

# OTSM-TRIZ: Short Introduction

This program was created with support  
of European Union.

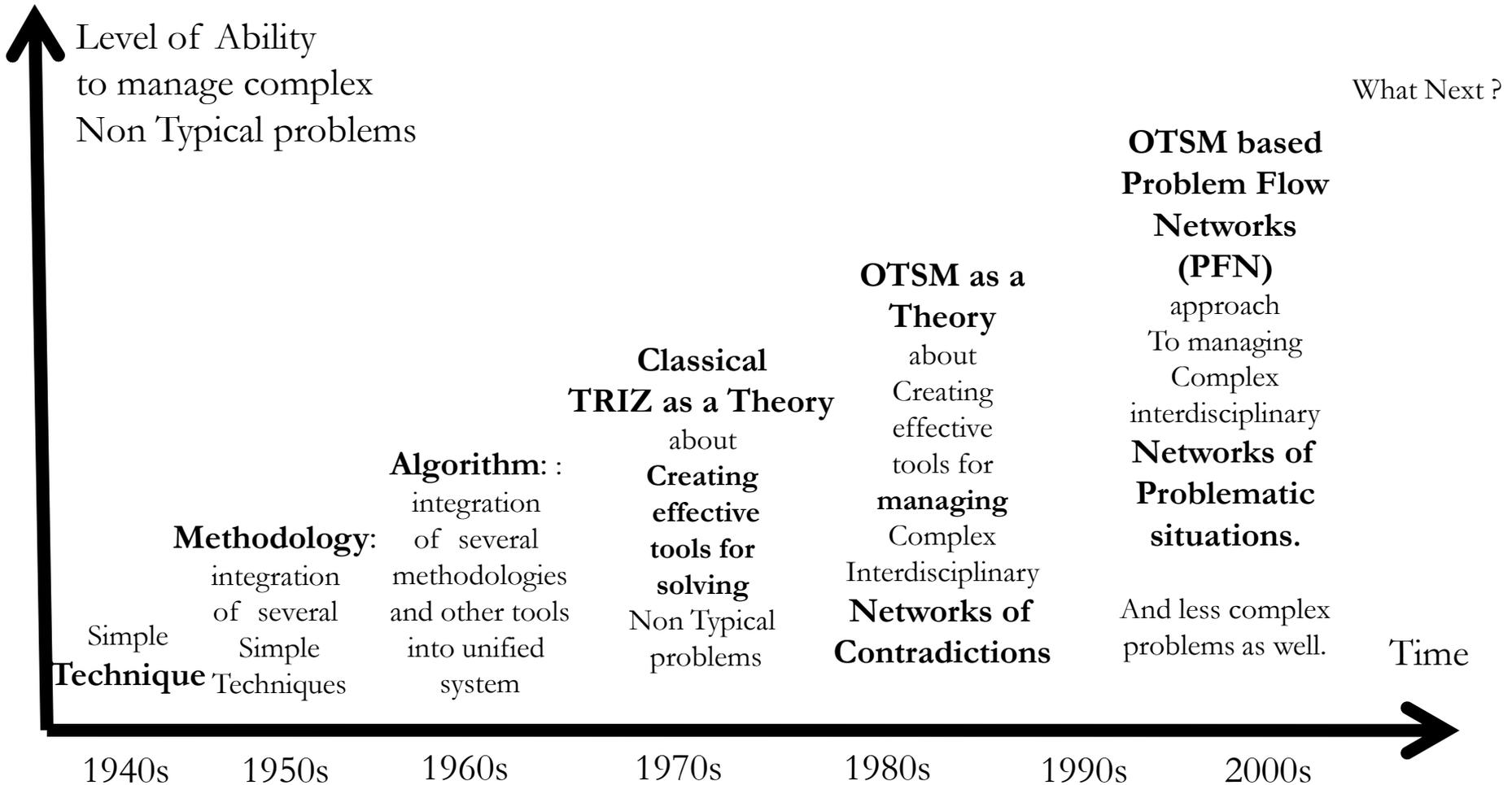
Project - TETRIS

Day 1.

# Main subjects for today's Training

- Short history and some problems were solved.
- “Tongs” model (Why OTSM-TRIZ is so effective).
- Exaggeration technique.
- What make a problem difficult?
- OTSM axiom of a root of problems.
- What does it means IMPROVE (Why OTSM-TRIZ effective)?
- OTSM Network of Problems/Solutions.
- OTSM ENV Model.
- How OTSM Process and Modeling complement to each other.
- Black Boxes of OTSM-TRIZ and Creative Chaos.

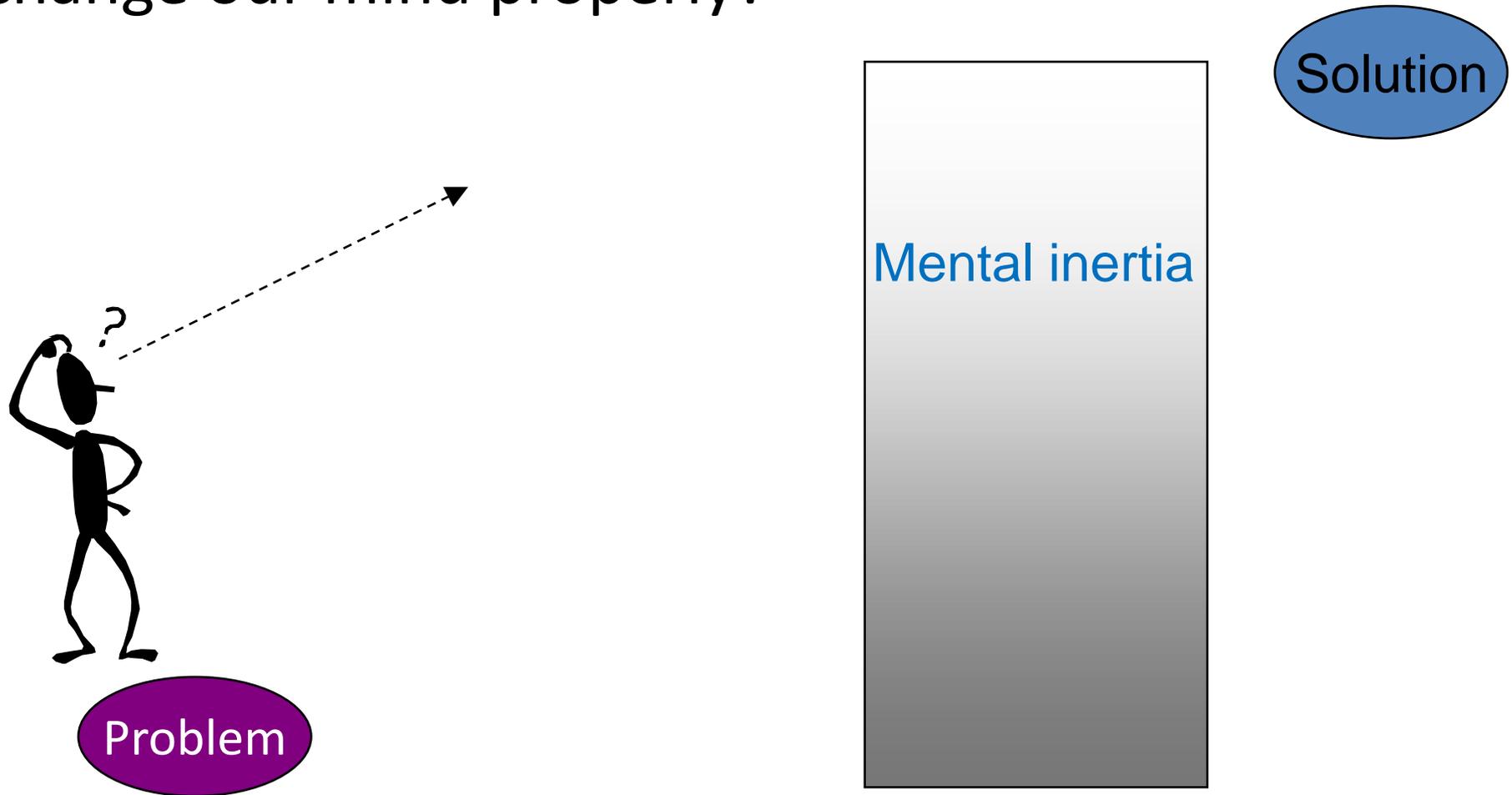
# Evolution of Classical TRIZ from simple Technique to OTSM Problem Flow Networks (PFN) approach



Some practical Tools before learning some practical Theory

# “TONGS” MODEL OF THE PROBLEM SOLVING PROCESS

# How can OTSM-TRIZ help us overcome mental inertia in order to pose the right problem and change our mind properly?



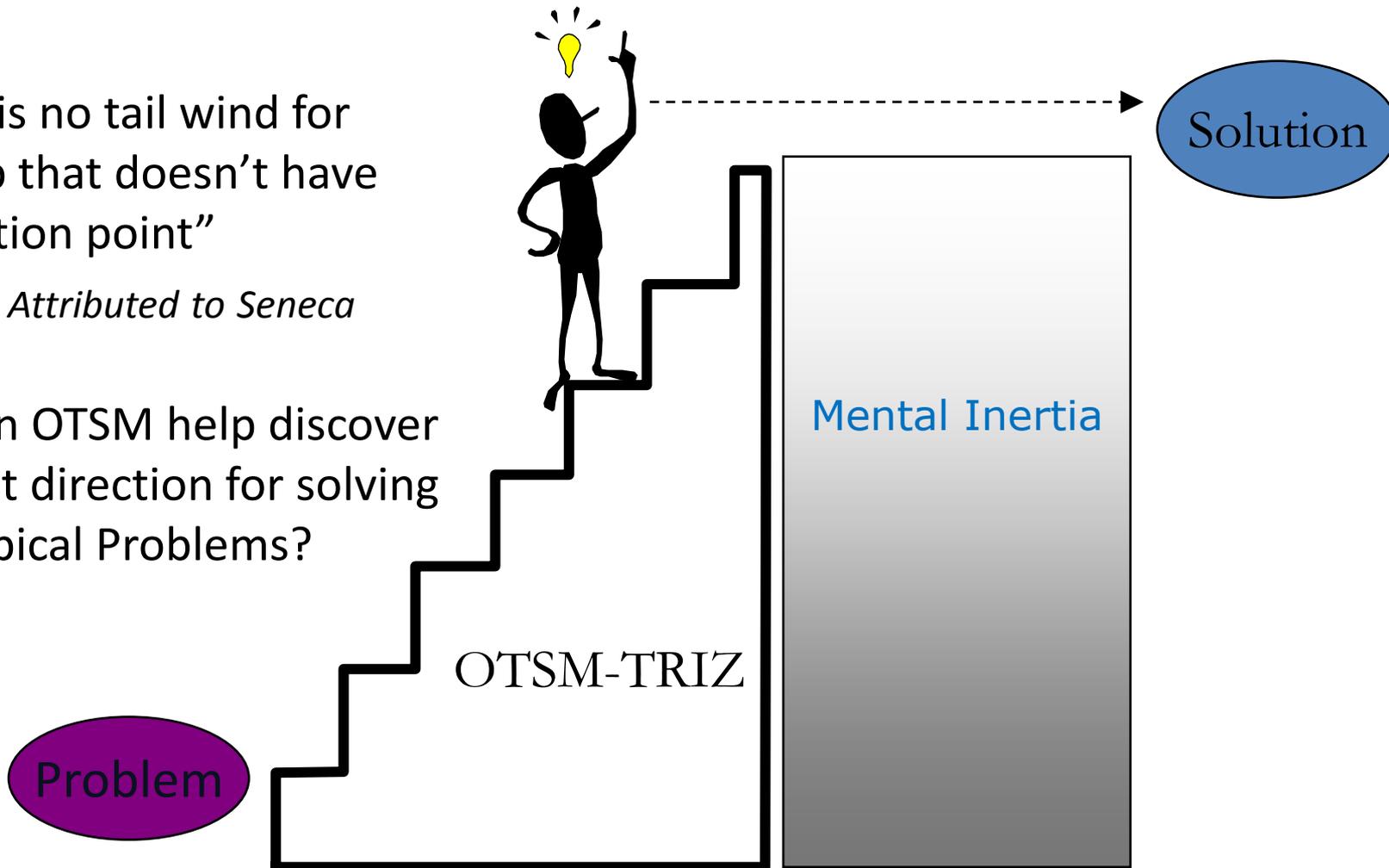
## OTSM -TRIZ provides us with stairs:

It is easy to overcome mental inertia making small steps in the RIGHT DIRECTION.

“There is no tail wind for the ship that doesn't have destination point”

. *Attributed to Seneca*

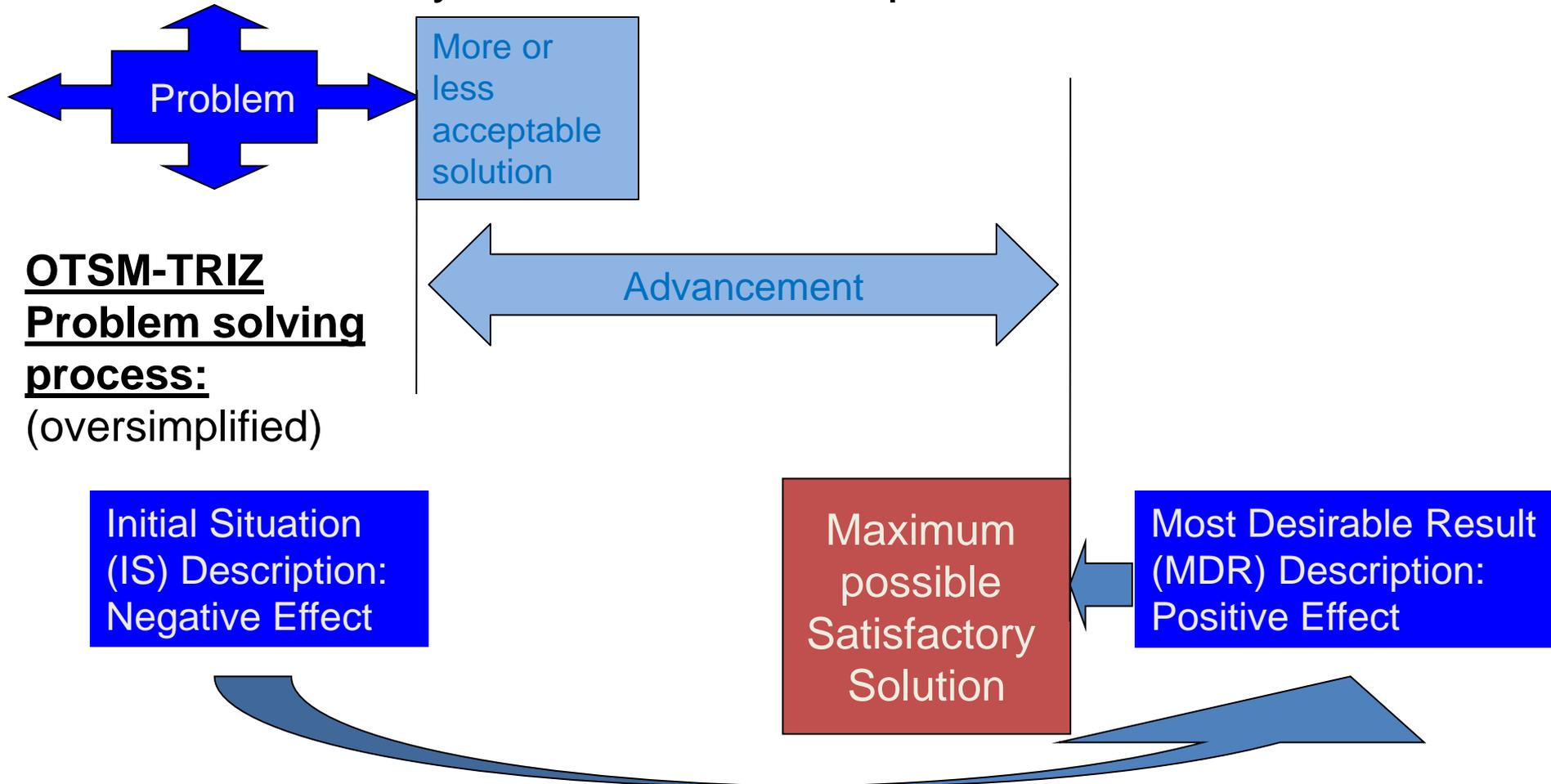
How can OTSM help discover the right direction for solving Non-Typical Problems?



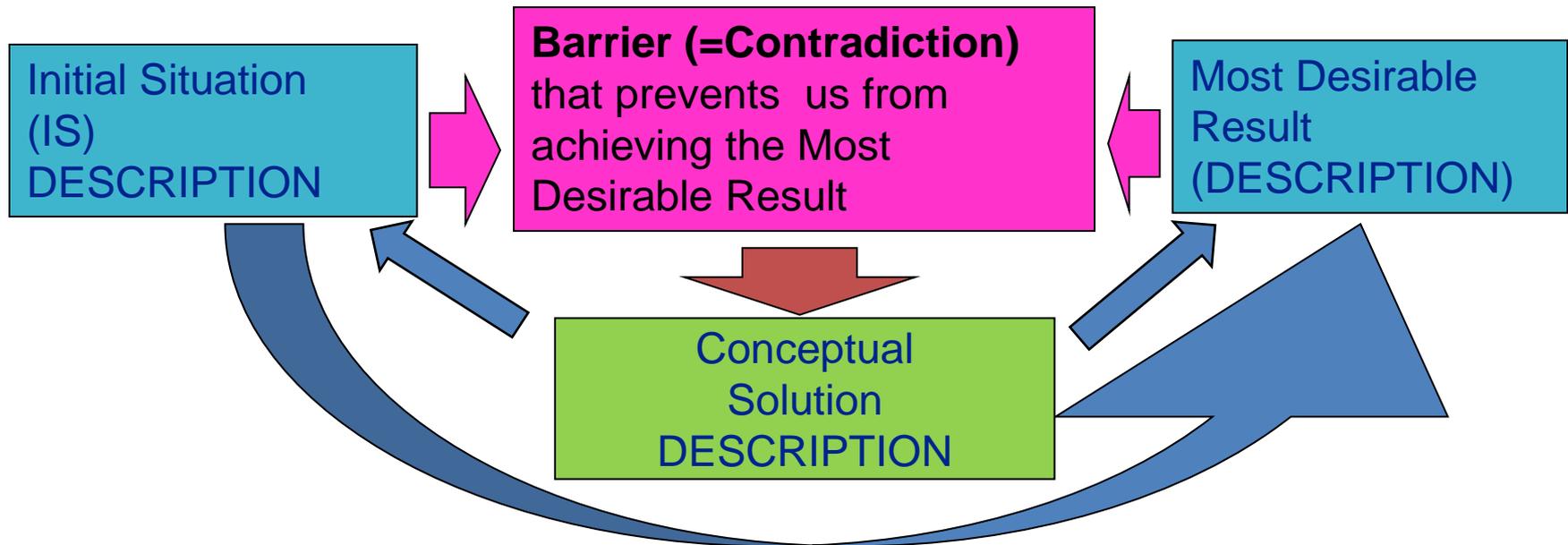
# Why are OTSM-TRIZ instruments so efficient?

**Typical stereotype** of problem solving:

Generate as many different ideas as possible!!!



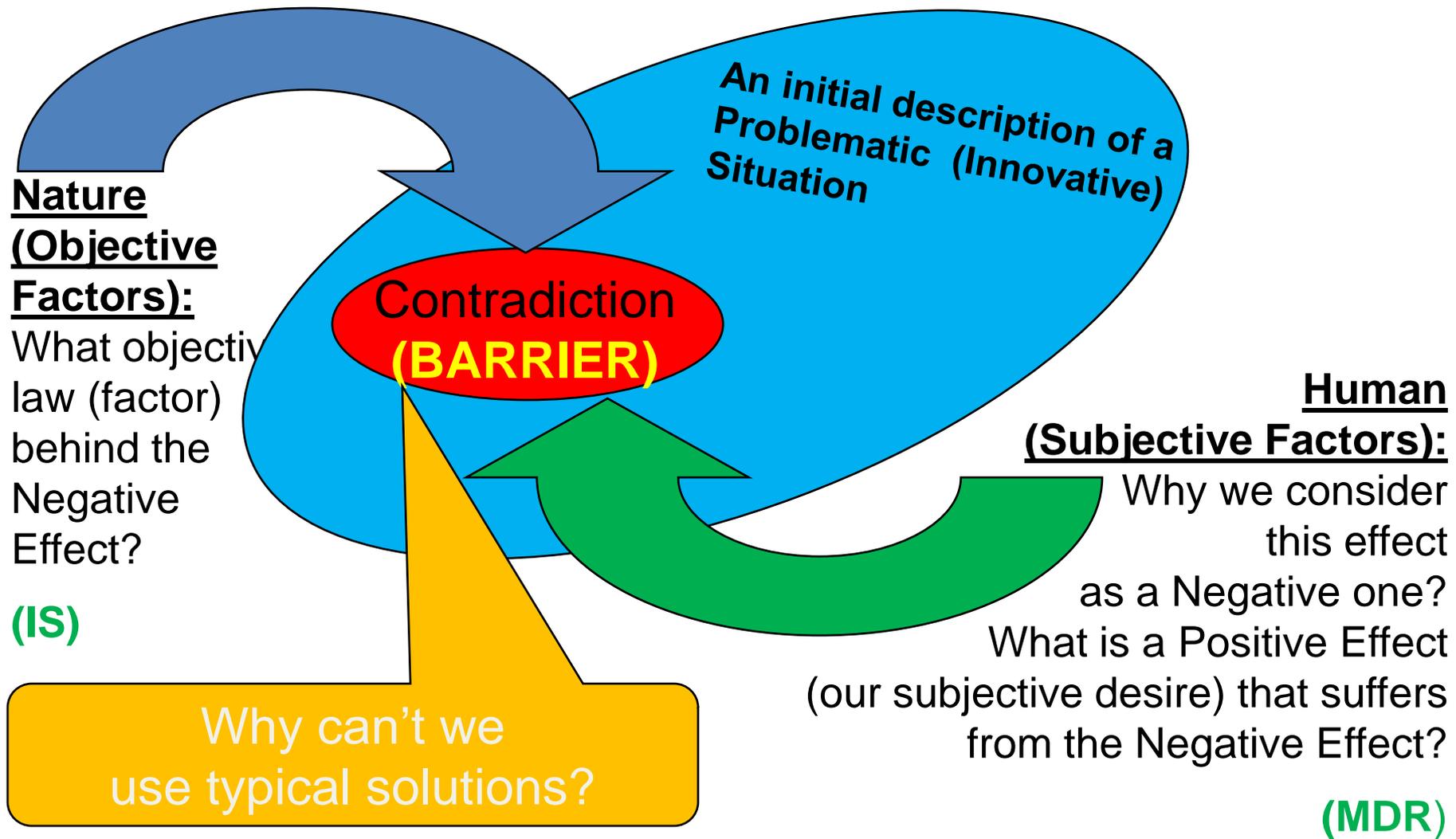
# “Tongs” Model of the Problem Solving Process



A specific barrier we should overcome is the root of a specific problem. The root of the barrier is a hidden CONTRADICTION.

What is the root of a contradiction?

# Art of Victory: Link between “Tongs” model and OTSM Axiom of the Core of Problem



# The Axiom and the “Tongs” help us discover the core of a specific problematic situation

## Step 0

Initial description of a problematic Situation

## Step 2

What we would like achieve (MDR)

## Last but not least:

*The sequence of steps (from 1 to 3) does NOT matter.*

## Step 1

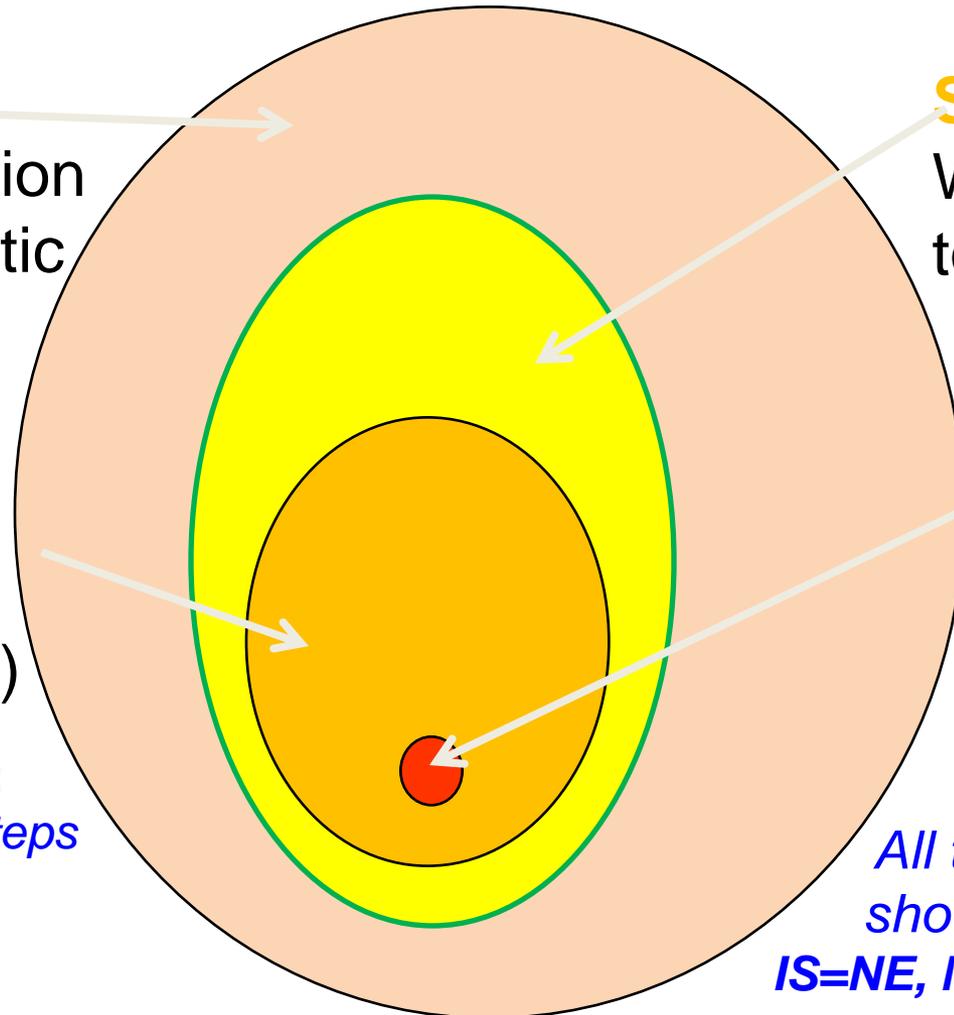
What we would like to change (IS=NE)

## Step 3

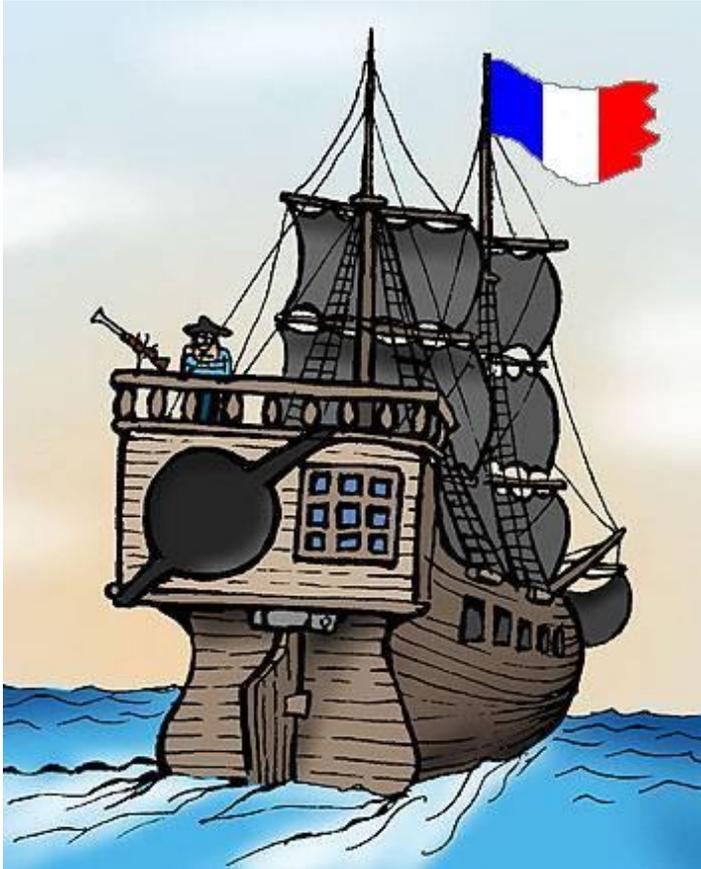
Barrier = Contradiction that underlies the problem

## What matters?

*All three components should be in harmony: IS=NE, MDR, Contradiction*



# Example: The Treasures of Surcouf



A famous French corsair Surcouf wanted to keep the treasure on the ship rather than hide it somewhere in the ground.  
But...

# Steps we should follow (1):

1. Initial Situation Description (IS=NE). Answer the question: “What makes me unhappy in the particular situation?”
2. Most Desirable Result (MDR) Description. Answer the question: “What would make me happy if I had a magic wand?” Describe what you would like to achieve if you had a magic wand. Develop list of specification for Magic Wand.

## *Comment:*

*Use OTSM Axiom of Impossibility: Forgot what is possible and what is not. Everything is possible with magic wand if you can clearly explain what you need. Leave Impossible for the next step... Think of MDR instead.*

# Steps we should follow (2):

## 3. a. Description of barrier.

Answer the question: “What seems impossible and prevent me from achieving the MDR in the framework of the IS?”

*Comment:*

*Now it is time to use second part of OTSM Axiom of Impossibility: Think of the most things that seems most impossible. Gold Fish method could be useful for this.*

## 3. b. Re-frame barrier in the form of contradiction with objective (Natural) factor or at least as a new Negative effect (new IS) that should be eliminated or improved. Answer the question: “What Problem description looks like now? What is NE to be eliminated or IS to be improved”

# Steps we should follow (3):

4. a Use appropriate common sense or typical solutions to eliminate the barrier.

Answer the question: “What common sense or professional typical solutions could be useful to solve the re-framed problem?”

4. b. If you are familiar with OTSM-TRIZ principles of contradiction resolution or with Classical TRIZ system of Standard Inventive Solution. Then:

Answer the question: “What Principles of technical contradiction resolution could be useful to resolve technical contradiction”

Answer the question: “What principles of OTSM-TRIZ could be used to satisfied both opposite demand for the same parameter”

Answer the question: “ What is a Vepol (SuField) model of the problem situation and which of 76 Standard Inventive solutions can be used.

# Template for Application of “Tongs” Model

1. IS – Initial Situation description: Undesirable (negative) situation (Negative Effect – NE). What would we like to change?:

2. Imagine that magic wand is in your hand (MDR):

3. Barrier (Contradiction or/and OTSM Axiom of root of problems) that prevents us from overcoming the negative effect (NE=IS) and obtain the MDR :

4. Use typical solution and collect Partial Solutions that should be integrated into Satisfactory solution description:

**New Problem (New Initial Situation (NE+IS)):**

How discover the core of the problem  
and destroy old models of thinking  
that prevent us from new ideas for the old problems?

**EXAGGERATION –  
ADDITIONAL DIMENSION  
OF MULTI SCREEN SCHEMA  
OF POWERFUL THINKING.**

# What for we need exaggeration?

- Exaggeration is a mental manipulation by the relationships between parameters. During this manipulations we should carefully discover consciences of these manipulations for our system functioning.
- Going beyond traditional values scale of the parameters we can destroy our mental inertia and obtain new perception and insights on our system and direction of its evolution.

*Comments: That is why Genrich Altshuller would like to enhance his schema of powerful thinking by several more dimensions*

# Rules of Exaggeration (Variation)

- 1. Chose a control parameter that influent one of the Evaluation parameters of the system.  $EP = F(\dots CP \dots)$
- 2. When change mentally value of the CP do not jump from “big” to “infinity” or from “small” to “zero”. Instead increase or decrease value of the Control Parameter step by step. Keep in mind possible “wave” dependence between CP and EP.
- 3. When step by step decrease to “Zero” try to go mentally beyond “Zero” the same way: step by step.  
(Ex: Renting office but get money from landlord).
- 4. When Increase Value of CP step by step in the direction to “Infinity” try to discover what other important parameter should decrease its value to “Zero” and even try to go beyond this “New Zero” (Ex: Boiler size versus Heater size)

# How do we exaggerate effectively?

- Use OTSM Axiom of impossibility (“Gold Fish” and “Sword Fish” Methods) to overcome mental inertia and obtain unusual ideas.
- Do exaggeration for Initial Situations, MDRs and Barriers.

# Examples:

(Work in small group and use “Tongs” + Exaggeration)

- Double-decker Bus Conductors-Drivers conflict:  
Conflict of interests: Conductors are paid for tickets.  
Drivers are paid for scheduler.
  - Proposal of consultant failed. Any negotiations failed.  
Union do not want to change system of salary as well.
  - Management choose absolution. But the conflict grow  
instead of disappear.
  
- What should be done?

Problem or not a problem?

This is a question...

# WHAT MAKES A PROBLEM DIFFICULT?

# Features of Difficult Problems:

*Summary of several years research: several hundreds people of various occupations, ages, cultures and nationalities around the World.*

- Lack of methodology of
  - problem understanding,
  - problem identification,
  - getting concept solutions
  - objective evaluation of the concepts.
- Lack of recourses: money, people, equipment etc.
- Complicated problem arise as a set of problems linked to each other.
- Research is necessary to clarify root of problem.
- Different demands contradict to each others
- Mental Inertia
- Social aspects

***Important: the features **DO NOT DEPEND ON** the problem nature: engineering, management, art, social, politics, economy etc .***

# What makes a Problem Difficult?

*...The problems that exist in the world today  
cannot be solved by the level of thinking  
that created them...  
attributed to Albert Einstein*

*“Making knowledge workers productive  
requires changes in basic attitude”  
Peter Drucker*

**Management Challenges for the 21-st century.**

## **Conclusion:**

**in the world of rapid changes we have to handle effectively Non-Typical problematic situations, i.e. we must change our way of thinking and change the basic attitude every time we faced with Non-Typical problem.**

Dr. Edward Deming (1900-1993):

“There are lot of models. Some of them are useful [NK: for certain specific situation].”

OTSM Interpretation:

The are infinite amount of models of the same element. EACH of them could be useful for the specific situation.

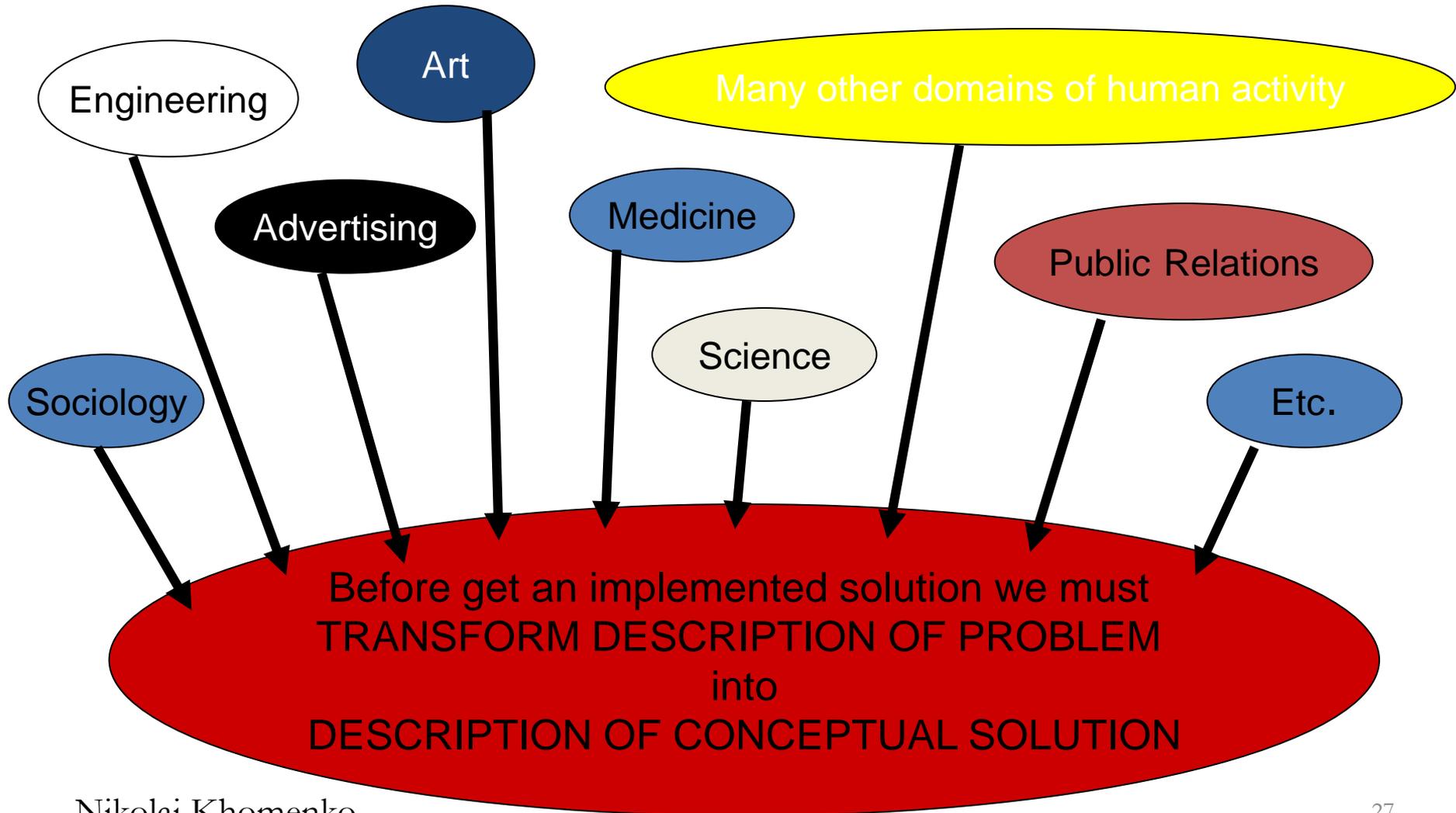
We have to be able to develop appropriate models that is useful for particular situation.



*Despite being considered something of a hero in Japan, he was only beginning to win widespread recognition in the U.S. at the time of his death*



# What do various problem solving processes have in common?



# OTSM Axiom of Descriptions (Models )

- For thinking process we use models (descriptions) of elements that we are thinking about. Each model just partially represent element we think about.

*Main consequences for practice:*

*In order to solve problem we have to re-frame model of problem description in order to overcome mental inertia and obtain deep insight on the root of problematic situation.*

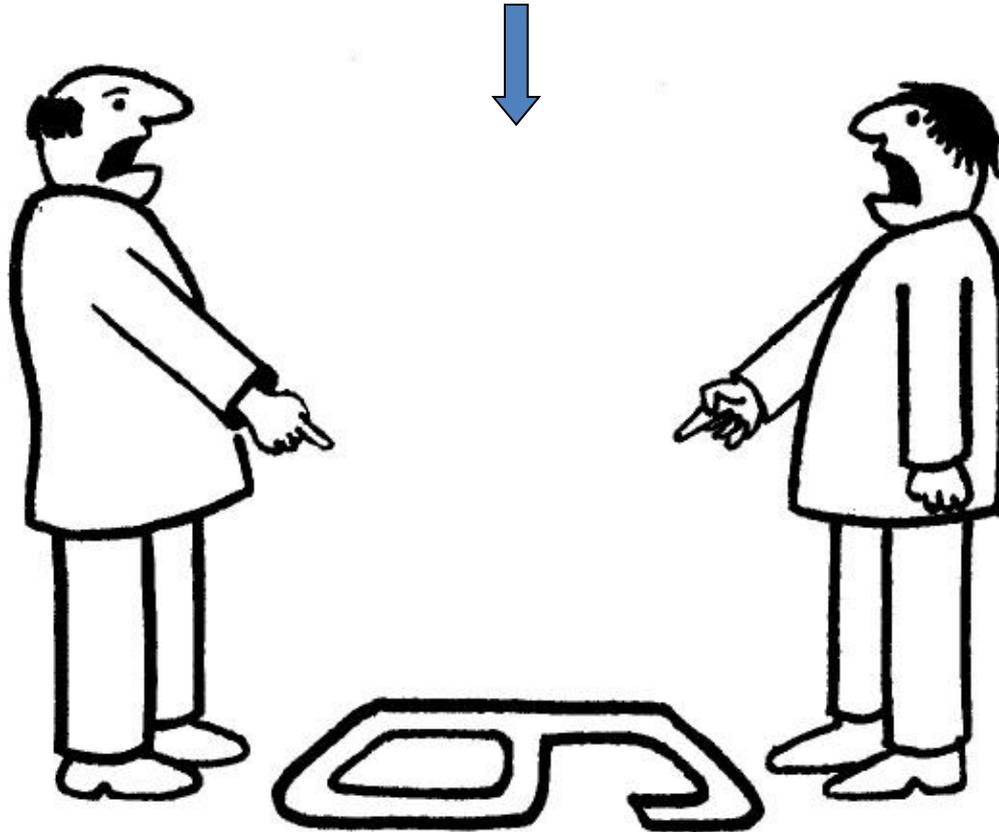
*Comment:*

*Appropriate Description of problem is a description that could be helpful to develop satisfactory conceptual solution description.*

*As a result Appropriate Description of problem depend on the instruments we use to develop description of a satisfactory conceptual solution.*

# Which Model is better?

Root-Cause of many Disagreements:



Everybody describe their perception about something from their own standing point. OTSM provide solution.

# Dilemma. Which mind is better: well-filled in or well-organized?

- Modern education system produces professionals with the mind well filled in with typical solutions from the past.
- The current situation demands regular and quick innovation which cannot be provided by past typical solutions.  
Cross disciplinary problem solving instruments are needed to produce new typical solutions quicker and more effectively than Trials and Errors Method that was used in the past.

# Well-organized mind

- Well organized mind is a mind that could proceed available knowledge in order to obtain satisfactory solution of unknown (non typical) problems.  
It is not only well organized storage of knowledge but creative knowledge proceeding system as well.
- Dynamic and well-organized mind is a new challenge for education, industry and research.  
This mind should able to handle difficult non-typical problems. These problems are often complex and cross-disciplinary. Collaborative negotiation between different professionals is necessary. This also requires efficient organization of the mind.

# How can we identify peculiarity of certain situation?

- OTSM-TRIZ has a set of instruments to clarify initial description of a problematic situation:
  - Network of Problems, OTSM Express Analysis in OTSM,
  - Altshuller's ARIZ and Multiscreen Schema of powerful thinking in Classical TRIZ.

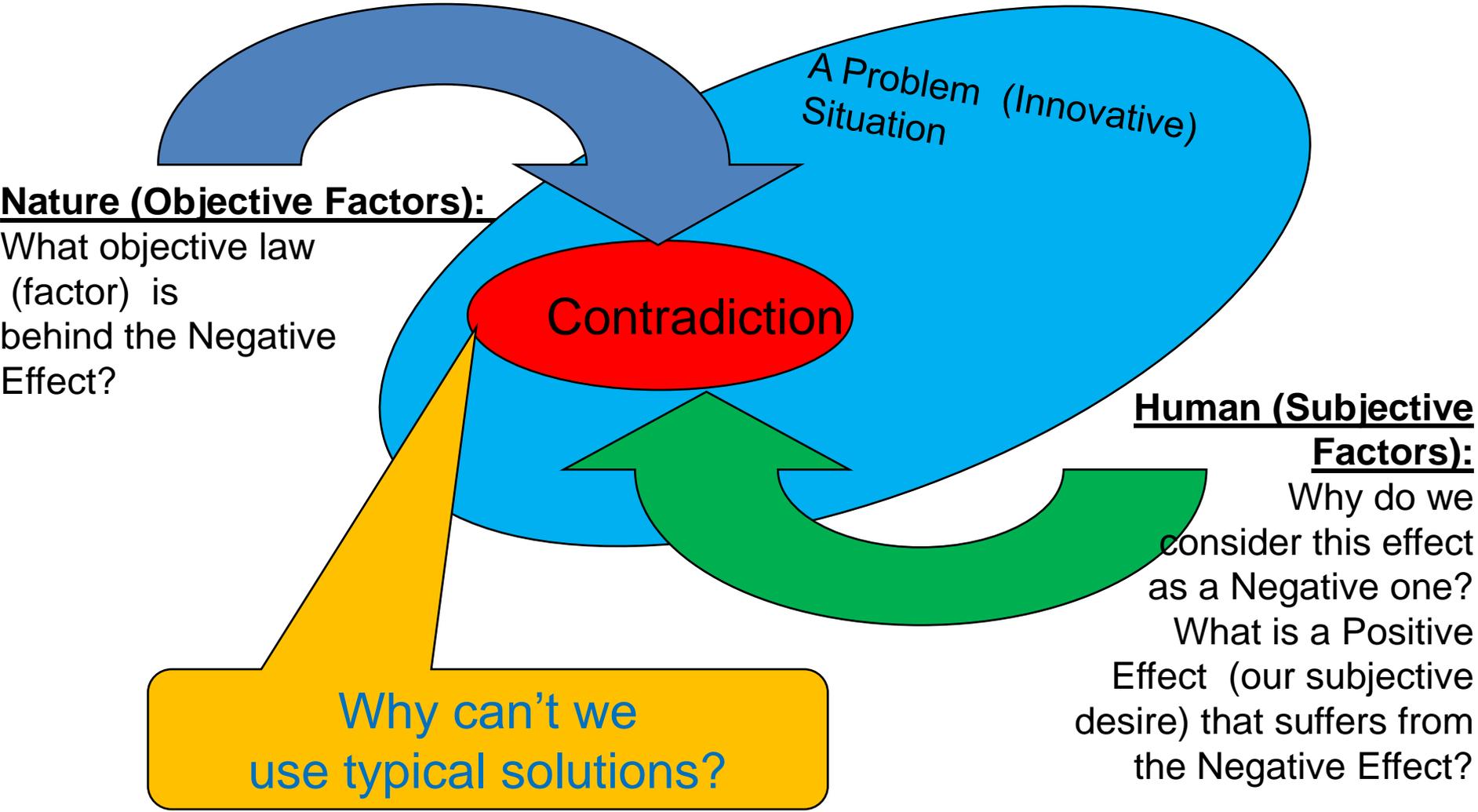
*Comment:*

*All of them are underlining by OTSM Axiom of root of problems and "Tongs" model of a problem solving process.*

The very Core of every single NON typical problem.

# OTSM AXIOM OF ROOT OF PROBLEMS

# Art of Victory: OTSM Axiom of the Core of Any Problem



# Examples:

- Example: Archimedes' Principle and floating piece of metal.
- Example: Flying Machines, Mongolfier, Airplane.
- Example: Marconi - cross continental Radio transmission. Opponent prove that it is impossible but... Ionosphere was forgotten and rediscovered.
- Example: Fuel Cell corrosion. Contact between oxygen and metal. We need contact with metal but we do not need it. What we need is free ions but not metal (solved). Or. All oxygen should react with Hydrogen. How it could be done (not solved yet)? New problems arise.

# Representative Sample

- Example: Detective story about Heavy Metals in the ash of power plants. Initial situation: Negative Effect – difficult to make representative sample for research. This is a Natural objective factor that make us unhappy.
- What we would like to achieve? What is a Most Desirable Result (MDR) for the particular situation? This is Human Factor that could make us happy.
- Why we could not achieve MDR? What objective factors underlining the problem? What is a barriers that prevent us from achieving the MDR? In this particular case Contradiction is hidden under certain barrier. We should clarify what is a barrier and discover contradiction.

# Clarification of MDR for the representative sample problem

- What is an **ULTIMATE GOAL** we have to achieve with this representative sample?



# Ultimate goal: Identify Source of Heavy Metal that appear in the ash

- Can we obtain the Ultimate Goal without representative sample of biomass fuel?
- How could we re-frame the problem description if we will imagine that we have already representative sample done?

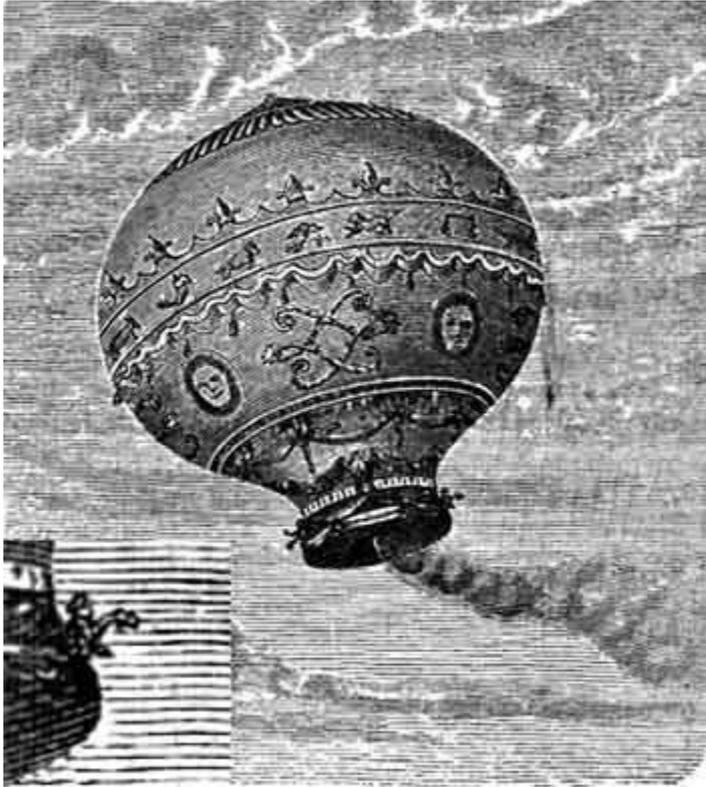
# Reflection stage: What we did?

- We were looking for objective law that underlining the problem.
- We were looking for a way to NARROW AREA OF OUR RESEARCH we have to focus on in order to find root of problem and eliminate it by using objective law that underlining the problematic situation.
- The closer to the Ultimate goal problem is formulated the better solution could be obtained.

## *Comment*

*Process of discovering a root of problem help us to decrease amount useless trials and errors. Sometimes problem could be re-framed the way that solution appear as obvious.*

# Conclusion: How can we “broke” Objective Law?



To “broke” particular objective law we have to recognize it and follow it!!!  
What produce negative effect will help us “eliminate” the effect.

What we are doing while improving existing system or situation?

**WHAT DOES IT MEANS IMPROVE?**

# S-curve of system evolution (*logistic curve*)

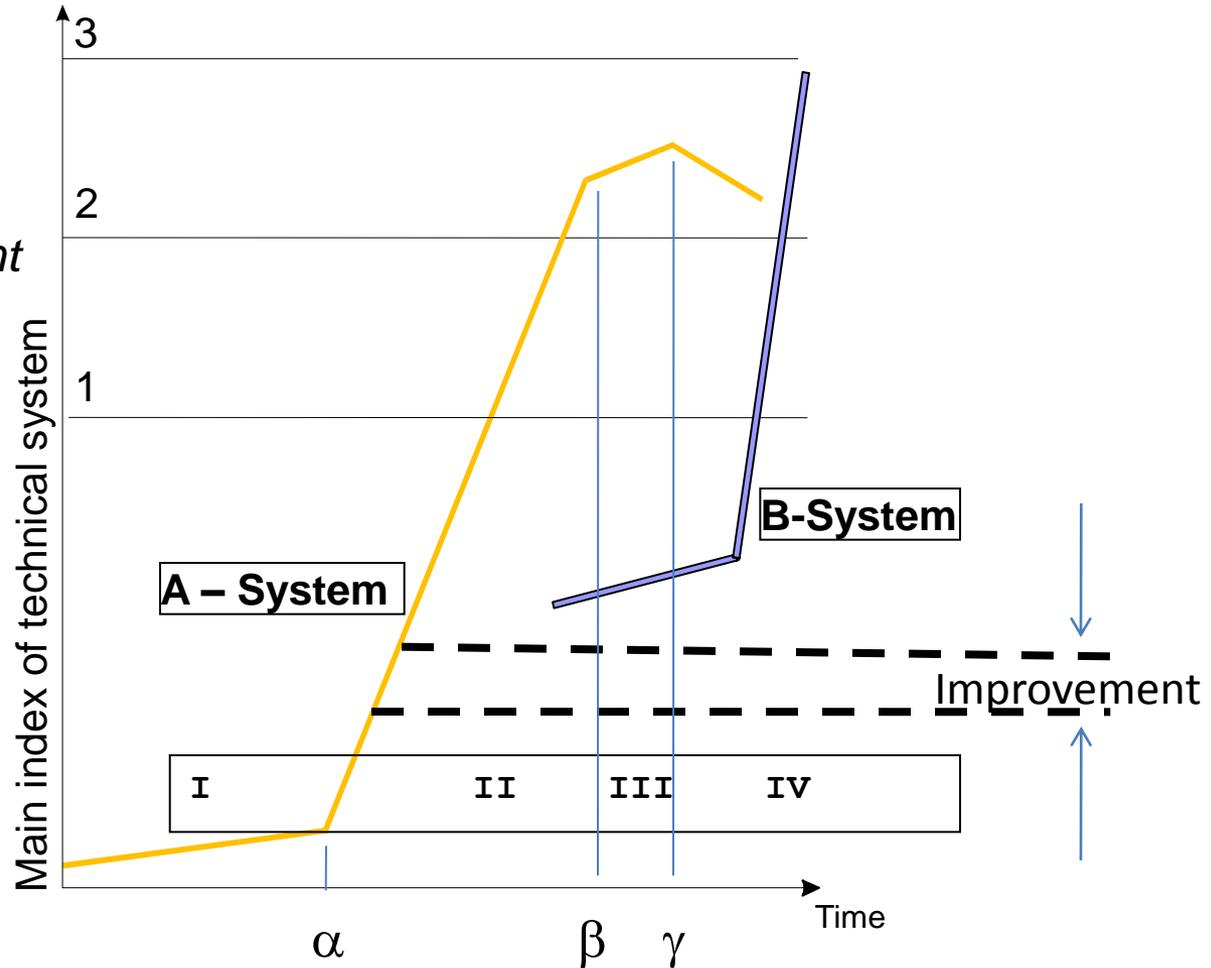
*Natural limits:*

*Objective Factors:*

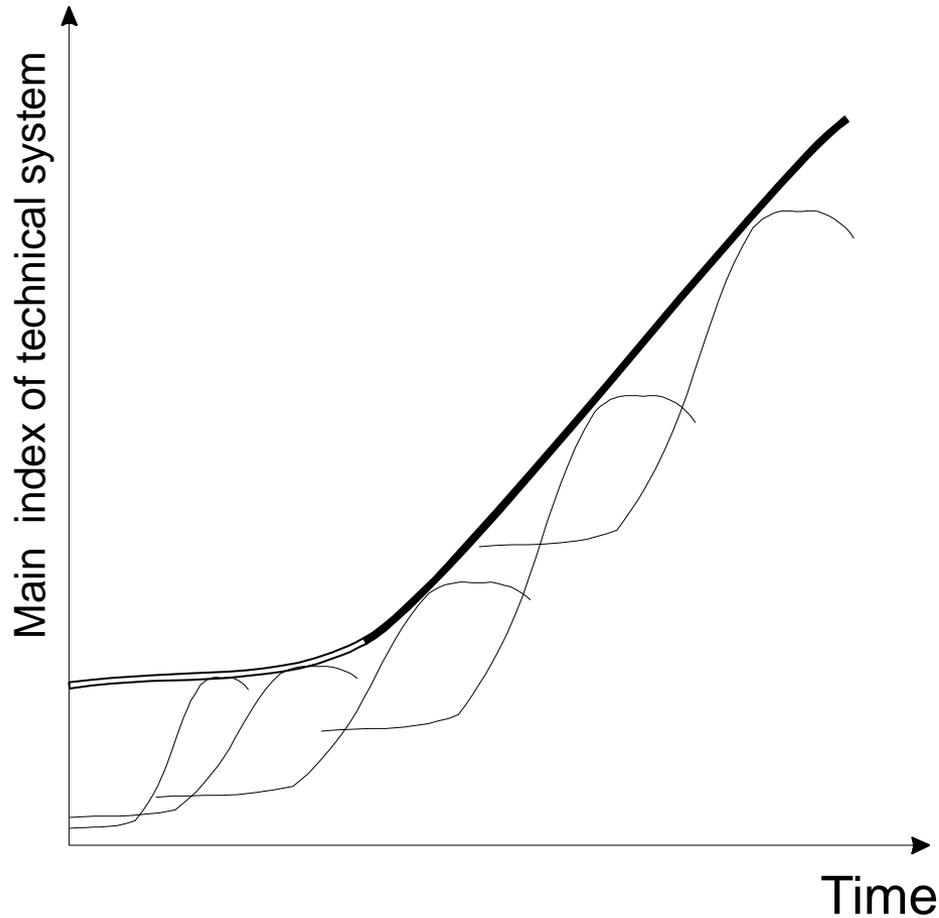
*Laws or/and  
Resources*

*Limits of Environment  
consumption*

*Limits of working  
Principle Concept*

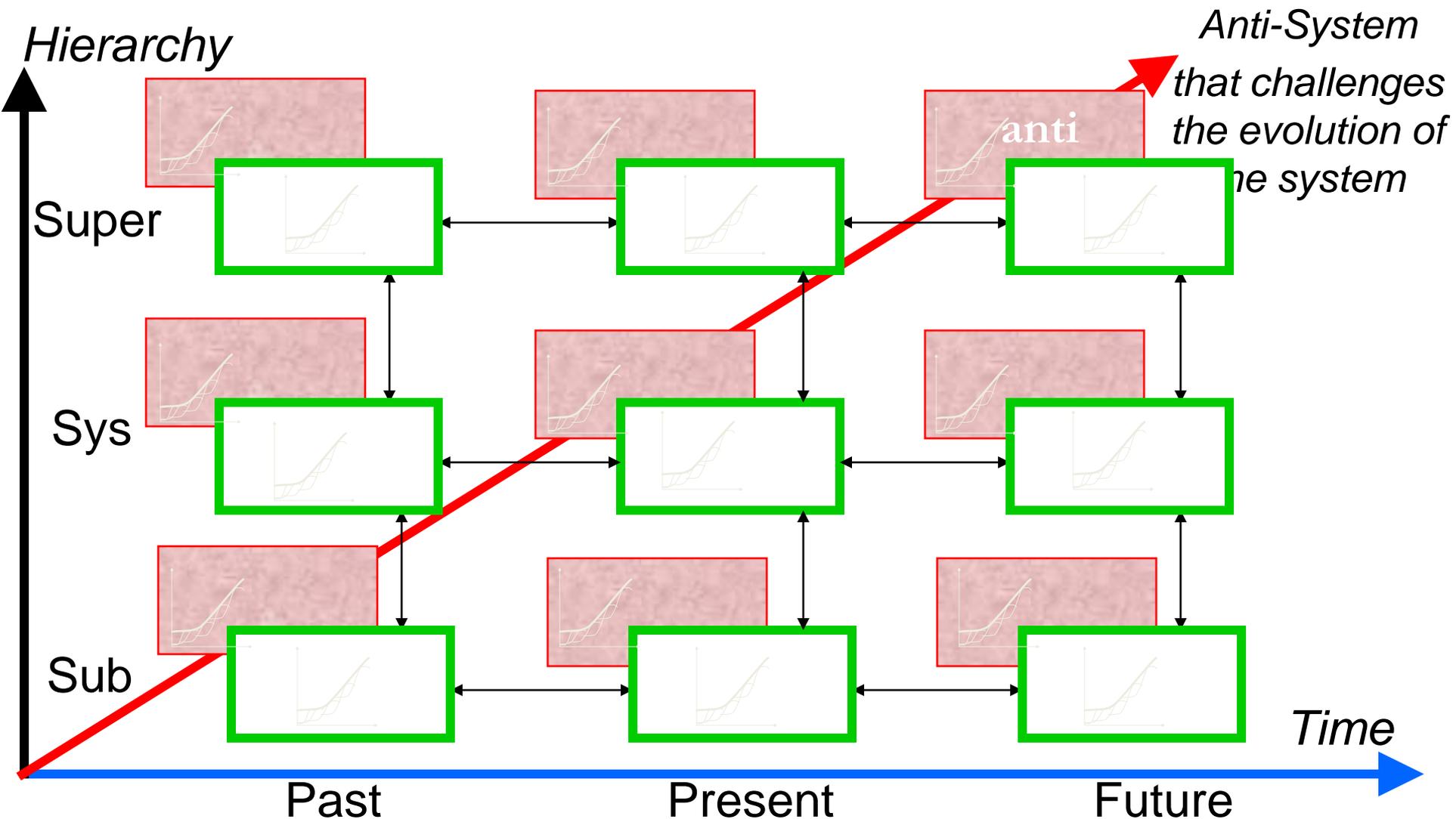


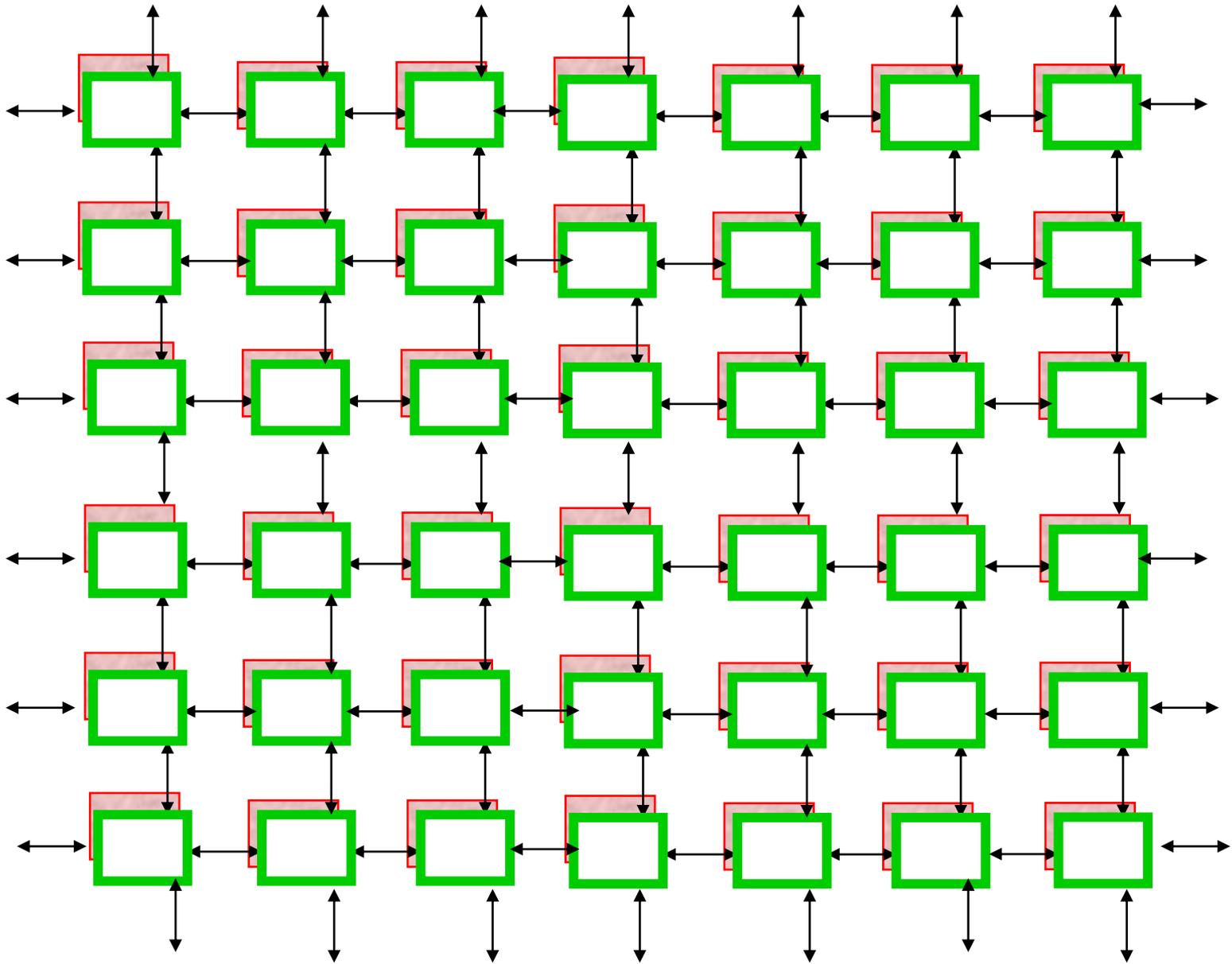
From generation to generation.  
From one driving contradiction  
to next driving contradiction.



[Example: =>](#)

# Classical TRIZ: Scheme of Powerful Thinking





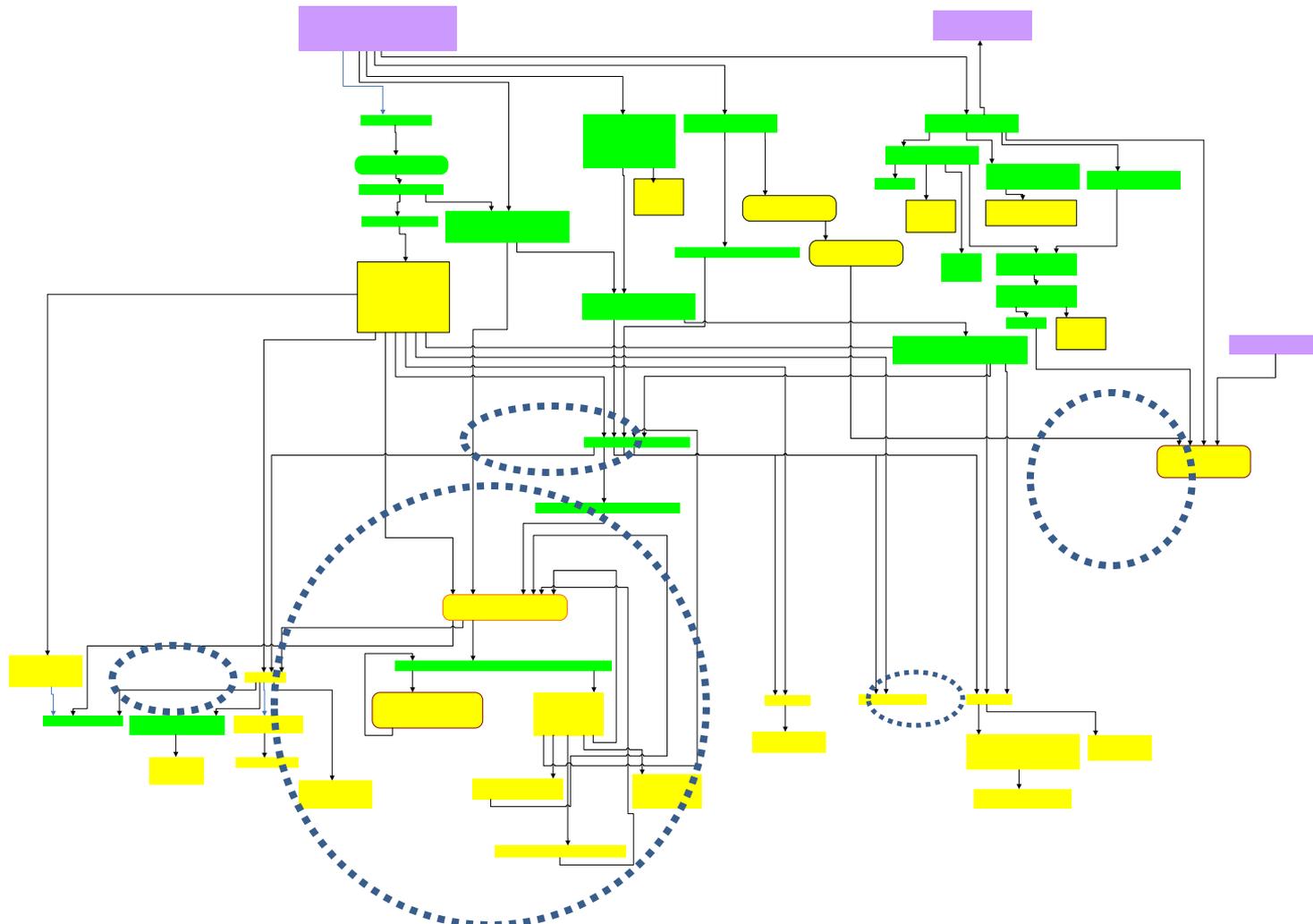
*“We are suffering form RIGHT solution  
of a WRONG problem  
more then  
form BAD solution  
of a RIGHT problem.”  
Unknown author*

OTSM network of problem is an instrument for using in practice theoretical  
Scheme of Powerful Thinking = Big Picture of a problematic situation.  
Orientation and Navigation tool for problematic situation.

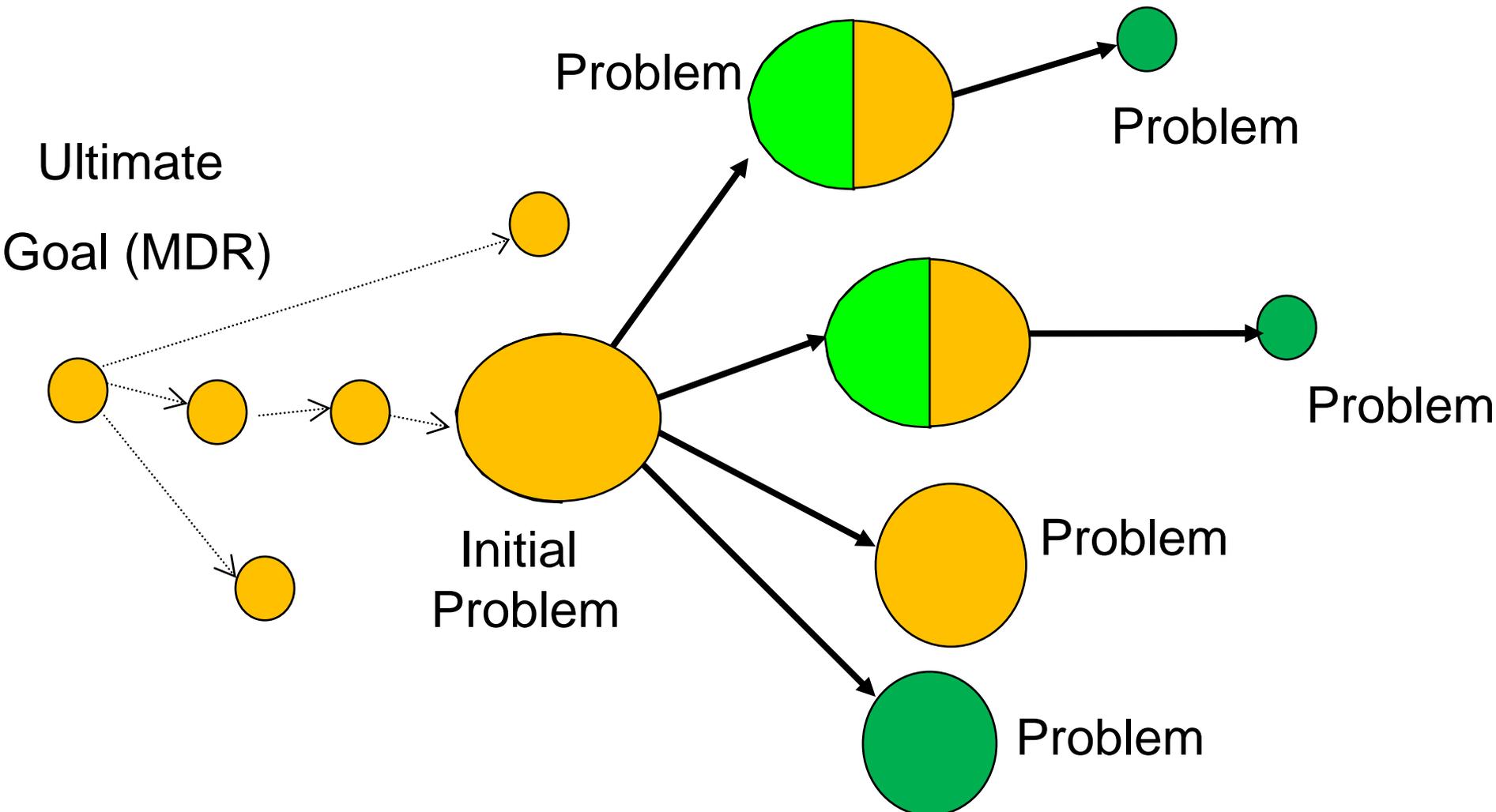
# OTSM NETWORK OF PROBLEMS / SOLUTIONS

*(SUPER SHORT INTRODUCTION)*

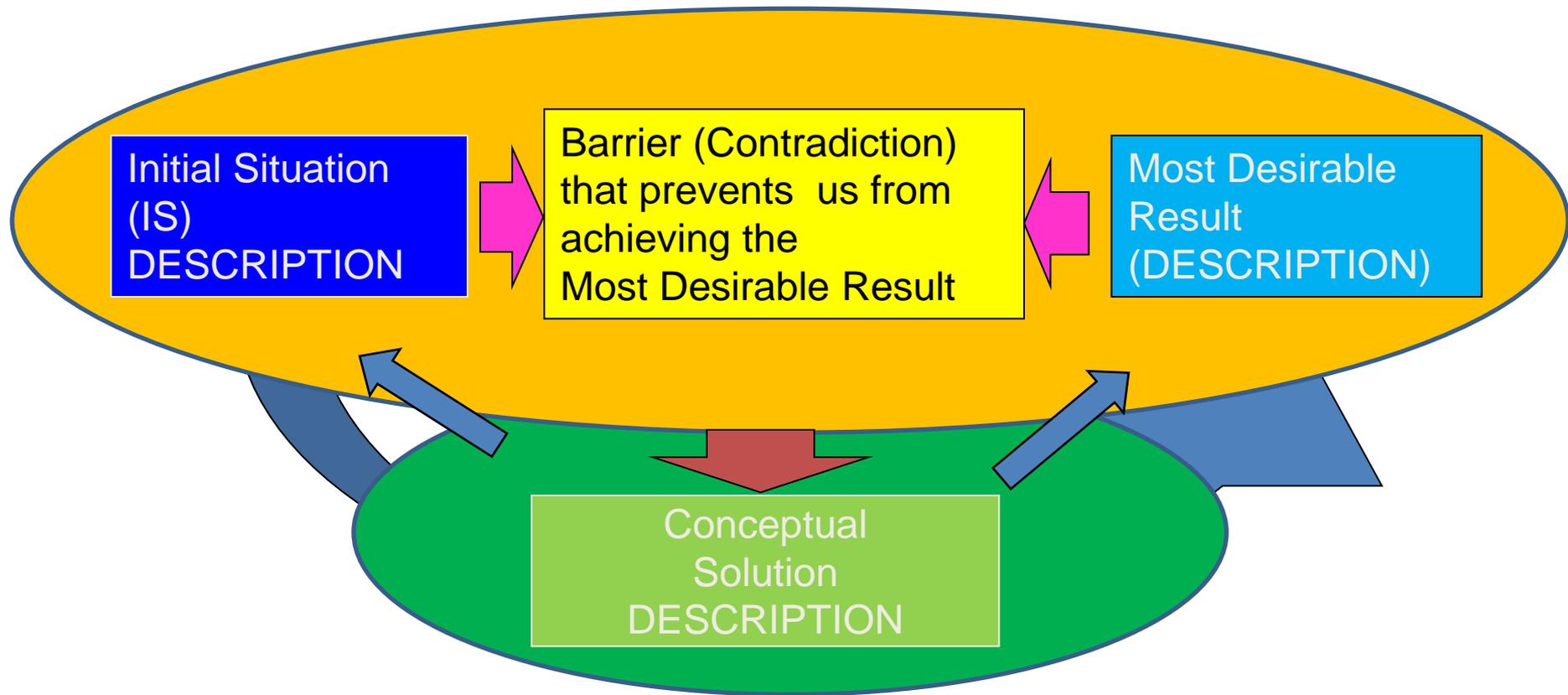
# Example: Fragment of Interdisciplinary Network of Problems



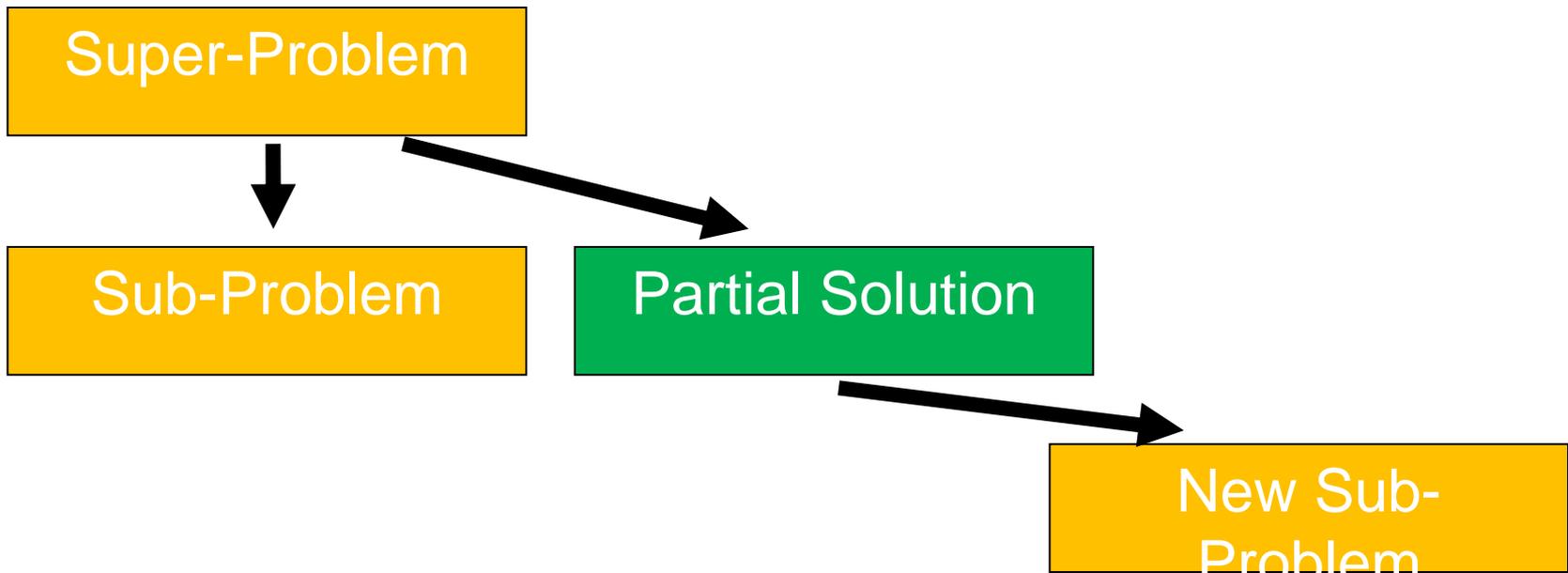
# Problem = Solution of (Problem)'



# Transition from the “Tongs” Model to a Network of Problems

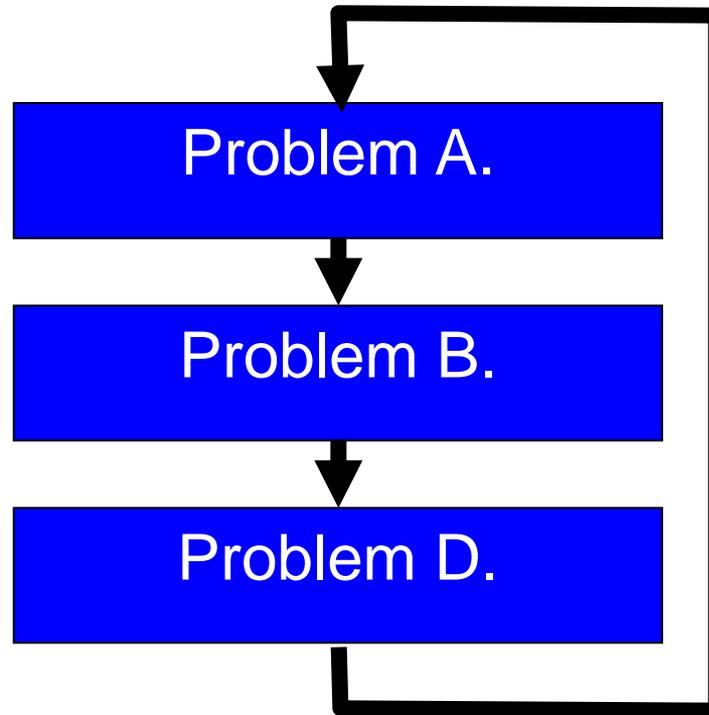


# Relationships Between Nodes: (based on our actual state of knowledge)

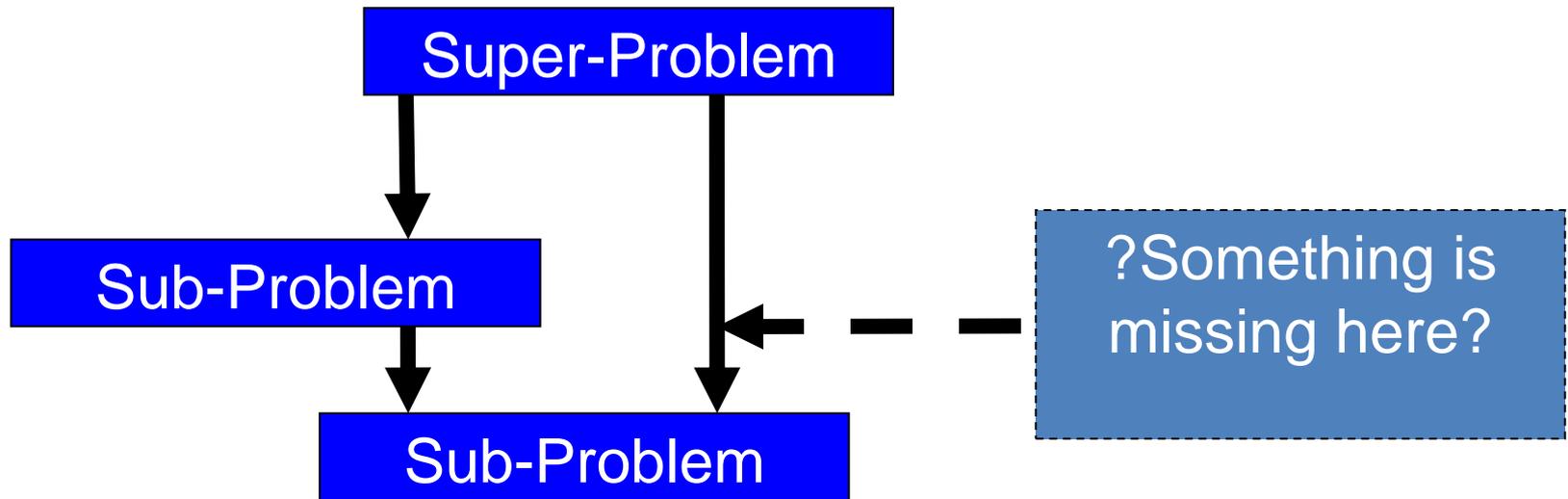


# Vicious Circle

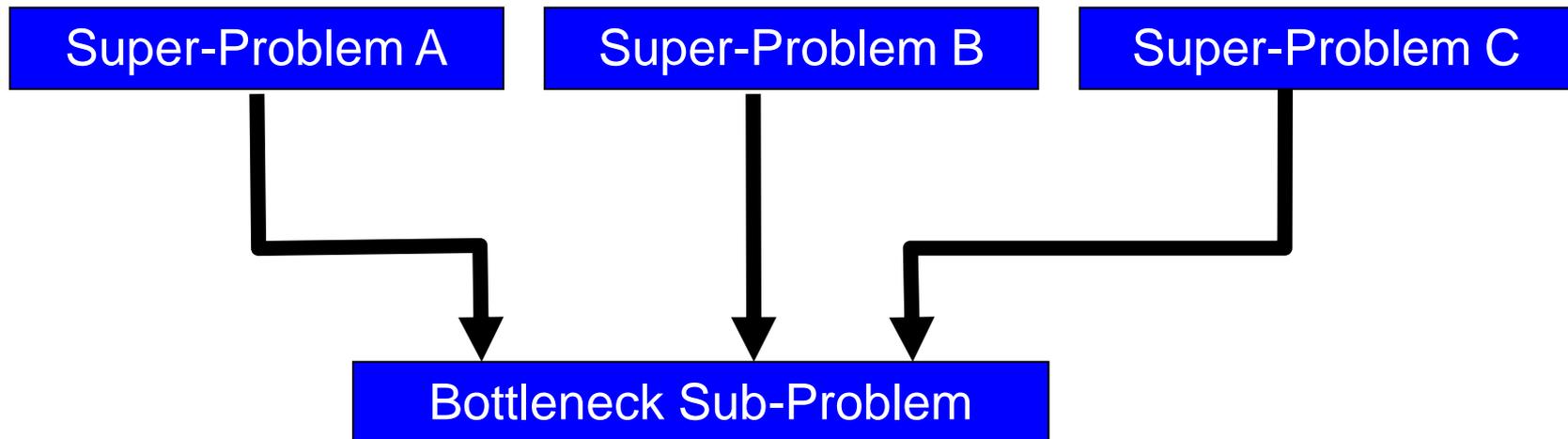
(at least one contradiction is hidden or lack of understanding)



# Short-Cut - Indicates the Lack of Understanding or a Special Case



# Bottleneck – Could Signal a Hidden System of Contradictions



# Example: developing OTSM Network of Problems/Solutions

- [See File in Visio](#)

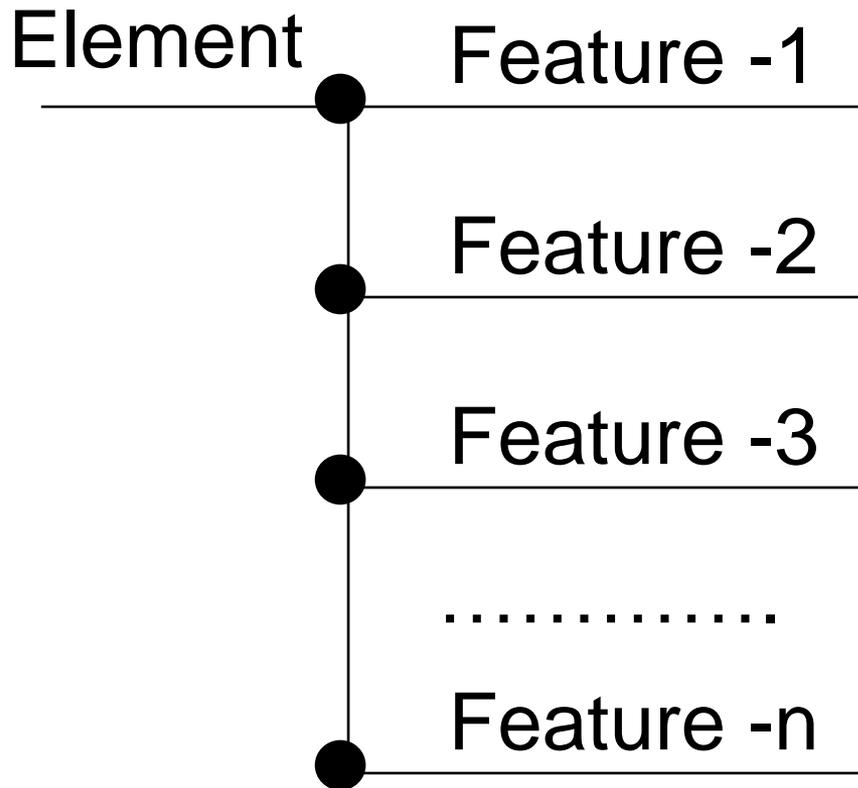
# Further Application of Problem Flow Networks (PFN) Approach

- Modeling for complex interdisciplinary problematic situation.
- Competitive Analysis of patents.
- Scientific and Business Research Problem solving.
- Application to extracting, storing and using knowledge necessary for sustainable development of an organization, its products and services.
- Support for Forecasting and Road maps.
- Supporting Strategy planning.
- Supporting R&D planning.
- Supporting Planning of an evolution of various organizations.
- Developing Educational system for Knowledge workers.
- Knowledge processing system of various kinds, including application to Artificial Intelligence.

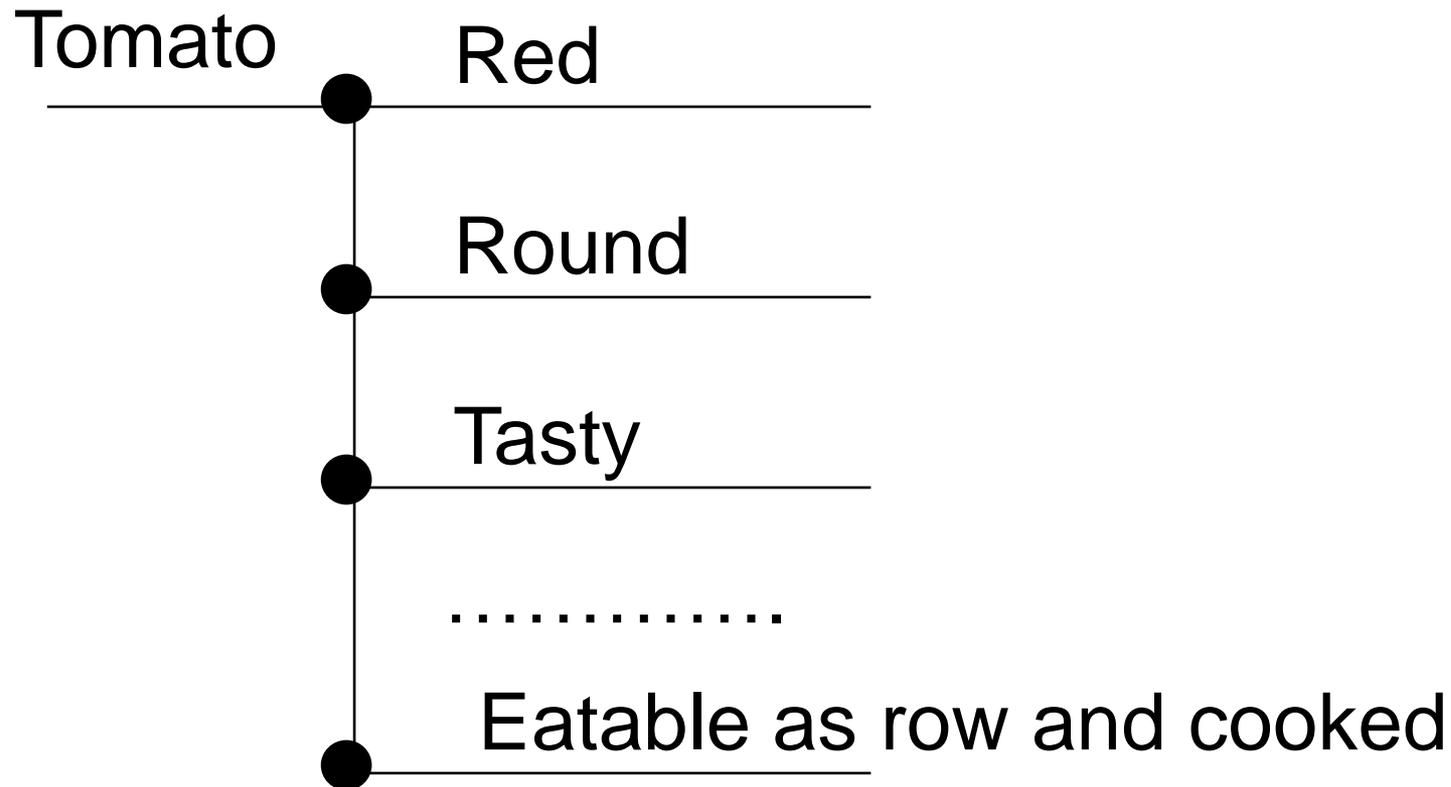
What model we can use to describe something?

# **OTSM ENV FRACTAL MODEL**

# Name of Element and List of Its Features

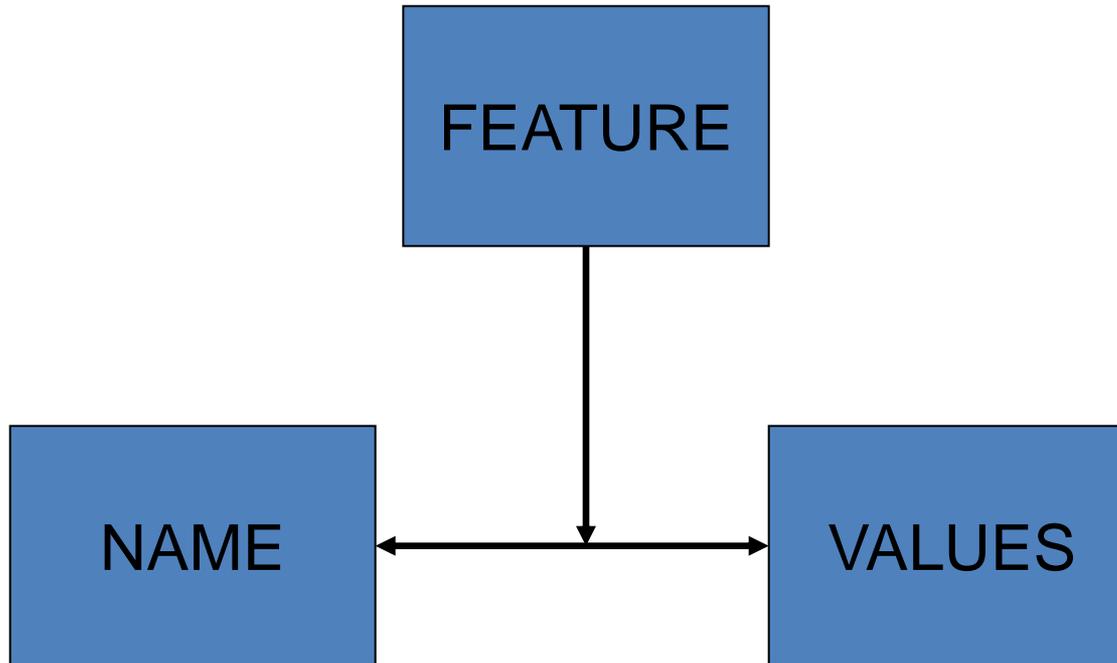


# Example:



# Element - Feature

## Element - Name - Value



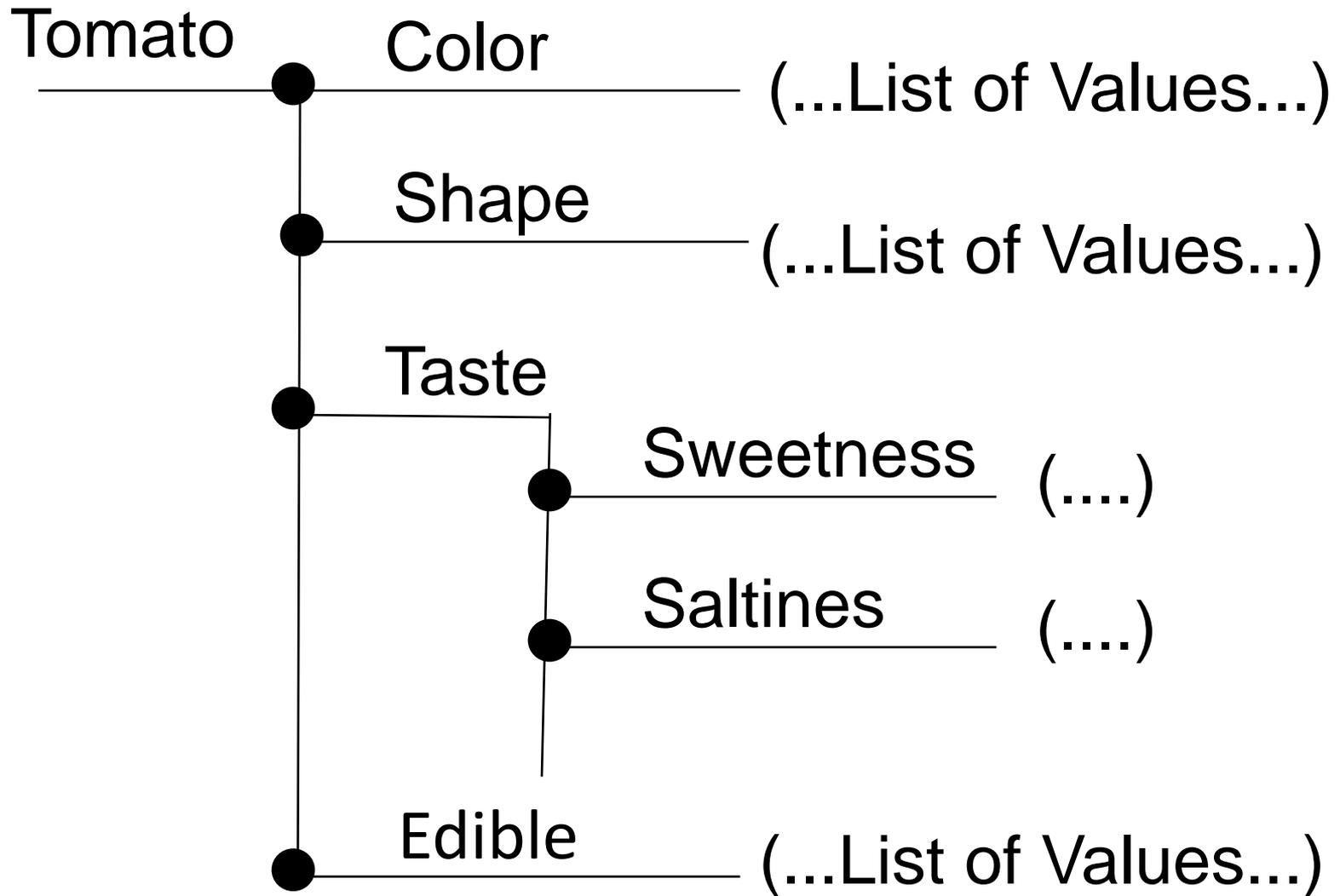
# Model: Element - Name – Value (ENV)



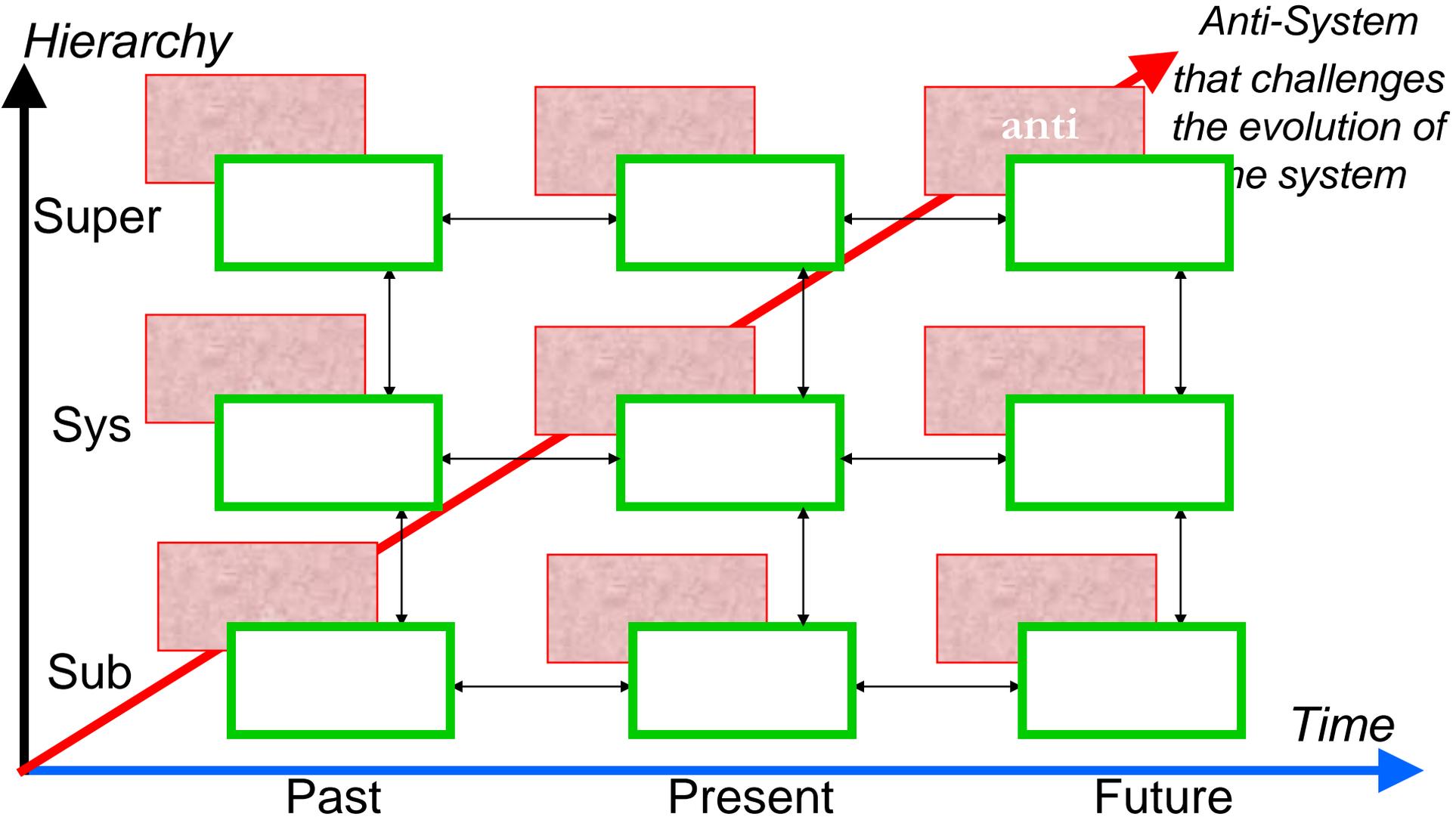
# Example:



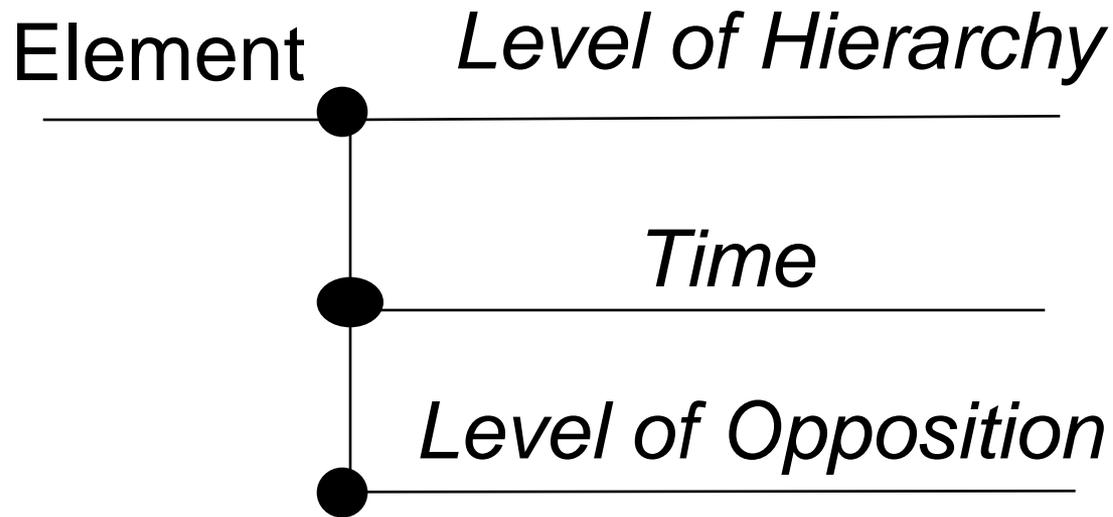
# Fractal Example:



# Altshuller's Scheme of Powerful Thinking



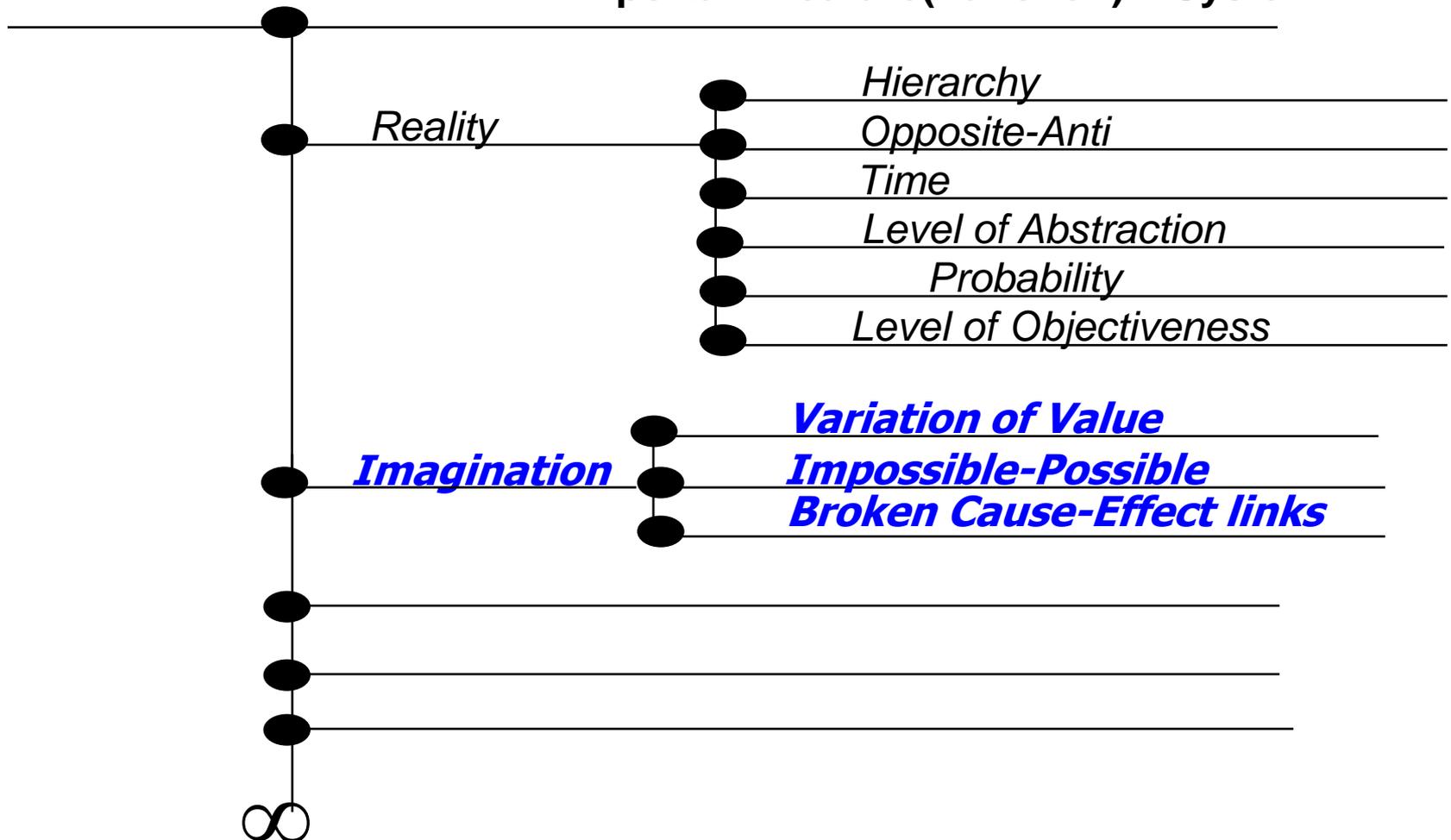
# ENV Representation of Classical TRIZ System Operator



# Advanced Schema of Powerful Thinking

Element

+ Important Feature(Function) = System

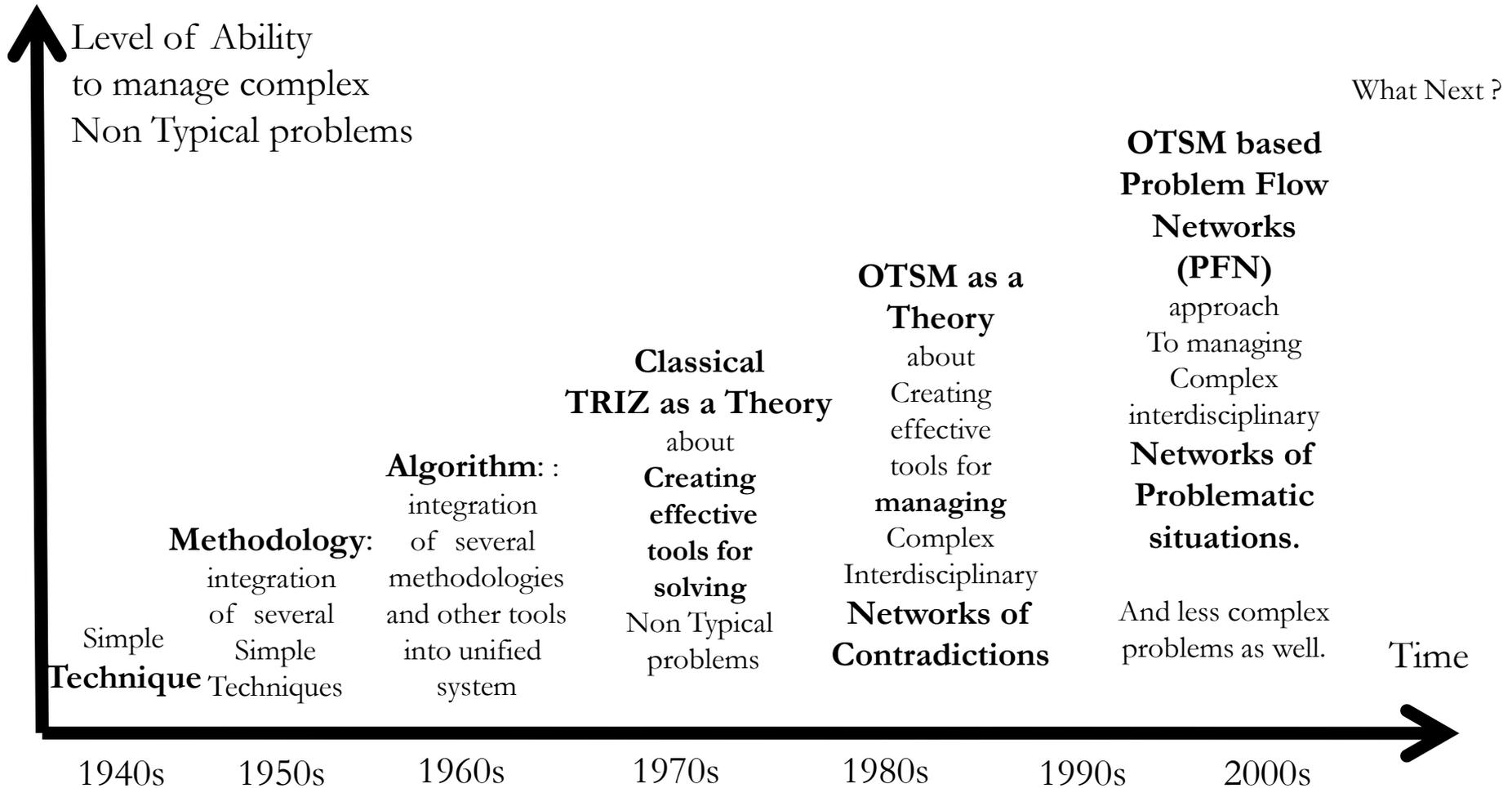


Law of systems evolution: Transition to a Super-system

Two independent system with the same Function will evolve into Super-system that will integrate both of them with synergy effect.

## **HOW OTSM AND MODELING COMPLEMENTARY TO EACH OTHER?**

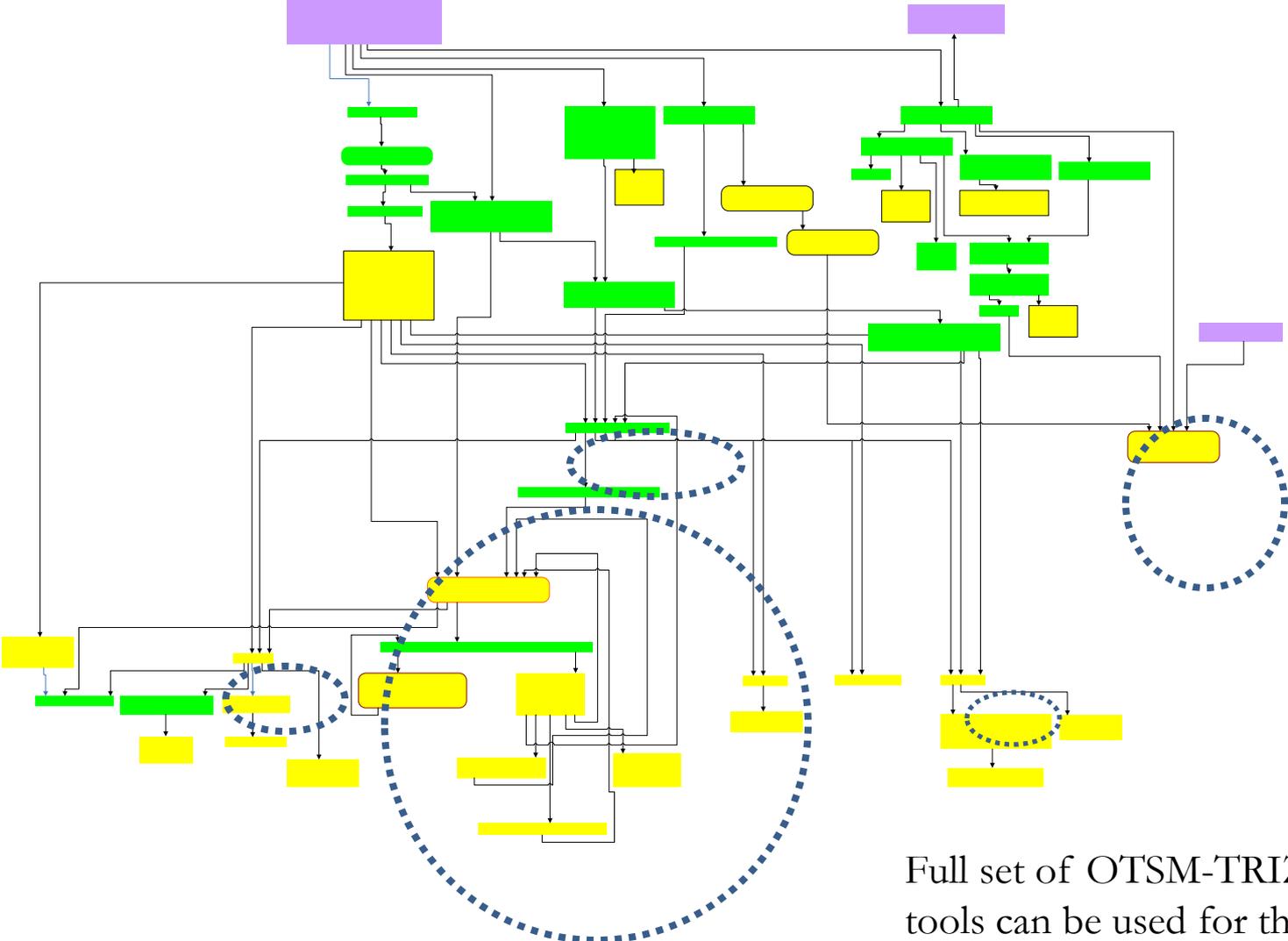
# Evolution of Classical TRIZ from simple Technique to OTSM Problem Flow Networks (PFN) approach



# Sort of decision problems, pointed out were OTSM-TRIZ could be implemented

<b>decision problems</b>	<b>task</b>	<b>occurrence</b>	<b>Support Systems</b>
Well structured Problems	Operative-tactical planning	regular	Operational Information System (OIS)
Partial structured Problems	Strategic planning	irregular	Decision Support System (DSS)
Bad structured problems	crisis management	seldom	Expert systems
Not structured problems	crisis management	seldom	Expert systems

# OTSM Network of problem as a tool to study a situation and transition to the Model of of the Problematic situation

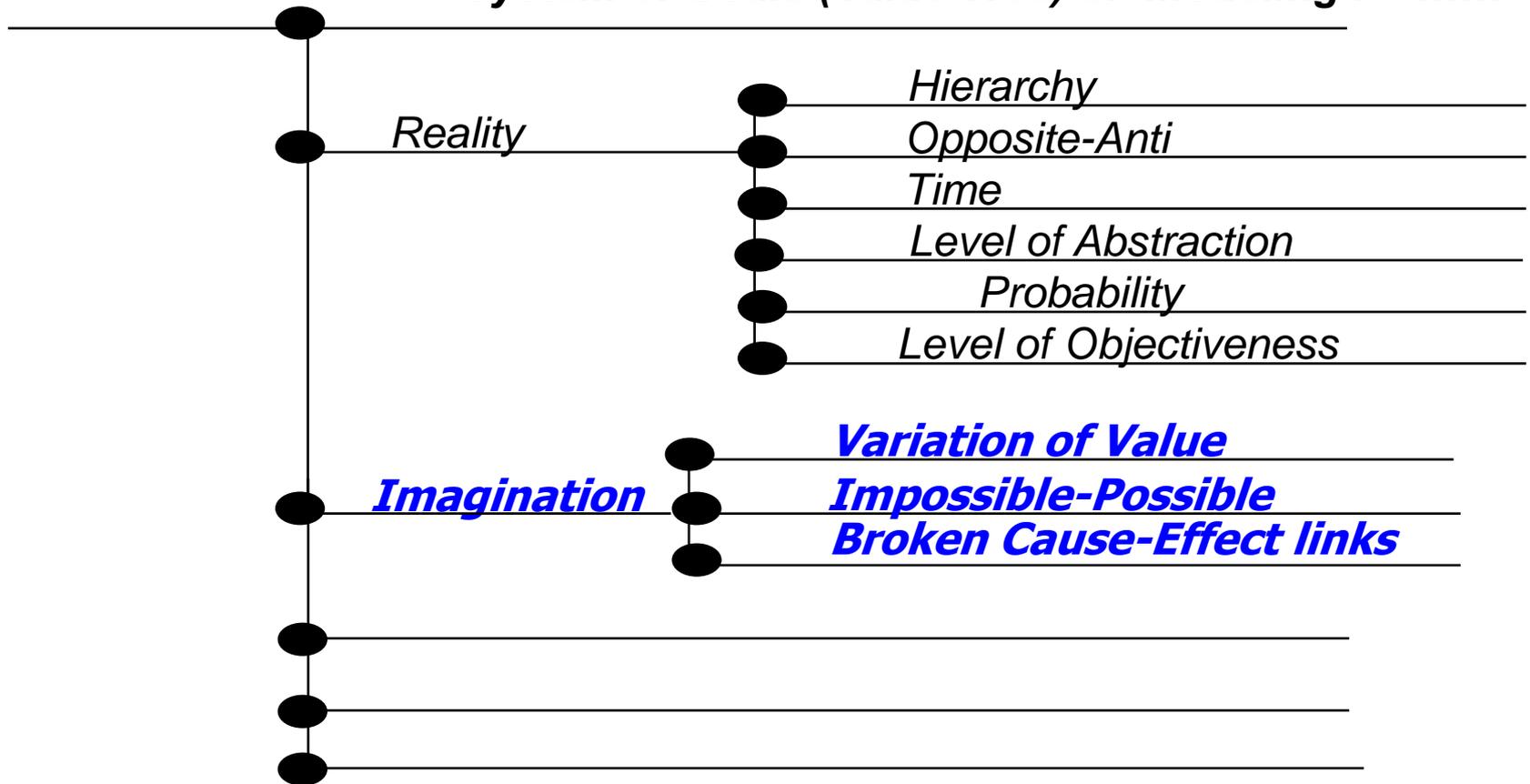


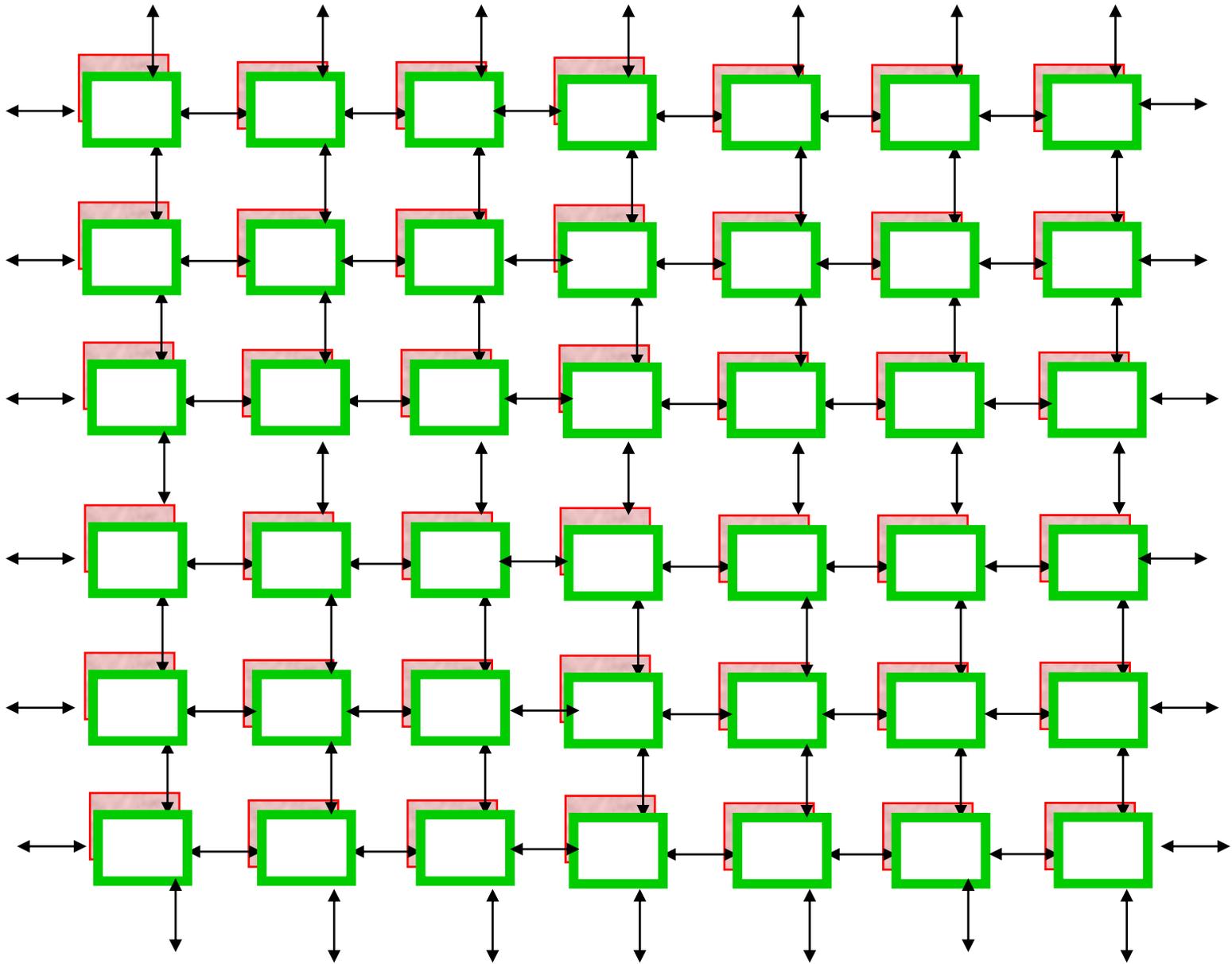
Full set of OTSM-TRIZ based tools can be used for this purpose.

# Advanced Schema of Powerful Thinking: Factors we have to take in to account during OTSM problem solving modeling:

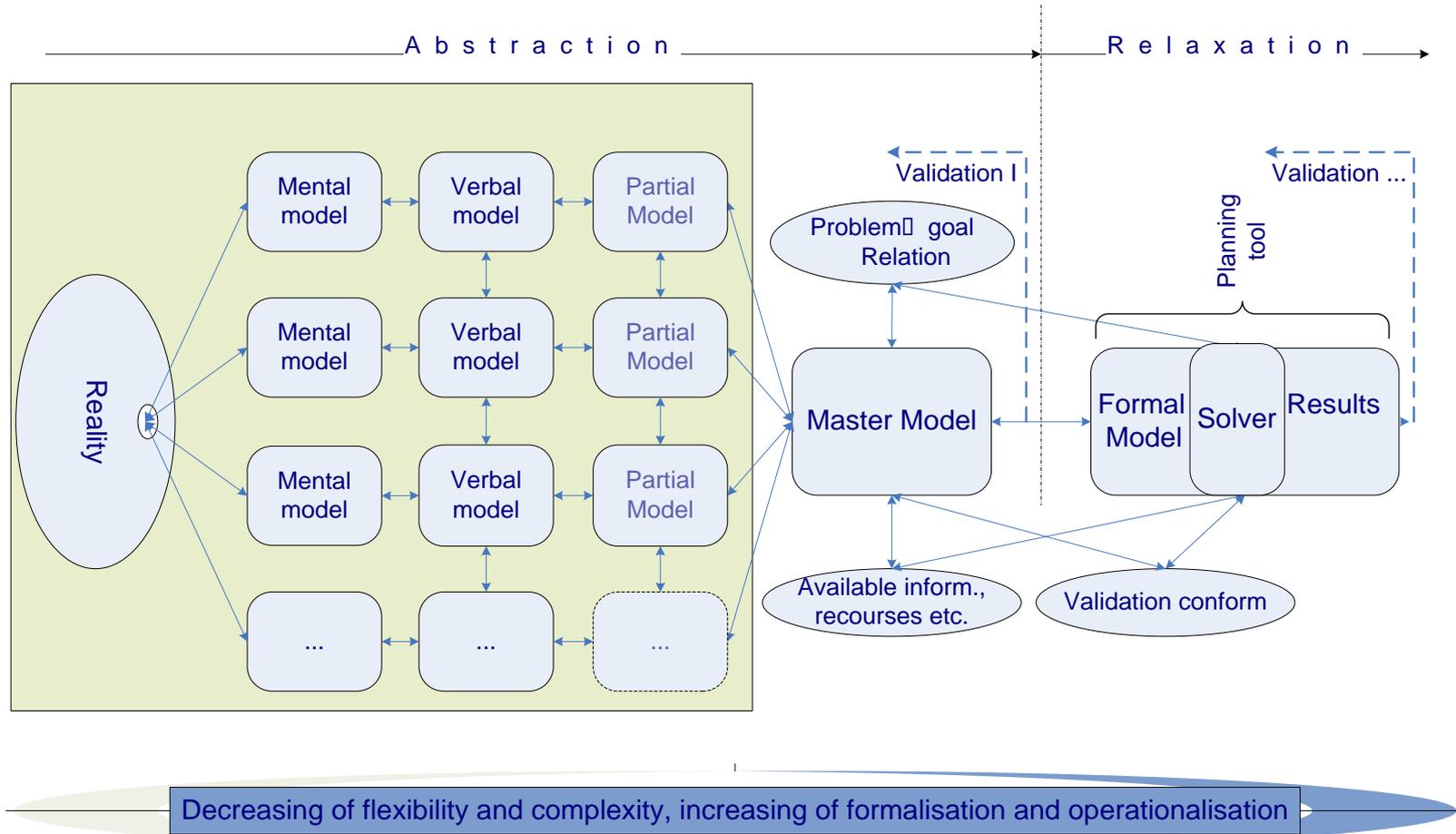
Element

*System of Goals (Value Tree) of modeling : .....*



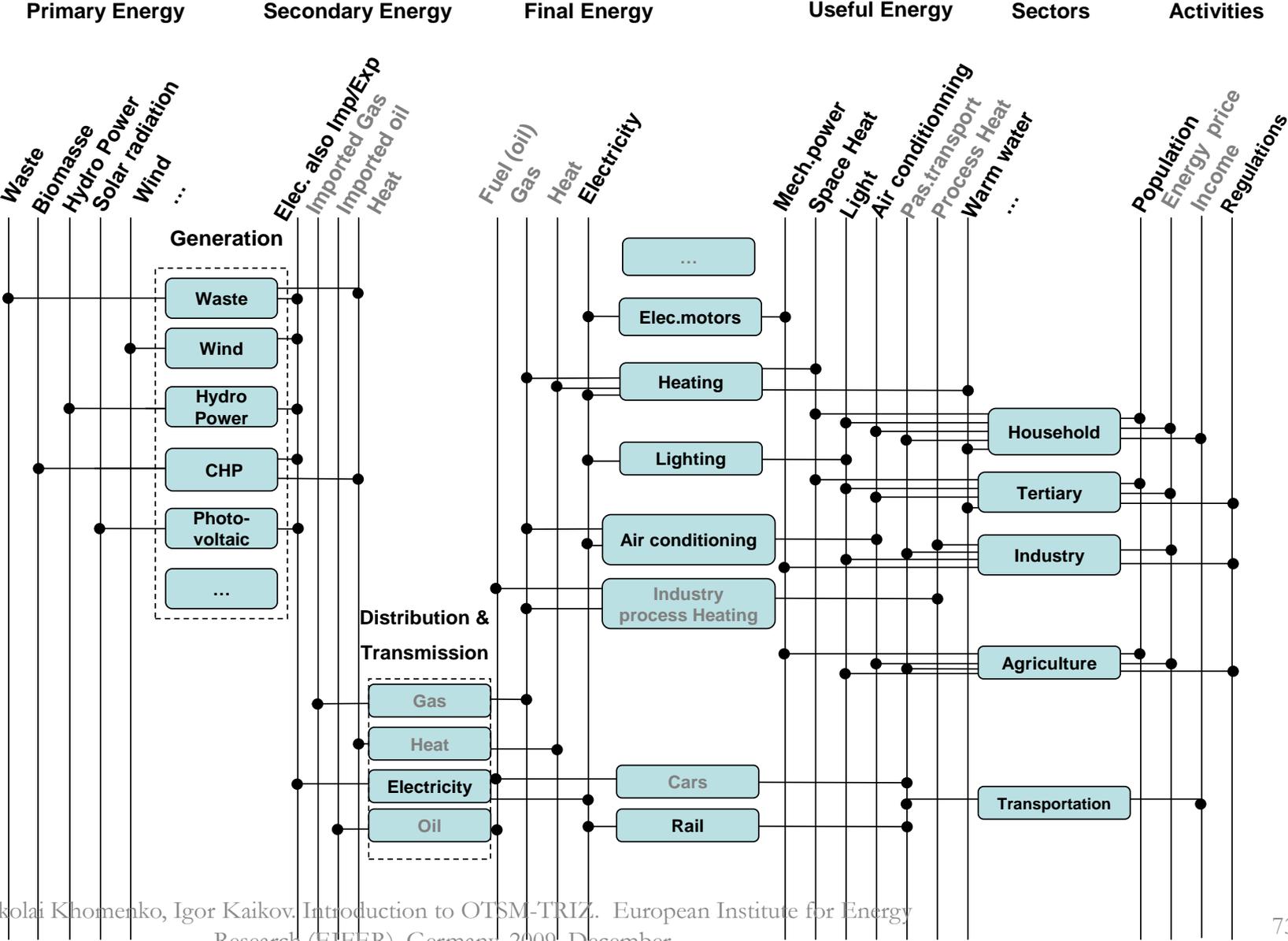


# Model building steps in the integrated, interactive energy planning

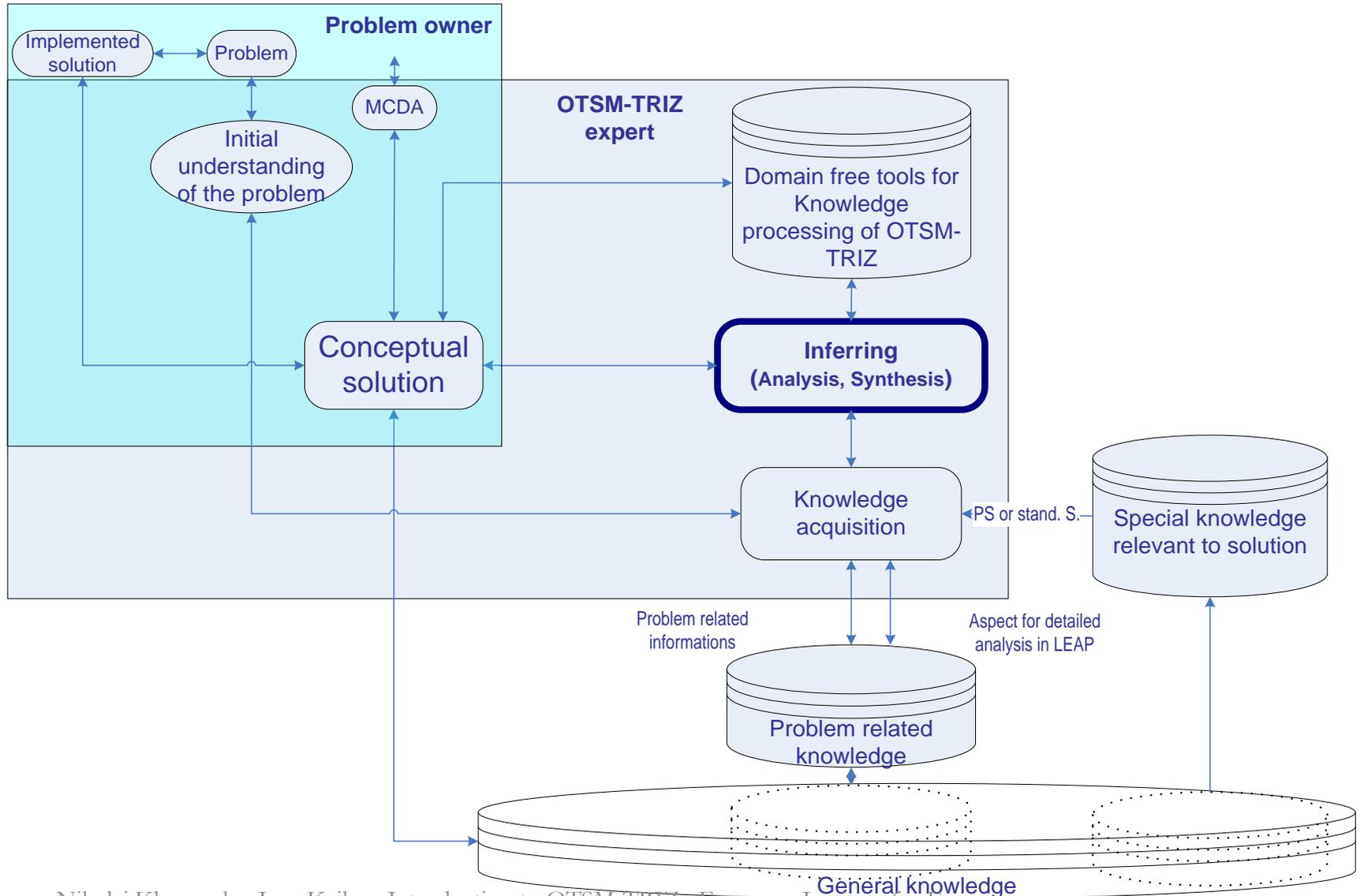


- The quality of future planning depends strongly on the quality of master model.
- If the master model was not done properly by using above all qualitative methods then using any analytical approaches in the formal model, in the planning instruments will lead to the results, which will be neither relevant nor helpful

# A fragment of Reference Energy System in the region

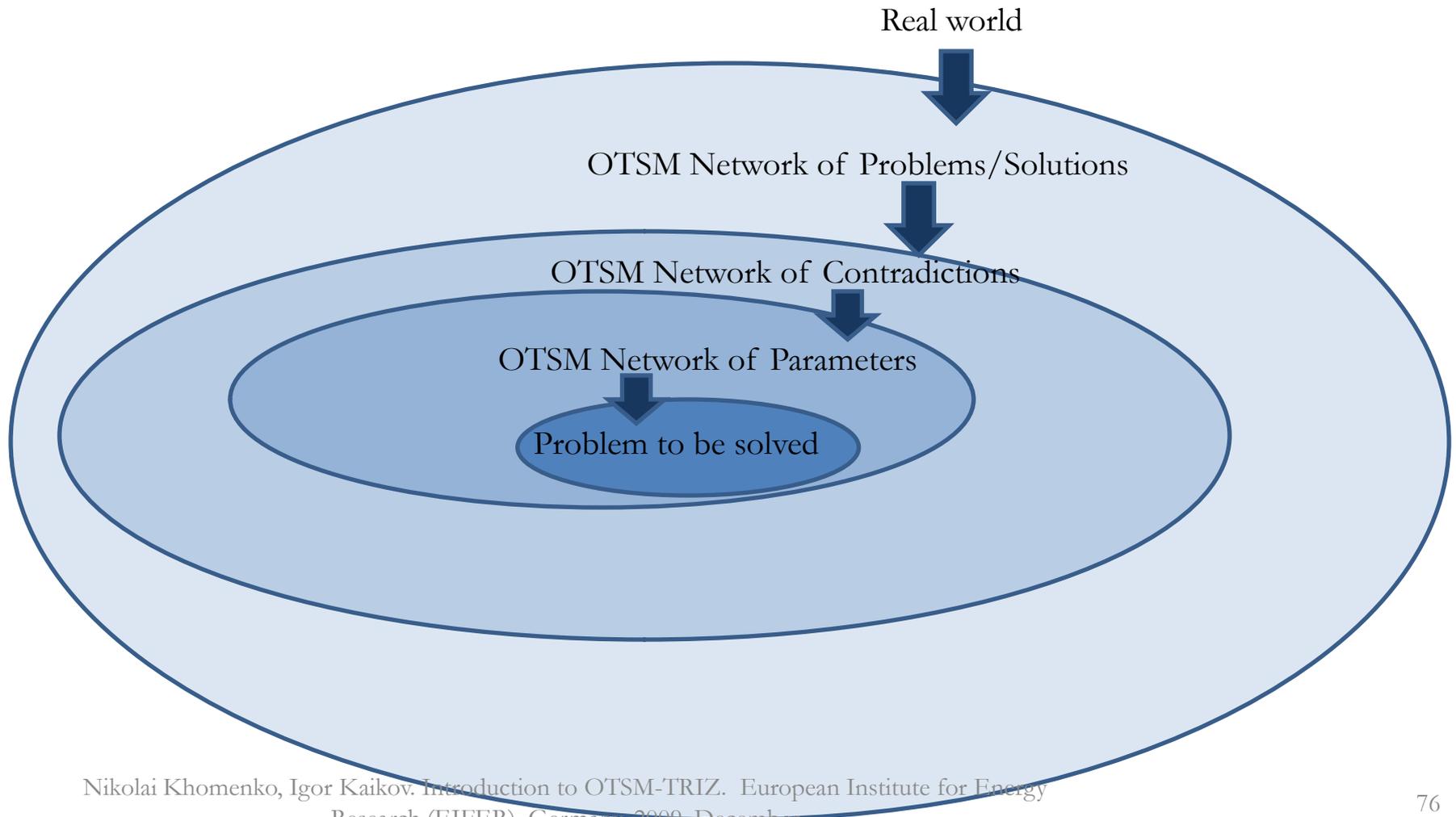


# OTSM-TRIZ model of knowledge processing in RIEP

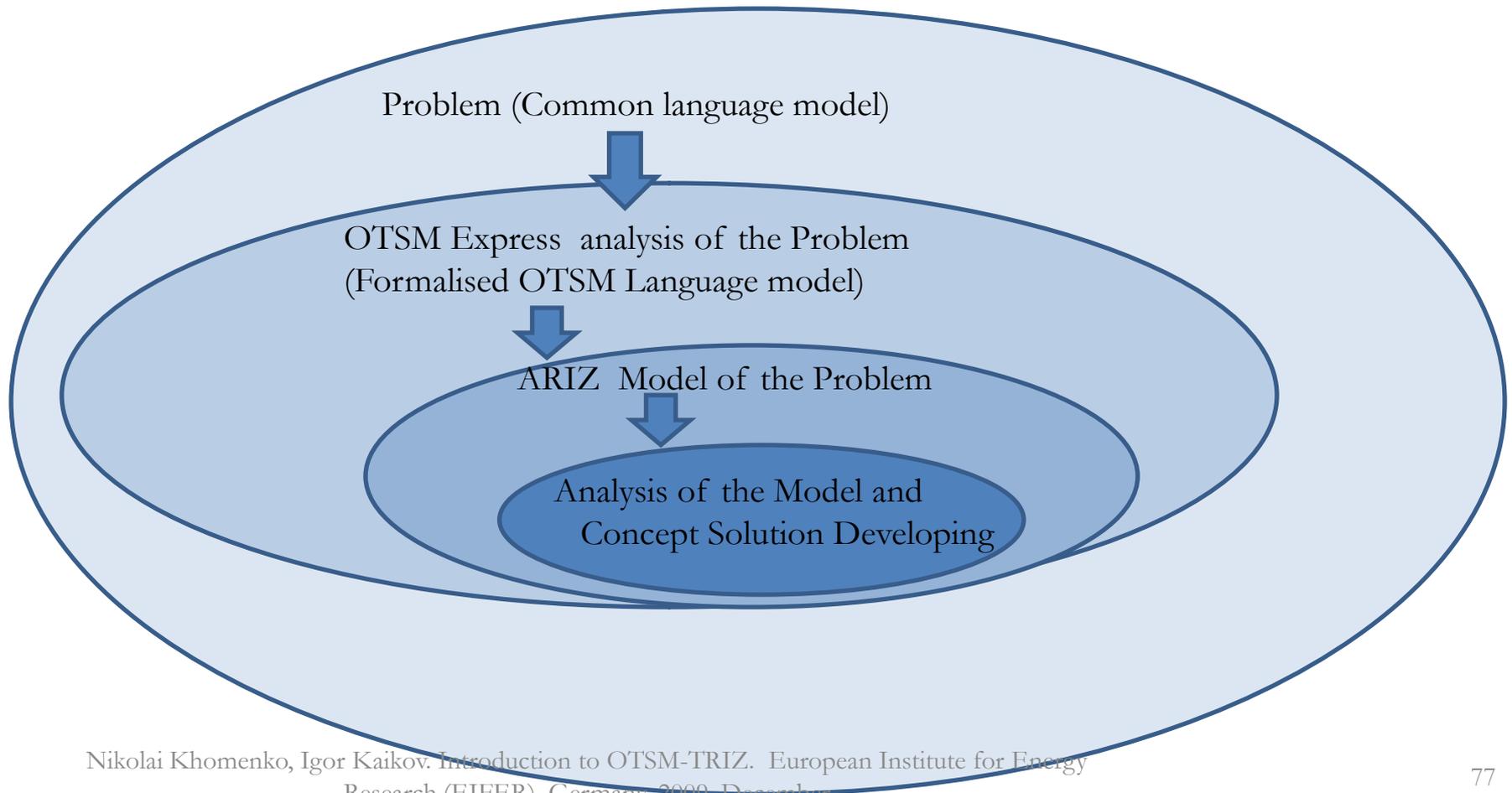


# **GENERAL SCHEMA OF OTSM PROBLEM MODELING PROCESS**

# General Model of OTSM problem modeling process : selecting a problem to be solved



# General Model of OTSM problem modeling process: stage of the problem analysis and concept solution development



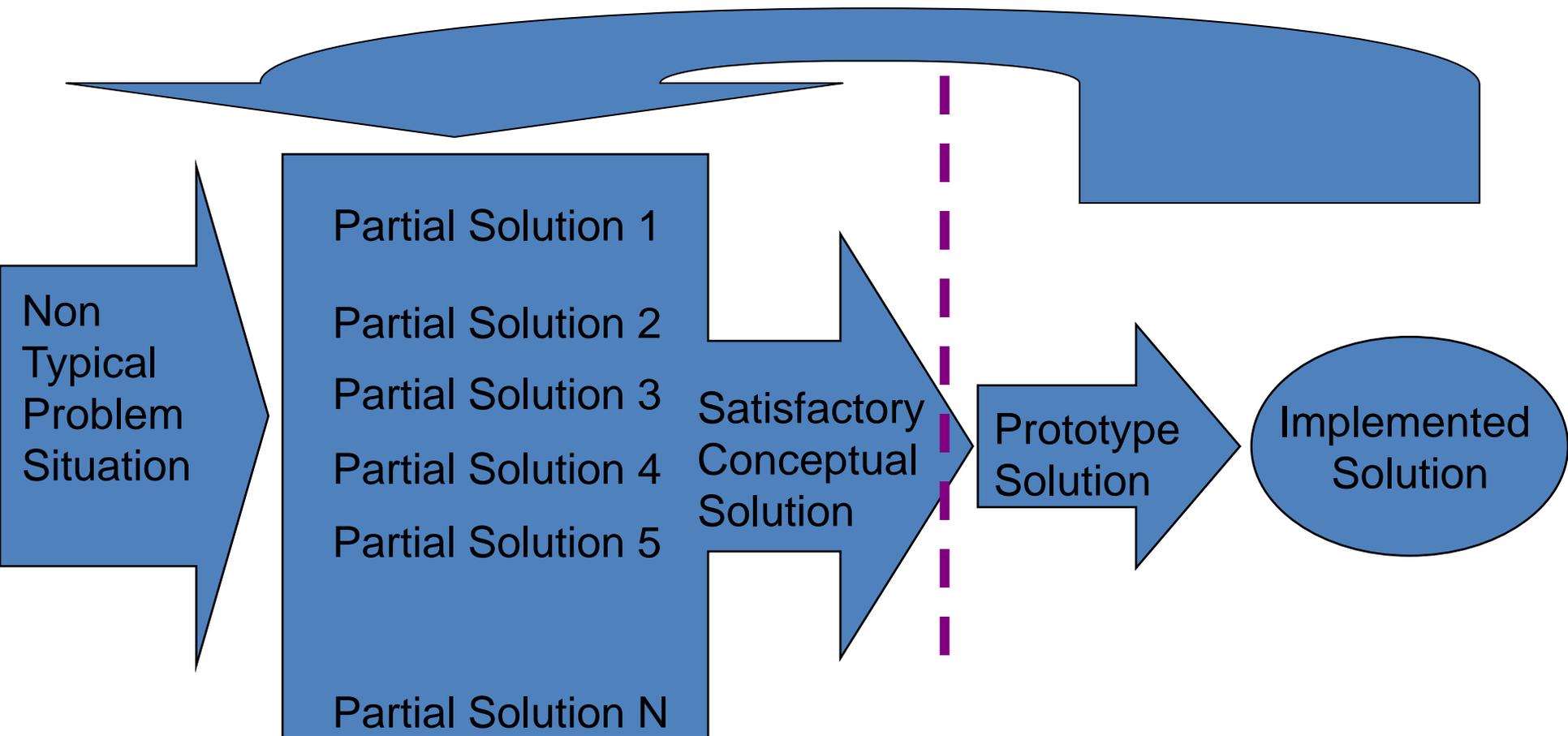
How can we know what tools of OTSM-TRIZ should be implemented for certain particular moment of a problem solving process?

## **BLACK BOXES OF OTSM**

# Instrument of OTSM-TRIZ as black boxes

- Each Instrument of Classical TRIZ and OTSM can be viewed as a Black Box that has input, and output, procedure inside the black box is an instrument itself.
- As soon as During problem solving process appear situation that we have enough Inputs for certain particular Black Box we can start typical procedure to transform inputs into outputs.
- These outputs can be inputs for some other Black Boxes (Instruments).

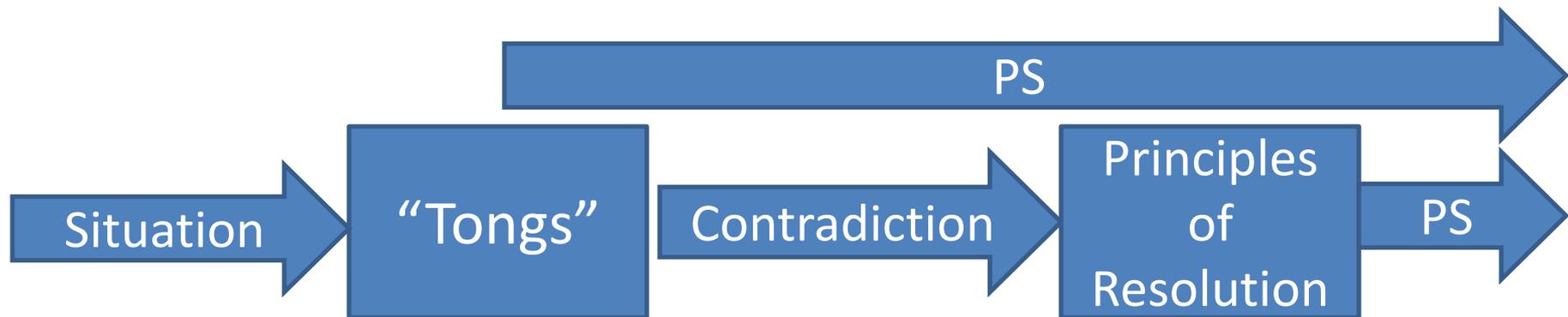
# Black boxes stimulate our mind to generate PCS and converge them into SCS



OTSM-TRIZ provides us with instruments (black boxes) to generate effective partial solutions (PS); converge those PS into a Satisfactory Conceptual Solution and evaluate those solutions objectively.

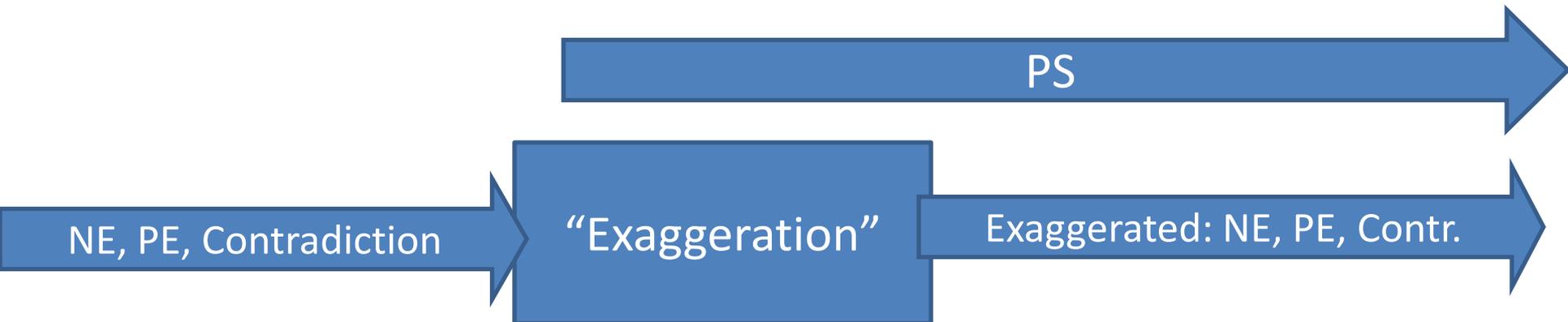
# How does it works?

- When we have initial Fuzzy situation we can use “Tongs” model to clarify it and re-frame problematic situation from situation to be improved described in common language into shape of Contradiction.
- Tongs Could be used in many ways for: Solving problem directly, for “network of problems”, to understand and fulfil each particular step of “ARIZ” or any other algorithms of OTSM-TRIZ.



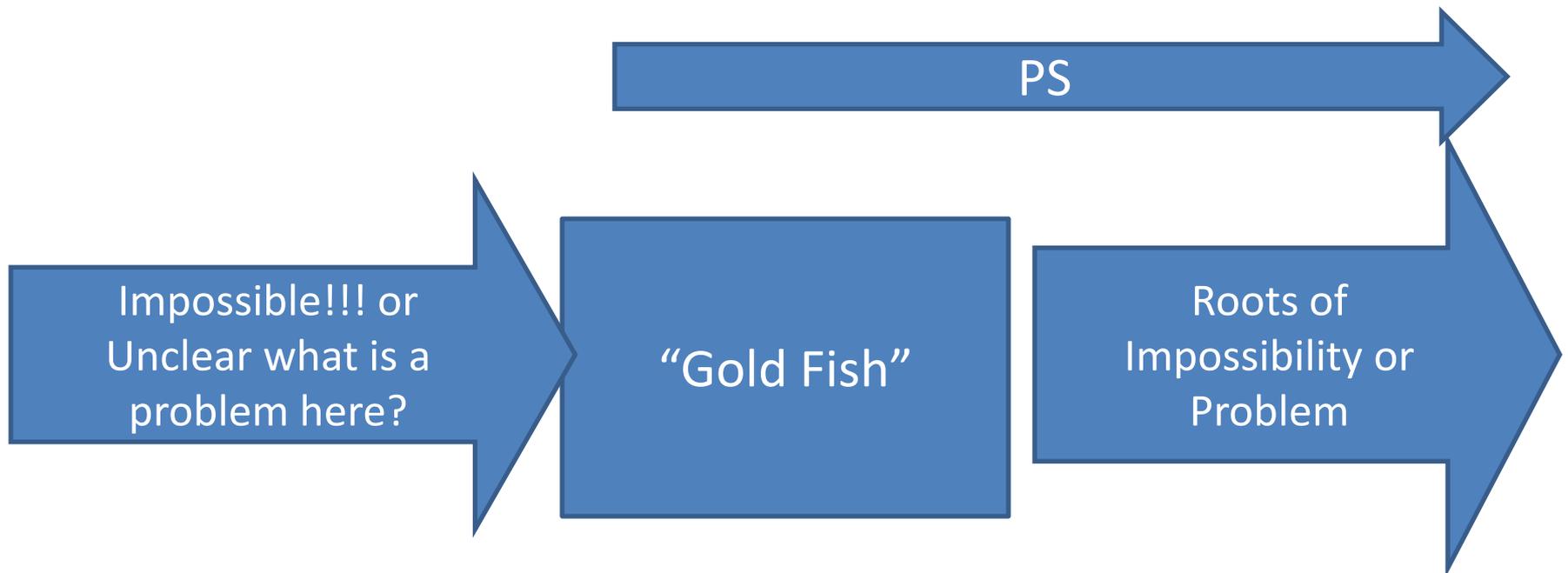
# How does it works?

- When we have Negative Effect, Positive Effect or Contradiction we can apply Black Box “Exaggeration” and obtain clear understanding on the situation. Remember that exaggeration should be done step by step.
- “Exaggeration” could be used for many black boxes: “Tongs”, “ARIZ”, “Network of problems”, “Gold Fish” etc.



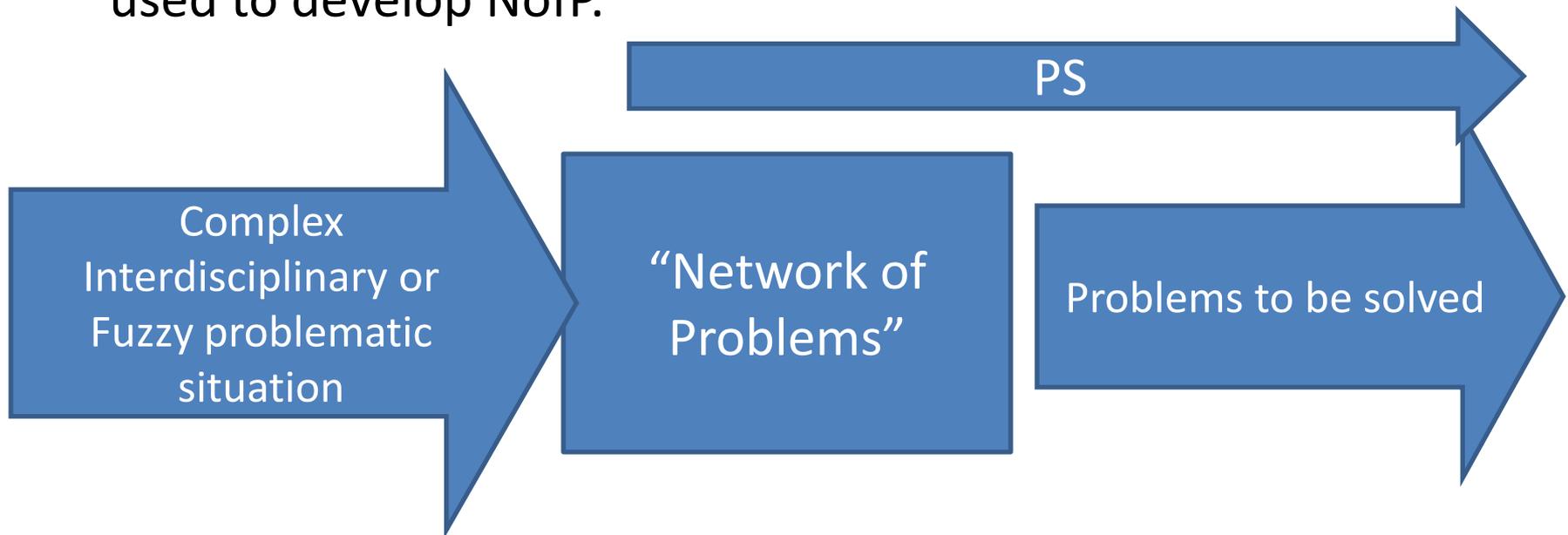
# How does it works?

- When something seems impossible or difficult identify the core of problem we can use “Gold Fish”.
- “Exaggeration” could be used for many black boxes: “Tongs”, “ARIZ”, “Network of problems”, “Gold Fish” etc.



# How does it works?

- When we confront with complex interdisciplinary problematic situation, or just unclear problematic situation, some solution leads us to new fuzzy situation we can use Network of problems (NofP).
- “NofP” could be used for “New Problem”, “Forecasting”, “Problem flow Networks” etc. In turn all Instruments could be used to develop NofP.



For the beginners problem solving process based on Classical TRIZ and OTSM often seems as a kind of Chaos that in the hand of professionals produce satisfactory solutions.

It seems as a wonder and they start to look for magic button.

But it is not.

# **MANAGING CREATIVE CHAOS**

# OTSM Chaos and self-organization of a problem solving process

- Classical TRIZ provide two main Instruments: 76 Standard Inventive Solutions (for typical TRIZ problems) and ARIZ (for non typical problems). Standards is a component of ARIZ which is Algorithm.
- However ARIZ-85-C started new generation of TRIZ based Instruments. It sufficiently improve problem solving process by better stimulating Unconscious creative processes in our mind. Sometimes at first look it seems as a Chaos.
- OTSM follow this direction further and develop instruments to manage the Creative Chaos better - Fractal Model of problem solving process. To apply the model for practise “Network of Problems” method was developed. For most complex problematic situation was developed “Problem Flow Networks” approach.
- OTSM is an “Intellectual Lego” for managing “Creative Chaos”.