

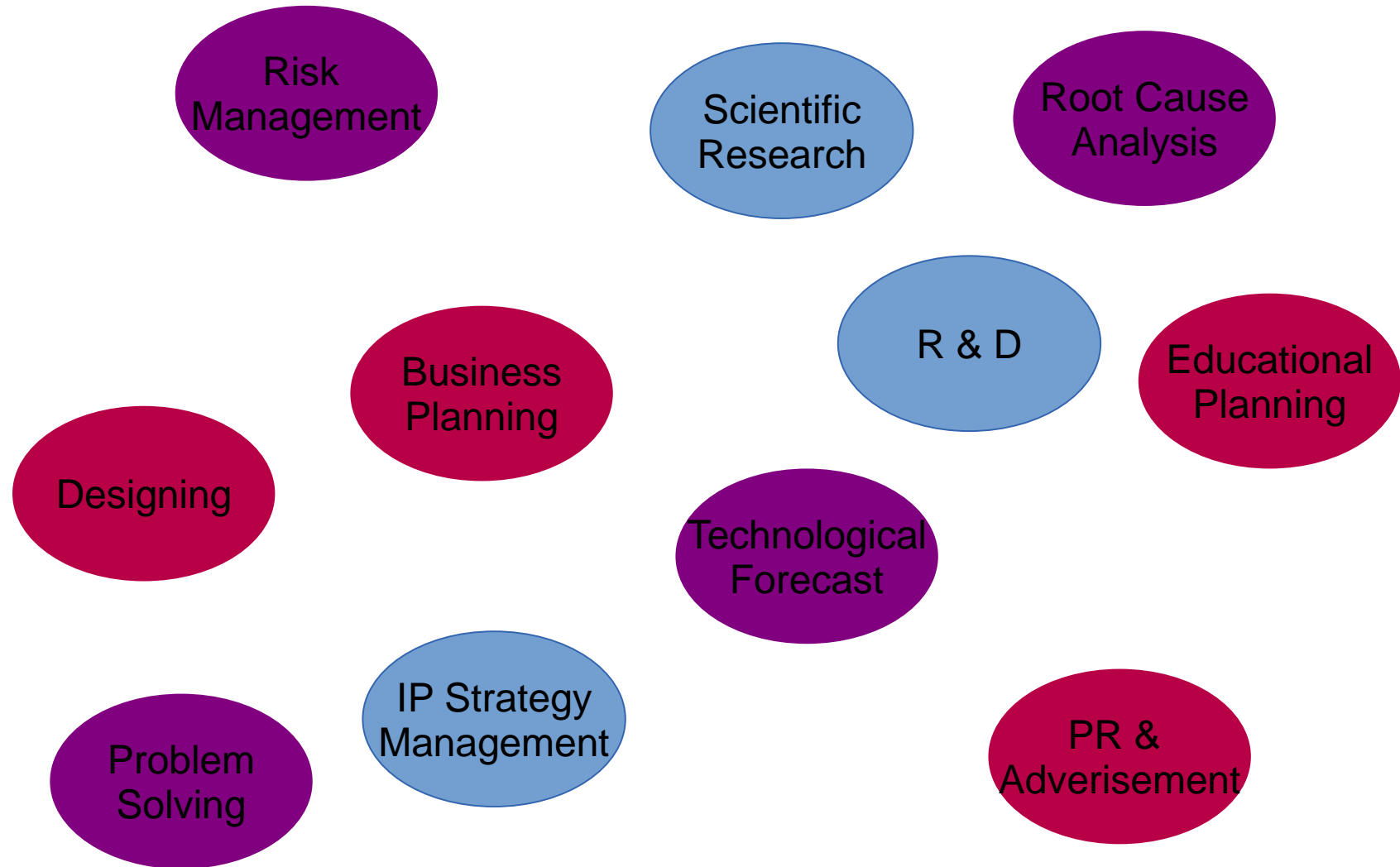
Eight Key Ideas of TRIZ

September 2014
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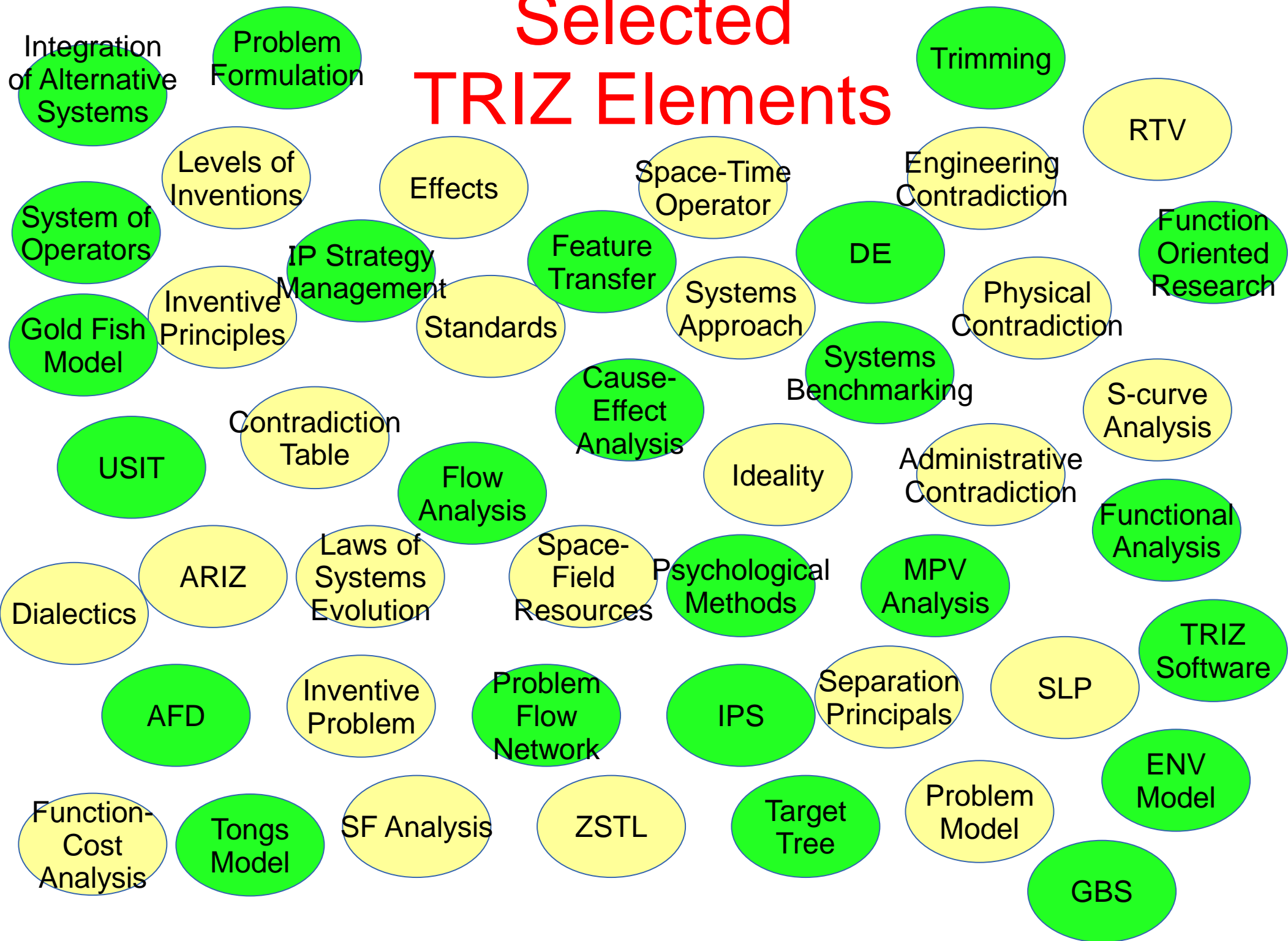
Aims of the Report

- TRIZ is a widely used technology for efficient thinking. It has supported tremendous achievements in different fields of human activity. Because it is abundant in multiple types of elements and used in various applications, however, it is not a simple task to grasp true nature of the technology.
- Impatient efforts to make TRIZ simple or easy to understand have ended up with serious sacrifice of its efficiency and potentiality.
- This report tries to present the structure of Key Ideas of TRIZ which make it powerful and fertile. Once you realize the structure, TRIZ turns out to be most logical and simple, though it is not easy to understand for those who stick to day-to-day framework of thinking.

Fields of TRIZ Application



Selected TRIZ Elements

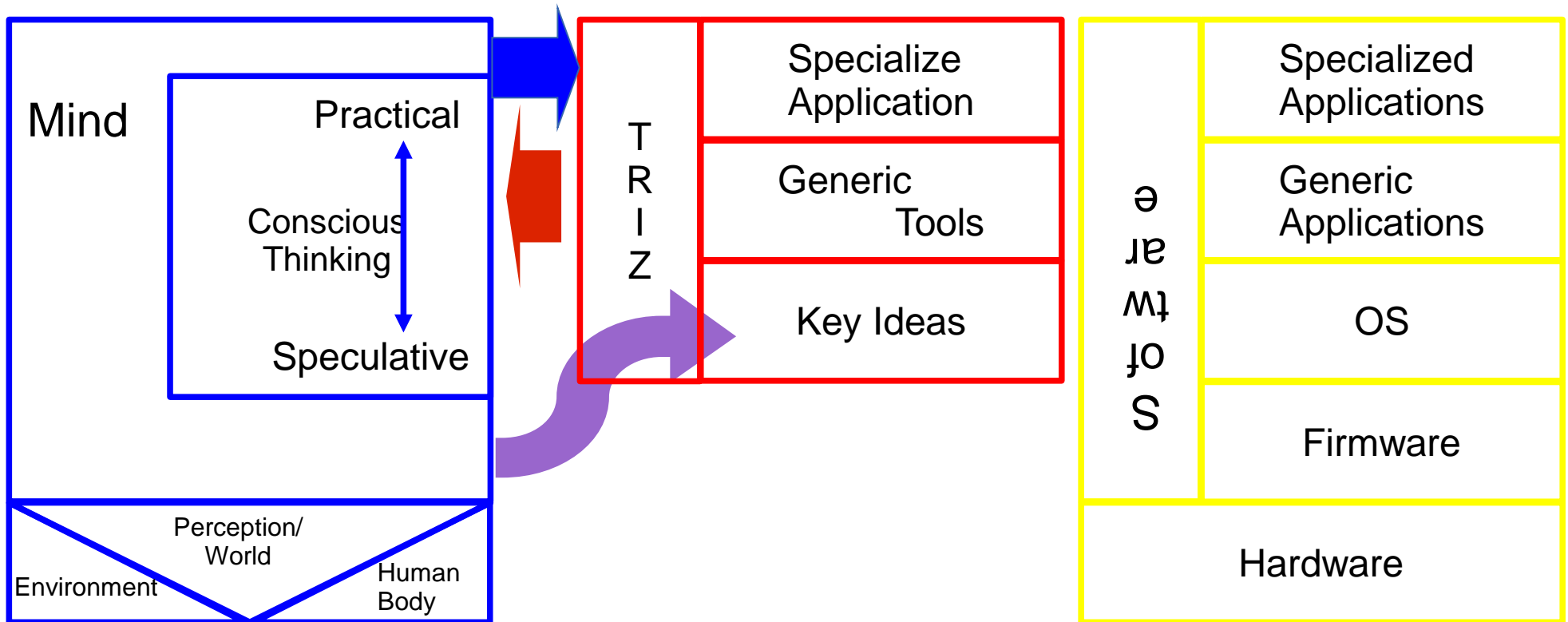


Functions of TRIZ Elements (Scope of elemental functions)

Function	Applicable Elements
Indication of Values	Contradiction, Ideality, Laws of Systems Evolution, Function-Cost Analysis, Trimming, MPV Analysis
Basis of Comparison	Levels of Invention, Ideality, Systems Benchmarking
Analysis of Macro-Structure of the Environment	Systems Approach, Problem Flow Network, Problem Formulation, ENV Model, S-curve Analysis, Function Analysis, Flow Analysis, Cause-Effect Analysis, Target Tree, Dialectics
Analysis of Micro-Structure of the Function	Problem Model, SF Analysis, Contradiction (Administrative, Engineering, Physical), ENV Model, Feature Transfer, Inventive Problem
Indication of Formal Changes	Ideality, Laws of Evolution, Inventive Principles, Standards, System of Operators, Trimming, Separation Principles, Tongs Model, Contradiction Table, Dialectics, Integration of Alternative Systems
Analysis of unused Resources	Space-Field Resources, Systems Approach, S-curve Analysis, ENV Model
Search of Resources among general information	Effects, Function Oriented Search
Focus on Features of Human Perception	Ideality, Space-Time Operator, Gold Fish Model, Tongs Model, Methods to cope with Psychological Inertia, RTV, SLP, ZSTL
Indication for Use of individual Elements	ARIZ, Function-Cost Analysis, IPS, AFD, DE, IP Strategy Management, USIT, GBS, TRIZ Software

Structure of TRIZ

an analogical inference



Preliminary Classification of TRIZ Elements

Category	Criteria	Applicable Elements
Specialized Applications	Used in limited TRIZ Applications	ARIZ, Function-Cost Analysis, IPS, AFD, DE, IP Strategy Management, USIT, GBS, TRIZ Software
Generic Tools	Used more often in different TRIZ Applications	Others
Key Ideas	Used in most of TRIZ Applications	Ideality, Contradiction, Laws of Evolution, Systems Approach, Resources, RTV (Methods to cope with Psychological Inertia), Levels of Inventions, Models, Dialectics

Productive Thinking

- We use TRIZ to support thinking efforts for satisfaction of practical needs of the life.
- This is a type of thinking which is not only conscious but also targeted to realistic results. Therefore, it can be named “Productive Thinking”.
- There are 2 types of thinking processes in Productive Thinking; **The Analytical Process** is for analysis of existing knowledges while **the Synthetic Process** is for development of new knowledges unknown to a certain group of people.
- When we think seriously, we often use a tactic where we set forth a counter argument to an existing argument for the purpose to produce an improved new reasoning. If we name the tactic “Dialectics”, it should be an inherent feature of “Productive Thinking”. Thus, it does not seem to be wise to take it a specific feature of TRIZ.

Two Processes of Productive Thinking

- Analytical Process
 - It analyzes existing knowledges to find ones which are efficient for satisfaction of confronting needs, and to clarify the border between the known and the unknown.
 - But it does not produce new knowledges.
 - Methods which support Analytical Process
 - Many methods are widely used before and parallel to TRIZ.
 - Less efforts were made for the purpose in the TRIZ community of the classical era.
 - Many TRIZ specialists are working to develop more and more practical tools, now.
- Synthetic Process
 - It develops new knowledges which have not been known to a certain group of people.
 - Methods which support Synthetic Process
 - We use “analogy” as the dal-to-day method for the Synthetic Process.
 - However, no system of technologies had been developed to support Synthetic Process before TRIZ, because it had been (and is) commonly believed that only talented people can develop outstanding new knowledges and that there could not be a method that supports Synthetic Process.
 - Abundance of elements that support Synthetic Process is a specific feature of TRIZ.

Analytical and Synthetic Processes in Action

- The target of Productive Thinking is to acquire knowledges in need.
- When they are found among the known knowledges, **Analytical Process** is productive.
- However, when no known knowledge can satisfy the needs, we ought to rely upon **Synthetic Process** and develop required knowledges.
- All the same, **we need to know the border between the known and the unknown** through **Analytical Process** before we develop new knowledges. Otherwise the **Synthetic Process could idle about**.

Analytical Process: Quadrants

- Target of Analytical Process
 - To identify what is not known for satisfaction of the confronting needs or what kind of new knowledges are necessary and to find them if they are known.

- Where the knowledges exist?
 - The table shows logical quadrants of knowledges.
 - The necessary knowledge should belong to one or more of the quadrants.

	Body/ Human Subject	Environment/ Object
Unit	Features of Perception	Features of Function of the Object
Group	Features of Values	Features of Structure of the Environment

Analytical Process and TRIZ Key Elements

	Body/ Human Subject	Environment/ Object
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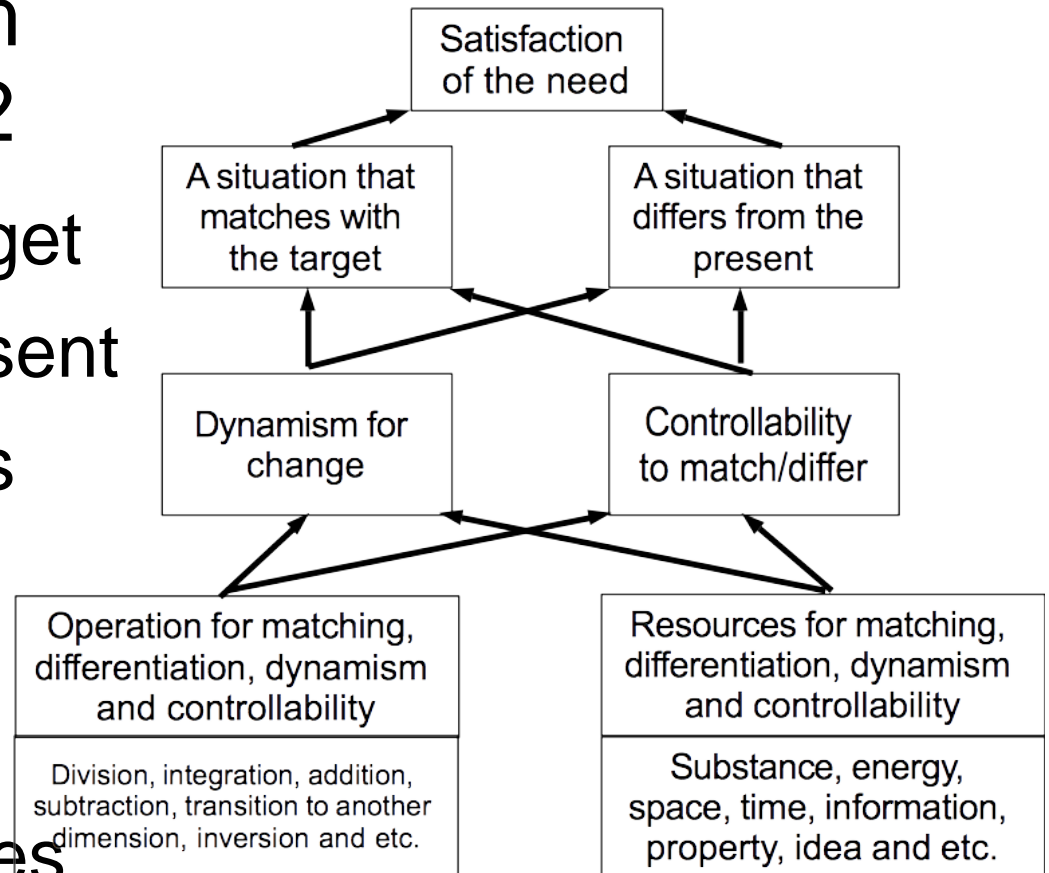
	Body /Human Subject	Environment/ Object
Unit	RTV (Methods to cope with Psychological Inertia)	Model (of the Function of an Object)
Group	Ideality/Levels of Invention (Basis of Comparison)	Systems Approach

Synthetic Process: 3 Approaches

- Target of Synthetic Process
 - To develop new knowledges that solve problems and help satisfy the confronting needs.
 - Change the present situation to match with the situation where the needs are satisfied.
- Possible 3 Approaches for Synthetic Process
 1. Improvement of Useful Factors
 - Present Situation: Necessary useful factors are missing or insufficient
 - Target: Situation where necessary factors are present.
 - Approach: Change the situation to match with the target.
 2. Elimination of Harmful Factors
 - Present Situation: Disturbing harmful factors are present.
 - Target: Situation where harmful factors do not exist.
 - Approach: Change the situation so as not to be the same with the present situation.
 3. Resolve Contradictions
 - Present Situation: Use of available knowledges for satisfaction of needs leads to harmful effect(s).
 - Target: Situation where the needs are satisfied without harmful effect(s)
 - Approach: Change the framework of the present situation and both achieve the target and avoid harmful effect(s) at the same time.

Scheme of Approaches 1 & 2

- Prerequisite for successful results from Approaches 1 and/or 2
 - Matching with the target
 - Difference from the present
 - Dynamism that allows the changes
 - Controllability for adjustment
 - Operations for changes
 - Resources which allow the changes



Approaches 1 & 2 and TRIZ Key Elements

- Strategy from the Top
 - Focus on the Ideal Results

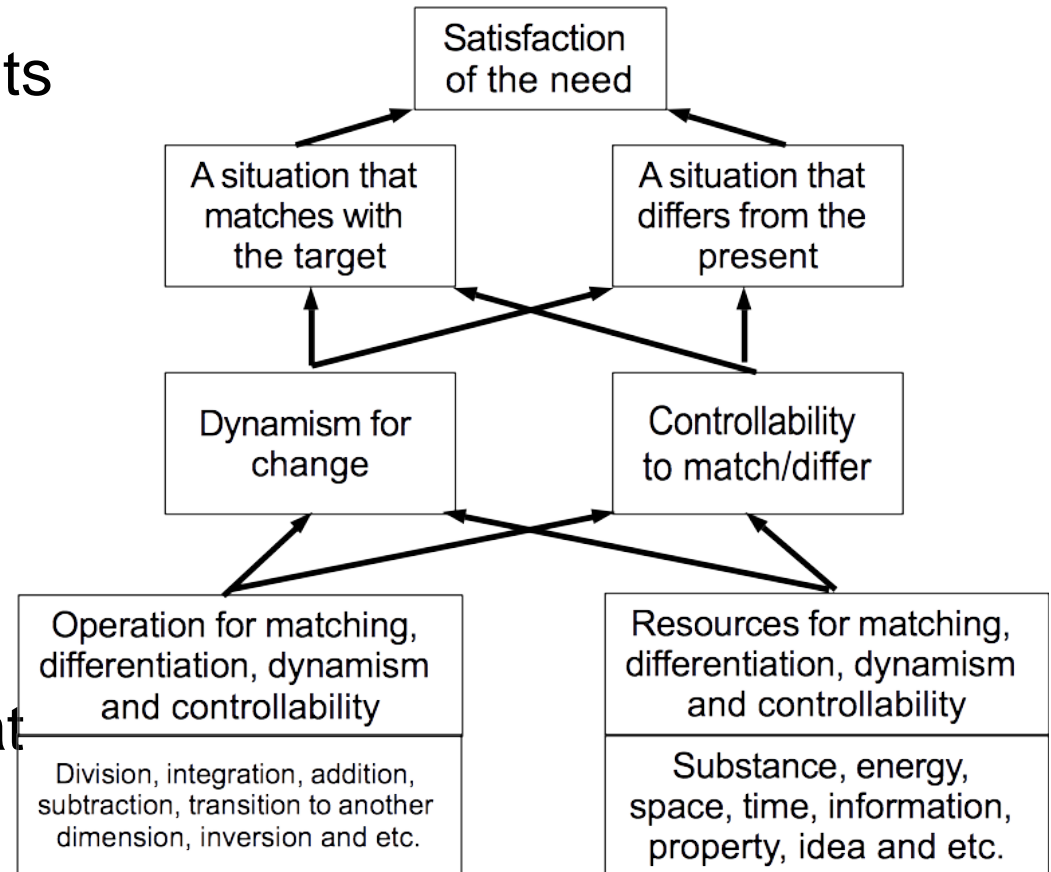
Ideality

- Strategy from the Bottom
 - Focus on the trends of formal changes of the Systems

Laws of Systems Evolution

- Strategy to utilize factors that allow changes
 - Focus on unused resources in the situation

Resources



Approach 3 and TRIZ Key Elements

- Achieve the target and avoid harmful effect(s) at the same time
- Strategy that focuses on the impossibility where use of available knowledge leads to harmful effect(s)
 - Focus to change the framework of the situation
- Strategy to utilize factors that allow changes
 - Focus on unused resources in the situation

Contradiction

Resources

TRIZ Elements and 8 Key Ideas

- Actual usage of following TRIZ Elements represents TRIZ 8 Key Ideas.
- Four Key Ideas that support Analytical Process of Productive Thinking:
 - **Models:** Focus on Function of Objects
 - **Systems Approach:** Analysis of Structure of the Environment
 - **RTV/Psychological Methods:** Focus on Human Perception
 - **Ideality/Levels of Inventions:** Analysis of Value (Sense)
- Four Key Ideas that support Synthetic Process of Productive Thinking:
 - **Contradiction:** Focus on Impossibility in the Situation
 - **Laws of Systems Evolution:** Focus on Trends of Formal Changes
 - **Resources:** Focus on Resources that allow Desirable Changes
 - **Ideality:** Focus on Desirable Results

Conclusions

- TRIZ is a system of Technologies that support Productive Thinking.
- There are 8 Key Ideas at the basement of TRIZ.
- The 8 Keys reflect the nature of Productive Thinking
- The 8 Keys can be used for the following purposes:
 - TRIZ Education
 - TRIZ Dissemination
 - Basis of skills for further development of TRIZ