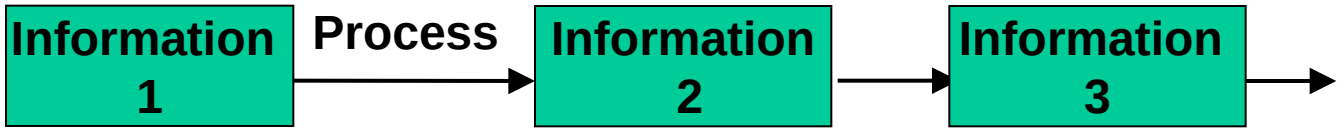
(5) Constructing solutions

We should build these two in parallel.
Essential components of the two are very similar.

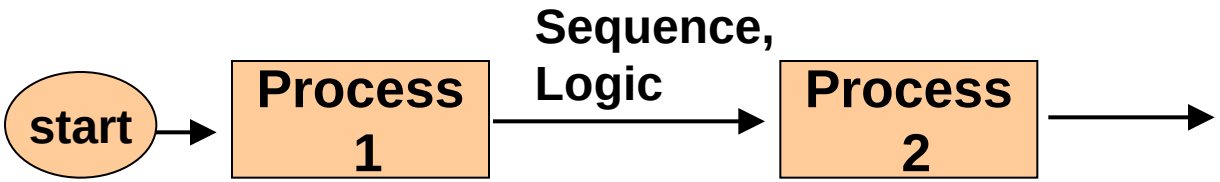
On Strategy (C)

We use the data-flow representation mainly.

Data Flow representation:



Flowchart representation:



Data Flow describes the in/out and intermediary information as requirements.

For describing information, it is important to specify the concepts and the representation methods.

In Flowcharts, the information to be handled are implicit, not specified explicitly.

Data Flow representations are more basic and stable than the Flowcharts.

On Strategy (D)

The ways and processes for acquiring/deriving information may have multiple alternatives.
(Allow different alternative processes.)

- This strategy concerns to some details of the component methods.
  We will not get involved in the differences in details;
  We will allow multiple alternative ways of processing.

- It will never work if we try to specify the ways of human thinking process.
  We should be free in the thinking process,
  especially in creative thinking.

- We should better appreciate many conventional methods, in their merits.
  We should know the positions of them in our general framework.

On Strategy (E)

(E) Take care of mental/psychological aspects of problem solvers and stakeholders.

- Important to have free & relaxed atmosphere.
- Need to break fixed thinking and psychological inertia.
- Group work and its facilitation are important.

- In the non-technological fields, principal difficulty lies in the differences in the value/interests evaluation among the stakeholders (including the problem solvers) reflecting their different situational positions and senses of values.
- Attitudes and minds of the stakeholders are often the keys to the success in problem solving.
- Necessary to include intentions and feelings in the description of problem situations.

On Strategy (F)

(F) Establish first the methods in the Thinking World in the Six-box scheme and then the connections to the pre/post methods in the Real World.

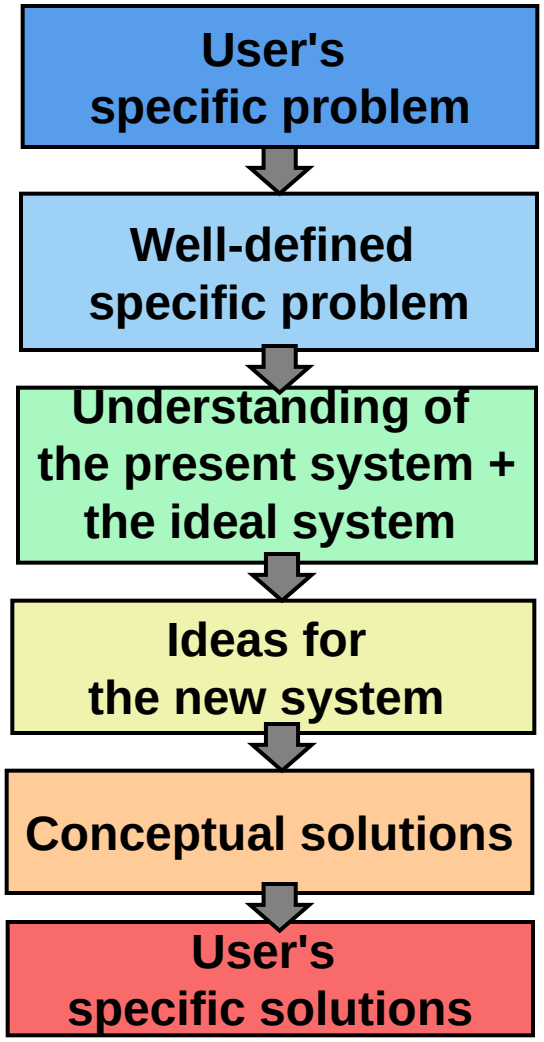
- **The methods inside the Thinking World are relatively clear now.**
  There exist many methods for creative problem solving.
  There remain a number of methods to be developed further

- **In the Real World (of the Six-box scheme), a lot to be developed:**
  - In which situations/stages, should we use our general methodology?
  - How can we catch the problems/tasks in the Real World and how can we formulate them into the 'Well-defined specific problems' to be handled in the Thinking World?
  - What procedures should we take for implementing the conceptual solutions (of the Thinking World) into the real solutions in the Real World?

- **We should better build our general methodology first by separating the issues of cooperating in the Real World.**

On Strategy (G)

(G) We first analyze and describe the methods in TRIZ/USIT under these policies, and then various other conventional methods.



Outline of USIT

Problem situations

⇩ Group discussion

Problem (Undesired effect), Task statement, Sketch, Plausible root causes, Minimum set of objects

⇩ Function & attribute analysis, Particles method

Function & attribute analysis, time & space characteristics, mechanism of the present system, Desirable behaviors and desirable properties of the ideal system

⇩ USIT Operators

Ideas for the new systems, A hierarchical system of ideas

⇩ Engineering capability

Conceptual solutions (multiple)

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Part 3:

Conceptual plan of the general methodology of creative problem-solving & task-achieving

One for technological applications and

Another for non-technological applications

in parallel

General method for creative problem-solving/task-achieving (for technology)

Whole procedure

- Consistent whole procedure
- Simple/specialized processes

Finding the problem

- Understanding the problem systematically
- Consider the goals and tasks
- Consider from broad perspectives
- Focusing the problem

Understanding the present system

- understanding difficulties and root causes
- Understanding the mechanism of the present system
- Functions & attributes
- space & time characteristics
- Clarifying contradictions
- Examine various present solutions
- Learn similar tasks in different fields

Imaging the ideals

- Thinking the images of the ideals
- Desirable behaviors & properties
- Consider the direction of evolution

Generating ideas

- Techniques of idea generation
- Collection of possible hints
- Resolve contradictions
- Generate ideas as widely as possible
- Identifying excellent ideas

Constructing solutions

- Extending the ideas
- Improving solutions with the ideas
- Designing new solutions
- Introducing good ideas used in different fields
- Solving secondary problems
- Identifying and evaluating excellent solutions

General method for creative problem-solving/task-achieving (for technology)

Requirements at the preceding stage

- Applicable widely to science & technology
  - Mechanical, electrical/electronic, chemical, etc.
  - biological, medical, etc.
- Using effectively the whole information in science & technology
  - Implementing the S & T information in the method.
- Effectively using patent information
- Possible to use concepts, theories, and methods in the subject-matter fields.
- Use the method of system analysis in the subject-matter field.

Requirements at the succeeding stage

- Able to construct solutions
- Able to use designing techniques in the subject-matter field
- Able to implement the solutions
- Coordinated with methods for implementing solutions (CAD/CAE/CAM, Taguchi method, etc...
- Able to evaluate the solutions in the real world
- Coordinated with industrial and company infrastructure, e.g., designing, manufacturing and sales

Whole procedure

- Finding the problem
- Understanding the present system
- Imaging the ideals
- Generating ideas
- Constructing solutions

Clear relationships with methods for technology development

Able to find and understand the problem in the real world

Able to focus down the problem and clarify the task.

Able to refer to S & T information whenever necessary

Introductory articles & materials

Easy-to-understand methods.

Textbooks of the methods

Practical application methods

Application examples

Chances to learn

Software tools & knowledge bases

Chances of training

General method for creative problem-solving/task-achieving (for non-technology fields) (e.g., humans, society, business)

Whole procedure

- Consistent whole procedure
- Simple/specialized processes

Finding the problem

- Understanding the problem systematically
- Consider the goals, tasks, **and visions**
- From **multiple** perspectives
- Focus the problem
- **Consider in steps**

Understanding the present system

- understanding difficulties and root causes
- Understanding the mechanism of the present system
- Functions & properties **of organizations & persons**
- space & time character-istics
- Clarifying contra-dictions
- Examine **preceding cases**
- Learn similar tasks in different **countries, companies,** and fields

Imaging ideals & visions

- Thinking the images of ideals
- **Stating the vision**
- Consider the directions **& steps** of evolution

Generating ideas

- Techniques of idea generation
- Collection of possible hints
- Resolve **conflicts &** contradictions
- List up the ideas as widely as possible
- Identifying excellent ideas

Constructing solutions

- Extending the ideas
- Improving solutions with the ideas
- Designing new solutions
- Introducing good ideas in different **countries and** fields
- Solving secondary problems
- Identifying and evaluating excellent solutions

Concluding Remarks

(1) 'General Methodology of Creative Problem-Solving / Task-Achieving' is an integration of many existing methods, including TRIZ, with the basic paradigm of the 'Six-Box Scheme'.

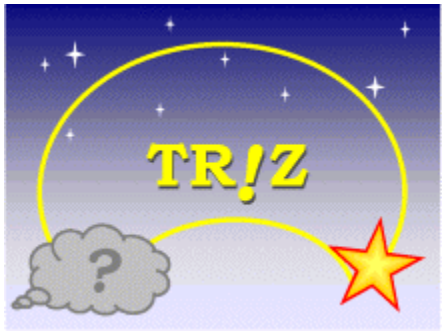
(2) For the technological application, its framework and components are under construction by TRIZ/USIT, and we need to integrate them with various other existing methods.

The significance of this vision need to be understood widely, as the basis for technological innovation and creativity education.

(3) For the non-technological application, the framework and basic components are similar to the technological ones.

However, real problems are often much larger, more complex and delicate. Mental/psychological aspects play even larger roles than the tools. We need to develop many and different methods further.

(4) By setting the new target at a higher level, we will be able to make better choices in our activities of development, application, and promotion.



Thank you
for your attention

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