

Breakthrough Concepts in TRIZ Systematic Innovation

D. Daniel Sheu

President, International Society of Innovation Methods

Professor, National Tsing Hua University

Editor-in-chief, the International Journal of Systematic Innovation

Honorary President, Society of Systematic Innovation

dsheu@i-sim.org; dsheu@ie.nthu.edu.tw;



Outline

- General Introduction of TRIZ/SI
 - Systematic vs Random Innovation
 - TRIZ history & usage overview
- Pillars of TRIZ Philosophy & Principles of TRIZ Operation
- Some TRIZ breakthrough concepts & examples
- TRIZ Positioning in Innovation Value Chain
- Closing & Q & A



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Systematic Innovation VS Random Innovation

**Innovation may be accidental, Systematic
Innovation is Destined.**

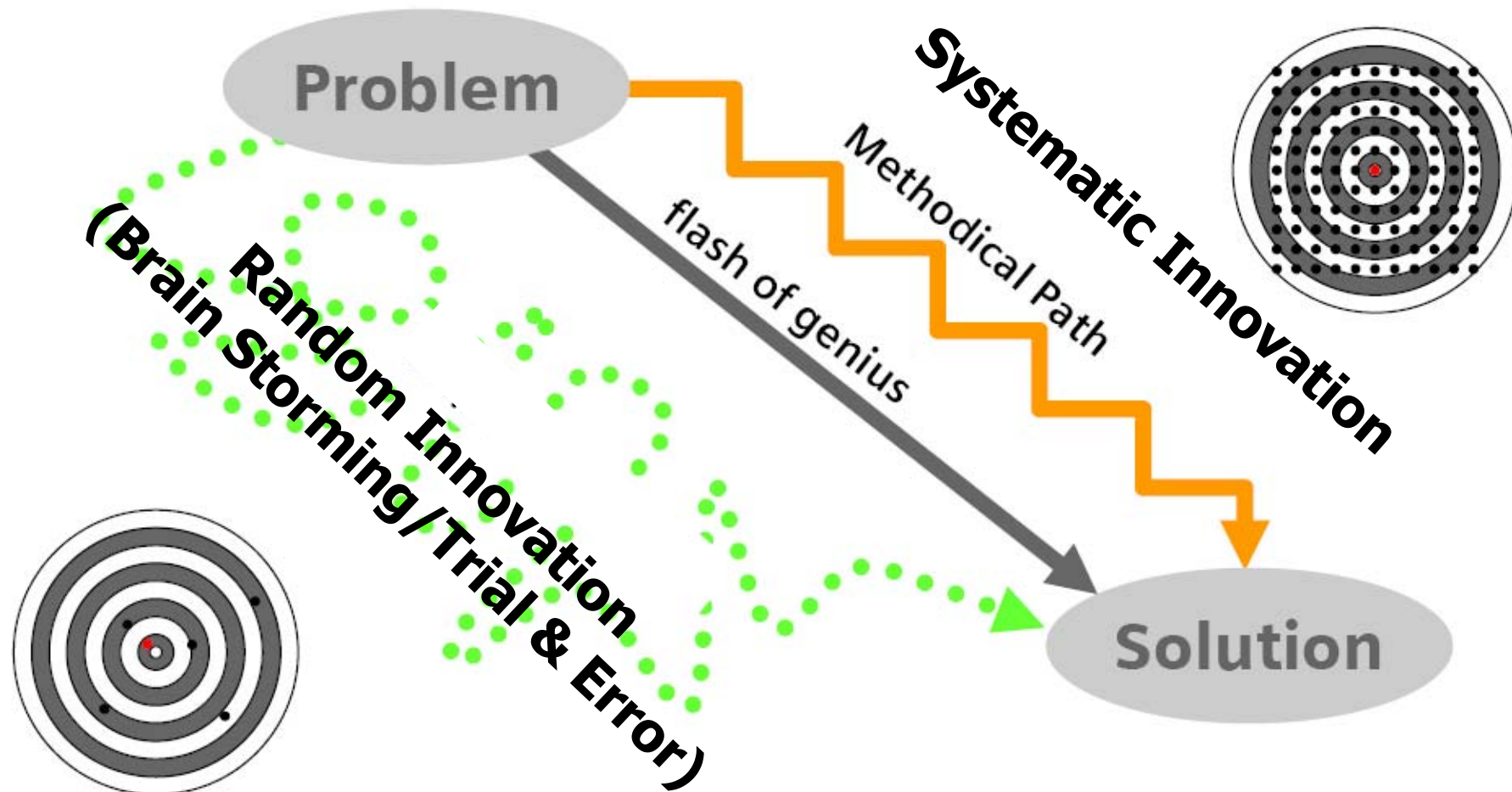
- D. Sheu 2007



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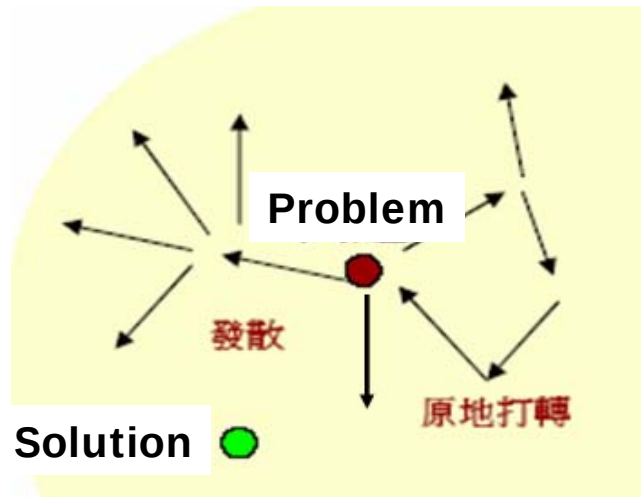
Classes of problem solving methods



The methodical path more reliably moves step-by-step to the solution
Therefore covers the whole solution space.

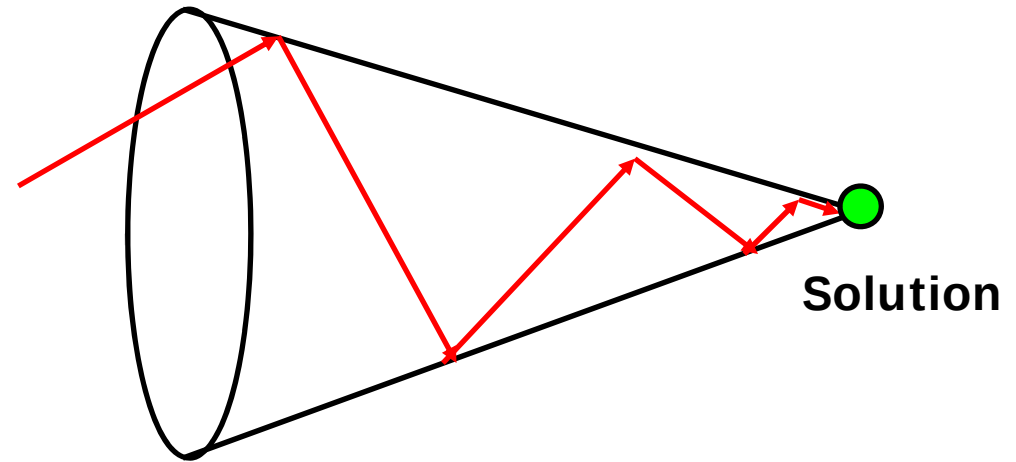
Random vs Systematic Innov.

Random Innovation
(eg. Brain Storming)



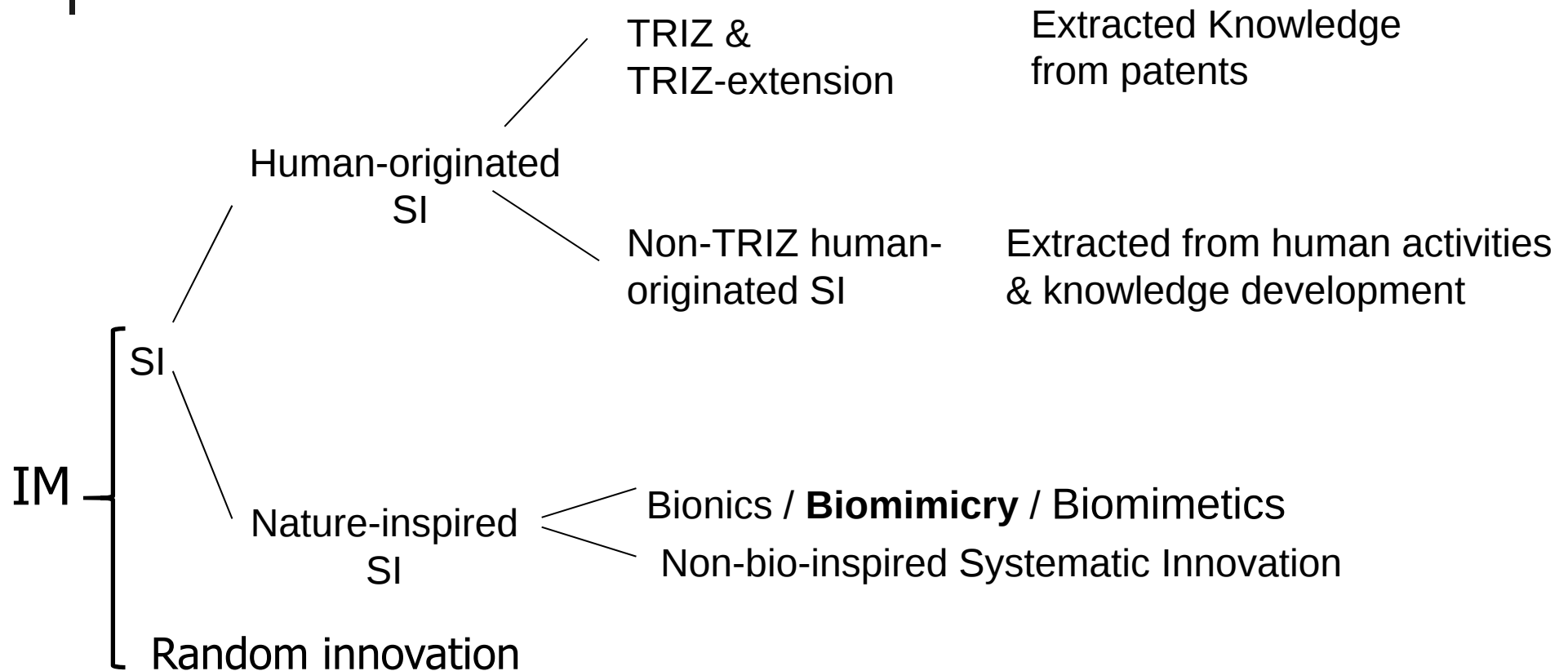
Heavily rely on luck.
Hard to get available
best solution.

Systematic Innovation: TRIZ



Use sys processes & tools can
convert to available best
solutions quicker + more
reliable.

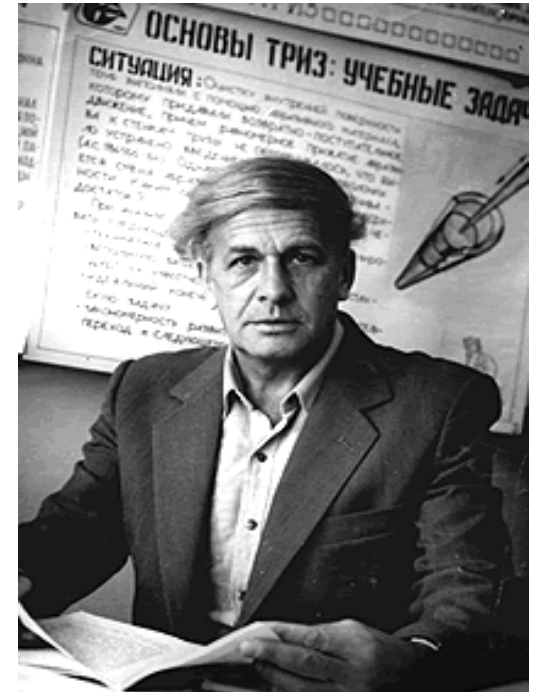
Classification of Innovation Methods (IM)



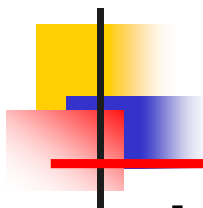
Bionics (aka **biomimetics**, **biognosis**, **biomimicry**, or **bionical creativity engineering**) is the application of biological methods and systems found in nature to the study and design of engineering systems and modern technology.

What is TRIZ ?

- TRIZ: Russian acronym of **T**eoriya **R**esheniya **I**zobreatatelskikh **Z**adatch , (Theory of Inventive Problem Solving) ◦ (TIPS)
- Chinese translation: 萃智 (Extraction of prior Wisdom)
- Originated by a Russian Navy patent examiner (Genrich Altshuller) since 1946.
- Comes from the study of best 40K patents in the world then. (Now over million patents studied.)
- Unlike random brain storming , TRIZ stress that innovation can be obtained from systematic thinking processes and tools instead of trial and Error.
- The whole process is systematically extracted from the in-depth studies of prior wisdom – best patents.



**G.Altshuller
(1926-1998)**



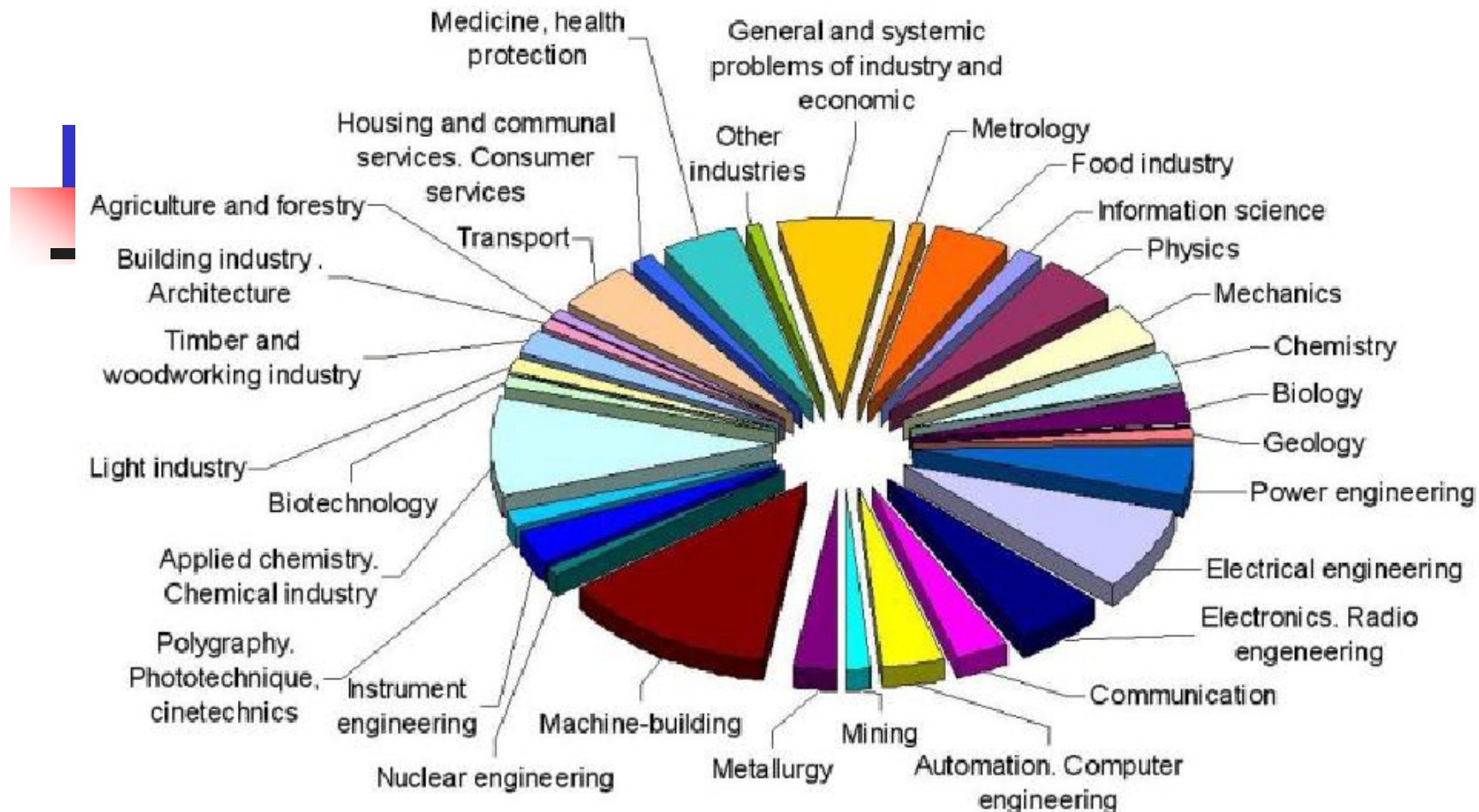
Applications of SI/TRIZ++

- **Identifying Innovative Products & Services**
- **Solving Engineering problems**
 - (New) product Development/Improvements
 - (New) Process/Eqm. Development /Improvements
 - Patent circumvention/enhancements
- **Management / Service Applications:**
 - Identifying Organizational conflicts & solving them
 - Business Model Innovation
 - Establish Innovation Strategies (SI)
- **Combine with other tools to solve problems:**
 - VE; QFD; FMEA; 6-Sigma tools, Lean, TOC,...



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Sample TRIZ Application Industries by a Consulting Company



**Source: 2009 TRIZ Developer Summit, Saint Petersburg
Open Workshop By GEN3 Partners**

Some Companies That Use TRIZ

Automotive



Medical Technology



Aerospace



Petroleum



Consumer Goods



Optics and telecom

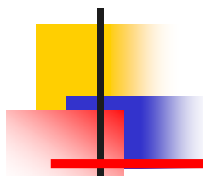


Electronics/Electrical



More...





Outline

- General Introduction

- Pillars of TRIZ Philosophy & Principles of TRIZ Operation

- Resources: $\cap$ to $\cup$ & H to H
- Product - Function - Value
- Contradiction
- Space-Time-Domain-Interface

- TRIZ breakthrough concepts & examples

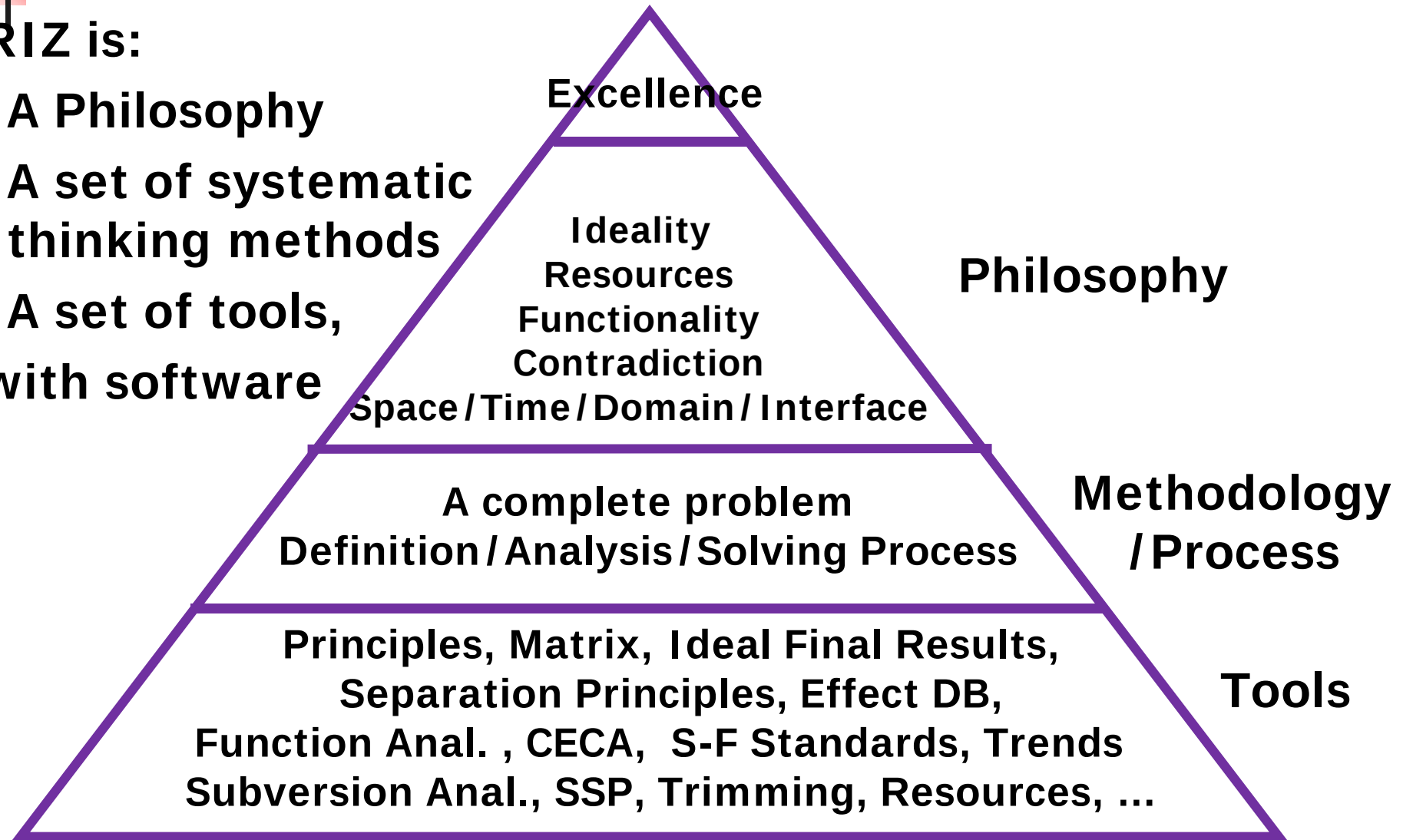
- Innovation Value Chain & TRIZ Positioning

- Summary & Further learning resources

Hierarchical View of TRIZ

TRIZ is:

- A Philosophy
- A set of systematic thinking methods
- A set of tools, with software



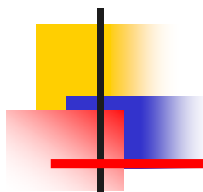
5 Pillars of TRIZ



- Ideality: goodness index for all products/services
- Resources):
 - Achieving function with minimum resource usage (Want horse to run fast but do not want to buy grasses to feed them.)
 - Non-use to Useful: (piezoelectric power on Tokyo subway) 
 - Harm to Help: Fossil fuel Power plant 
- Functionality: => Sheu:→Value 
- Contradiction: Barrier for all technical advancements
- Space-Time-Domain-Interface (**Think out-of-box**)
 - Seeing things from diff. perspectives.
 - Something may be difficult from one viewpoint, but can become easy to understand seeing from a different viewpoint.
 - Image example 

TRIZ provided systematic way of achieving above.





Ideality & IFR

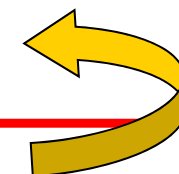
■ Ideality = Benefit / (Cost + Harm)

$$= \frac{(\textit{Perceived}) \textit{Benefit}}{\textit{Cost} + \textit{Harm}}$$

$$= \frac{\textit{UsefulFunction}}{\textit{HarmfulFunction}}$$

■ IFR (Ideal Final Result)

Achieving desired function with no harm and no resource costs. (i.e.: Ideality = ∞)



Non-use/waste => Useful

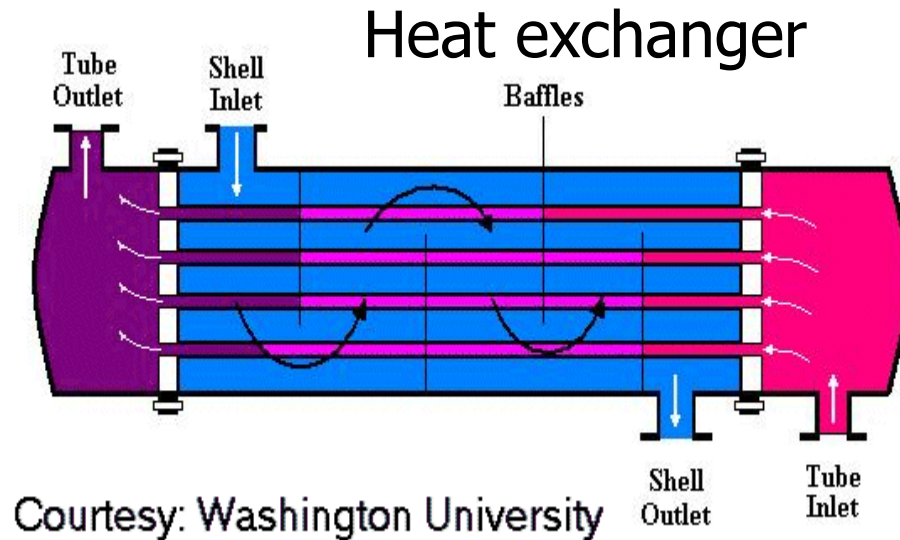
<http://inhabitat.com/tokyo-subway-stations-get-piezoelectric-floors/>



More than 4 millions of people commute at Tokyo station. The energy stepped on floor are useless.

Tokyo station created piezoelectric (floor) sheets which generate electricity when pedestrians step on it. The system harvest the kinetic energy generated by crowds to power ticket gates and display systems!

Turning Harm to Help

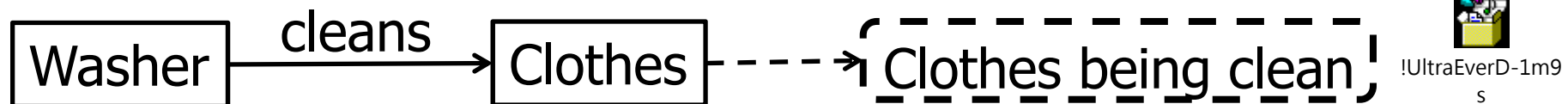


Product -> function -> Value

- TRIZ Functionality: physical system is means NOT goal.
Function is what you need. => minimize physical system/comp.

- Sheu's **Value** concept:

Value is what you really need. You may obtain value without current function or by using different function; (clean clothes => cloth repulsive to particles. Never get dirt.)



Function: Clean Clothes; Value: clothes being clean

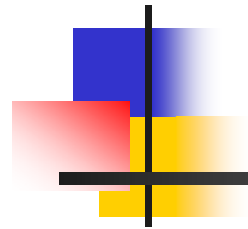
- 1) Use diff **function** to achieve same value. (Clean dirt => Repel particle)
 - 2) Achieving same function, you can use diff **action principles (effect)** (eg.: water cleaning => chemical clean / air blowing off particles)
 - 3) Achieve same action principle, you may use different **components**. (Instead of water carrying detergent, use other liquid or steam to carry detergent.)
- Solve a problem @ **Value / Function / Effect / Comp. levels.**
 - **Satisfying @ a higher level achieves higher innovation.**
 - Can also be used for patent circumvention/enhancement/regeneration

Psychological Inertia

- We don't see things as they are, we see things as we are.
- People often see things based on their own experience/thinking patterns and look at the things on the space/times/interface of where it appears.
=> Psychological Inertia
- TRIZ has a number of tools to help us break our Psychological Inertia



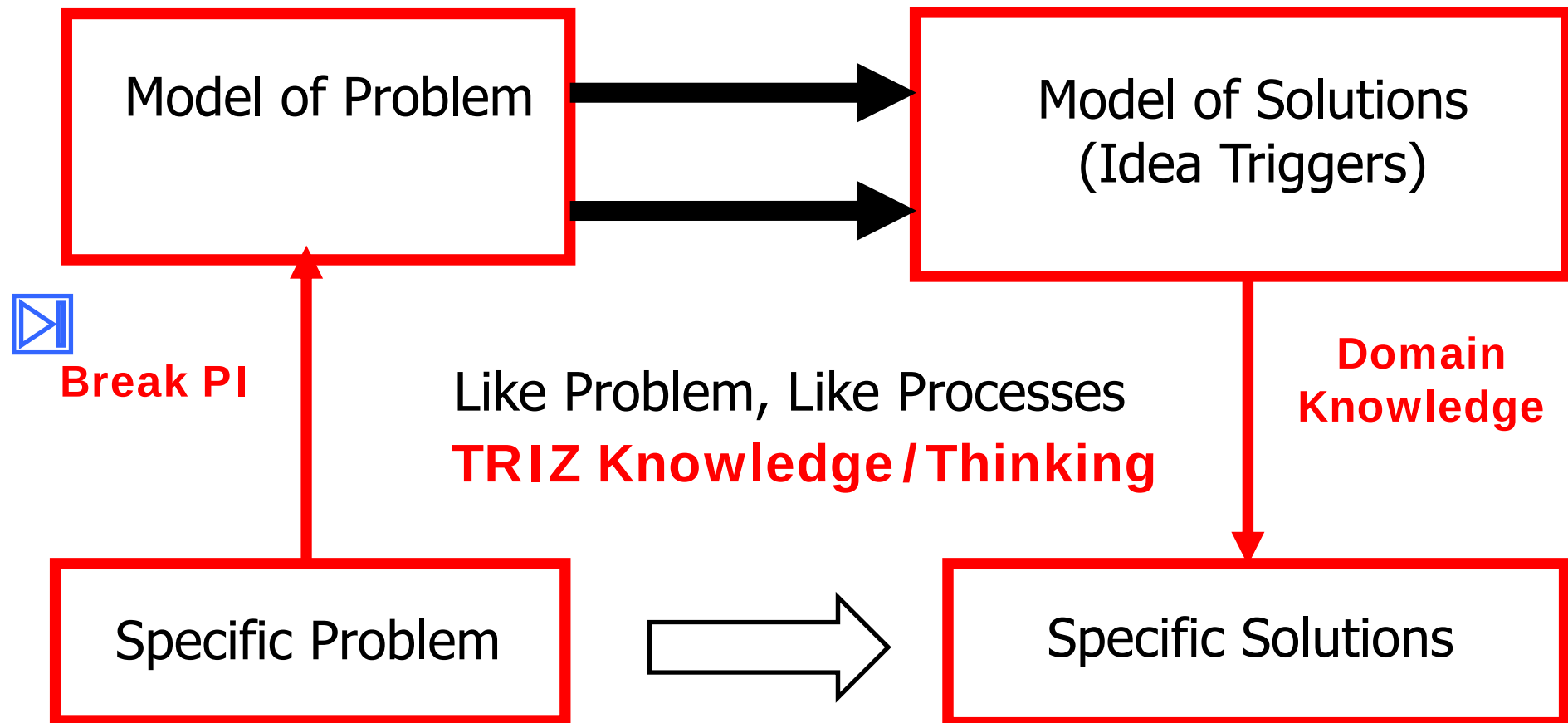
Anaïs Nin (1903 – 77),
a Cuban-French author.



How TRIZ works

TRIZ Problem Solving Model & Factors for success

Like Problem, Like Solutions



Same Generic Function Leveraging across industries

Field/Industry	Func. Carrier	Action	Object
Construction Industry	Hammer	Hits	Nail
Printer industry	Printer mechanism	Advances	Paper
Athletic Industry	Pitcher	Throws	Ball

NONE of the functions/objects look similar.

Generic term: To move a solid.

Frictional force (advance paper) => throw curve balls

Normal force on nail => Throw balls

Space– Time – Domain - Interface

Back

Start Again

The Effects Database has 208 suggestions for Move Solid

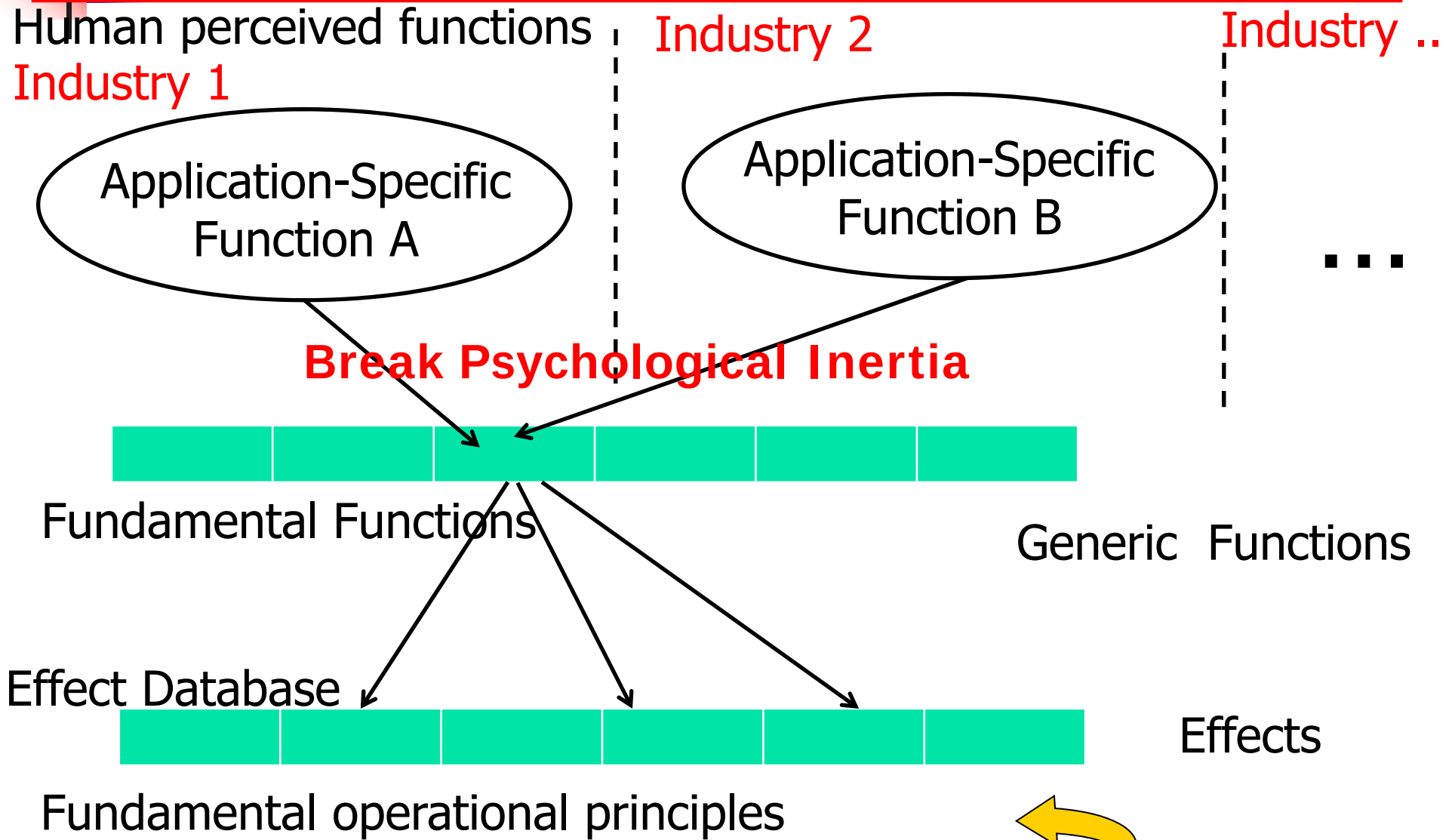
Advection	Electrohydrodynamic Thruster	Jet	Roller
Aeolipile	Electrohydrodynamics	Johnsen-Rahbek Effect	Saltation (geology)
Aeroelastic Flutter	Electrolysis	Kármán Vortex Street	Screw
Aerofoil	Electromagnet	Lever	Sedimentation
Angle of Repose	Electromagnetic Induction	Lewis	Settling
Angular Momentum	Electromechanical Film	Light	Shaking
Angular Momentum Conservation	Electron Impact Desorption	Linear Motor	Shape Memory Alloy
Archimedes Screw	Electrophoresis	Liquid-Liquid Extraction	Shape Memory Polymer
Archimedes' Principle (Buoyancy)	Electrophoretic Deposition	Lorentz Force	Shock Wave
Auxetic Materials	Electroplating	Lotus Leaf Effect	Sol
Auxetic Structures	Electrostatic Deposition	Maglev	Solenoid
Ball	Electrostatic Induction	Magnetic Field	Solvation
Bernoulli Effect	Electrostatics	Magnetic Pulse Welding	Sound
Bi-Metallic Strip	Electrostriction	Magnetic River	Spanish Windlass
Block and Tackle	Entropic Explosion	Magnetic Shape Memory	Sphericon
Boundary Layer	Erosion	Magnetism	Spheroid
Bourdon Spring	Escapement	Magnetoelastic Effects	Spring
Brazil Nut Effect	Explosion	Magnetohydrodynamic Effect	Stick-slip Phenomenon
Brownian Motion	Fan	Magnetovolume Effect	Stirling Cycle
Brownian Motor	Ferromagnetism	Magnus Effect	Stokes Drift
Brush	Fin	Mechanical Force	Sublimation
Cam	Flocculation	Meissner Body	Sun and Planet Gear
Catapult Effect	Fluid Spray	Misznay-Schardin Effect	Superconductivity
Centrifugal Force	Fluidisation	Mixed Convection	Surface Acoustic Wave
Cheerio Effect	Flywheel	Möbius Strip	Surface of Constant Width
Chemical Transport Reactions	Foil (fluid mechanics)	Negative Thermal Expansion	Tea Leaf Paradox
Coanda Effect	Force	Nuclear Fission	Tension
Coilgun	Forced Convection	Oloid	Thermal Contraction
Colloid	Free Convection	Optical Tweezers	Thermal Expansion
Compression	Free Fall	Origami	Thermo-magnetic Motor
Conservation of Momentum	Friction	Ostwald Ripening	Thermophoresis

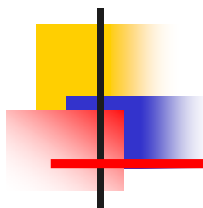
www.triz.co.uk => 208 (Effect + Resources)



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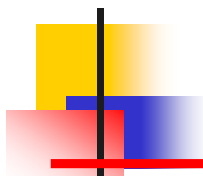
From Specific to Generic Function for cross-industry leveraging of experience





The TRIZ Philosophy

- **Someone somewhere has already solved something like my problem intelligently, before.**
 - 99 %: something like your problem has been solved before.
 - Underlines the basic thought of TRIZ methodology and its usefulness.
- **The Problem:**
 - W/O TRIZ training, 99% of people can't see the similarity between your problem and the solved previous problems in other industry/application due to Psychological Inertia (PI).

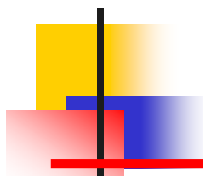


Fundamental Benefits of TRIZ

- TRIZ Benefits:

- **Greatly increase problem solving prob., Quality of Solutions, number of solutions**
 - [S/T/I] Systematically taking you to see problems from various perspectives allowing :
 - To some thing you would normally not see due to PI.
 - To see the full set of perspectives -> ID full range of problems & full solutions that maybe connected to prior wisdom.
 - To leverage prior wisdom (Knowledge base) for problem solving.
- **Rigorous logics training**
- **Jump-out-of-box thinking.** (Space/Time/Interface)





Outline

- General Introduction
- Pillars of TRIZ Philosophy & Principles of TRIZ Operation
- Some TRIZ breakthrough concepts & examples
 - Paradigm shift vs Optimization
 - Human view vs Component view
 - Subtraction vs “Addition/Substitution”
 - ...
- Innovation Value Chain & TRIZ Positioning
- Summary

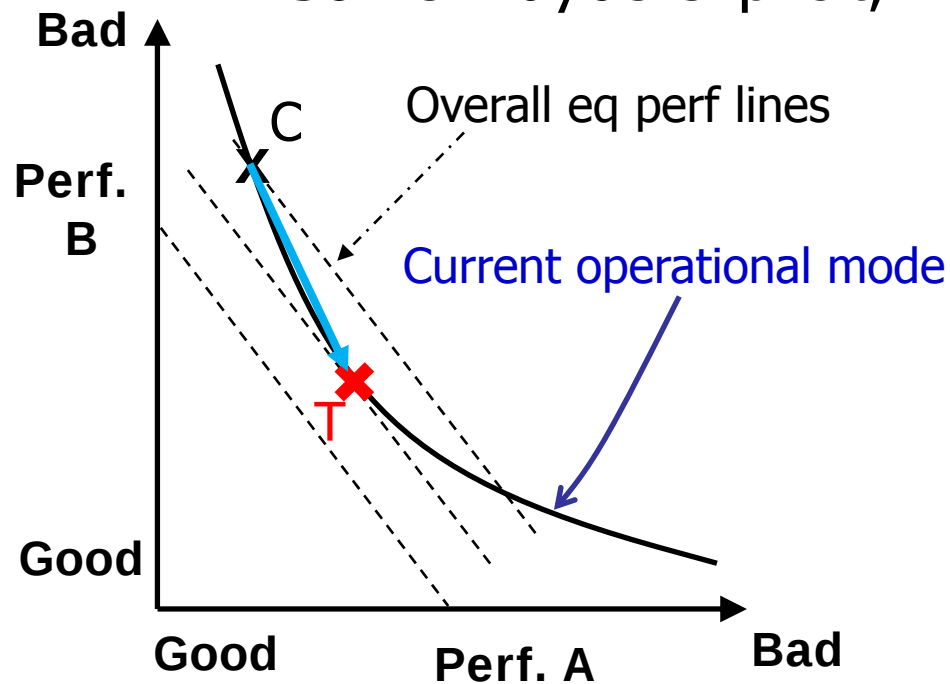
Major TRIZ Breakthrough Concepts

Principles (All Use prior wisdom)

- 1) Don't compromise, **paradigm shift**
- 2) Innovate against **right** product, not current product
- 3) Look from **Component perspective** instead of Human perspective.
- 4) Focus on **value / function**, not physical system.
- 5) **Resources**: Make the most of existing resources. Waste to Wonderful; Harm to Help;
- 6) **Subtract** NOT Add or substitute to solve problem
- 7) Address problem NOT at the initial sore point but **from the causal root** to maximum effect.
- 8) Use **evolutionary trends** for : 1) **Product Problem Solving**; 2) **Patent / Product Enhancement**; 3) R & D strategic Decisions; 4) Forecasting
- 9) Ideal Final Result
- 10) Adapt existing solutions, don't always invent.
- 11) System transfer: Transfer problem issue from current system to another system

TRIZ vs Traditional Problem Solving

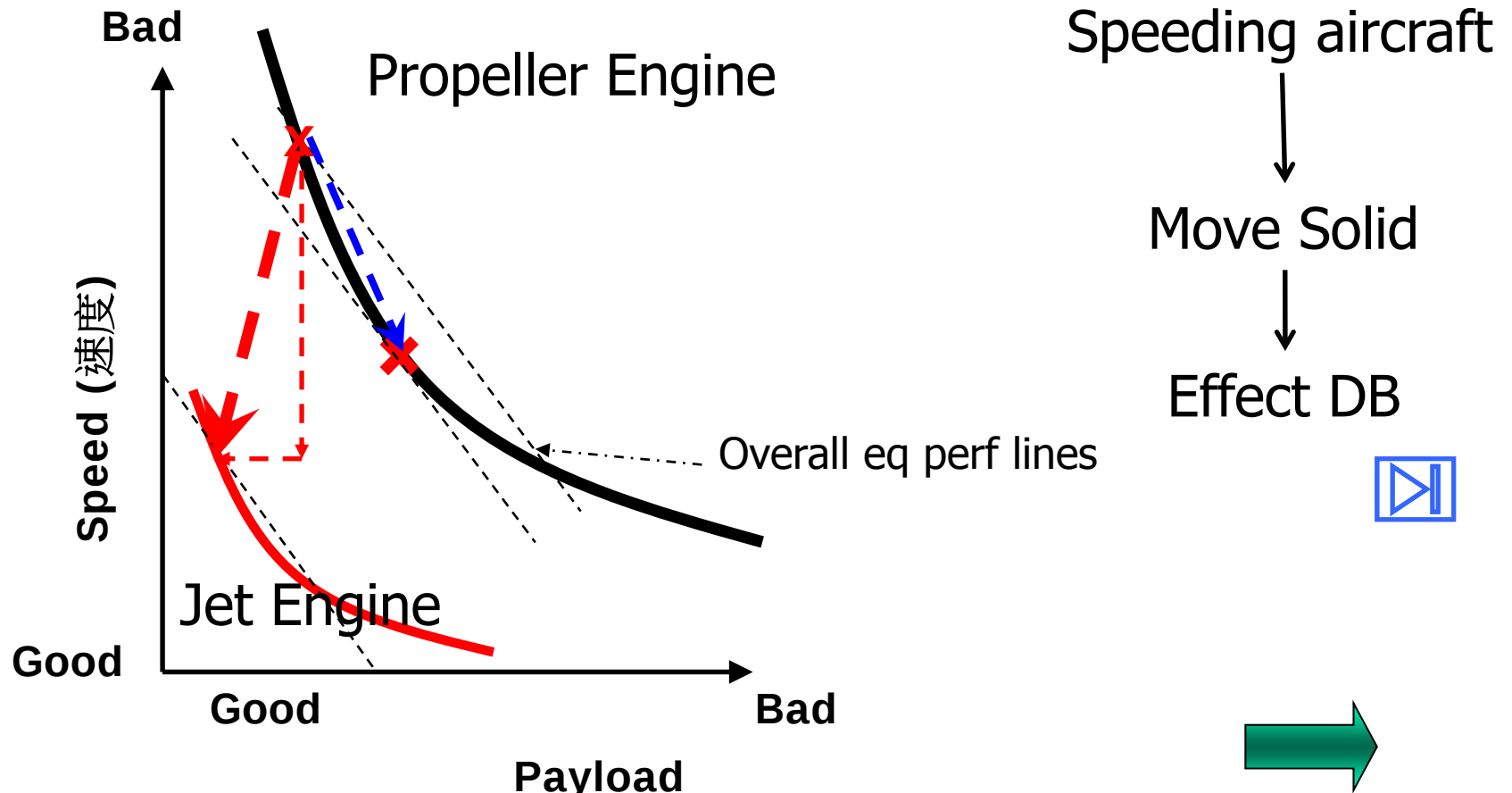
- What blocks our advancement?
 - Conflict/contradiction: In TRIZ viewpoint
 - If there is no conflict, we would just go ahead without hesitation.
 - Some maybe explicit, Most contradictions are implicit.



Traditional Prob Solving: Optimization / DOE

- Under the current model, Find the best operational point.
- => Compromise to get overall best point of operation.

Comparison of Contradiction Solving



Get to a diff operational principle where there is no need to compromise.

Back

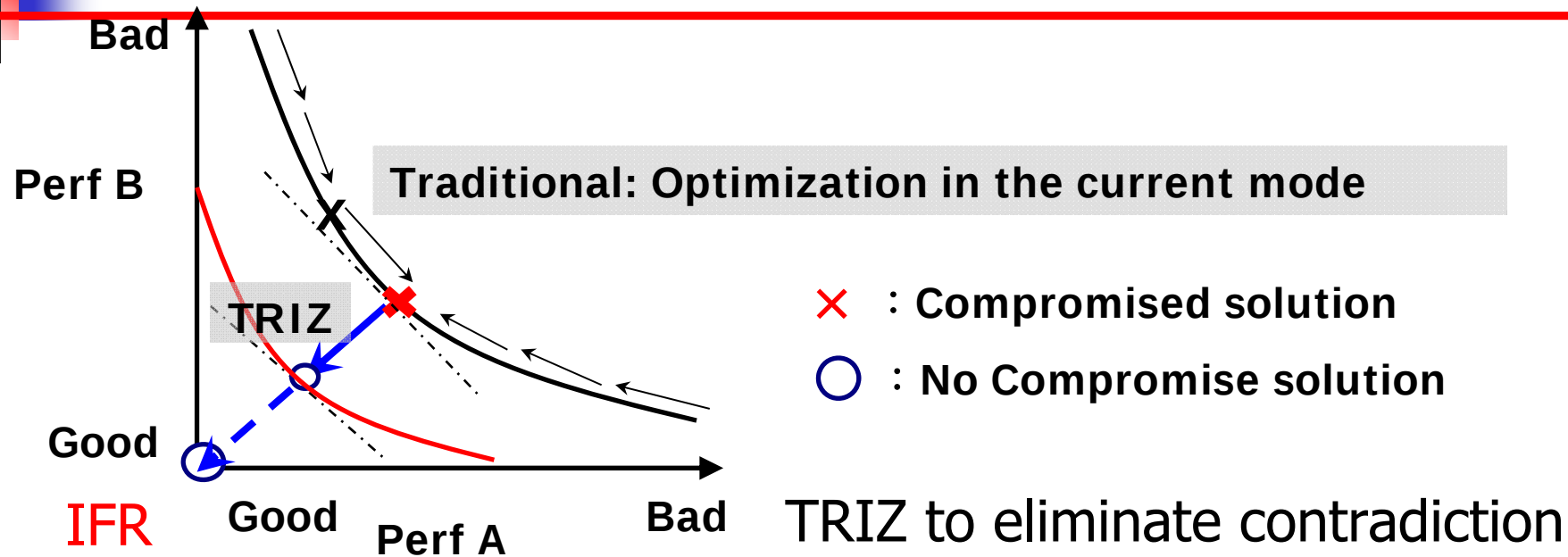
Start Again

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www.triz.co.uk => 208 (Effect + Resources)

TRIZ vs Traditional Problem Solving



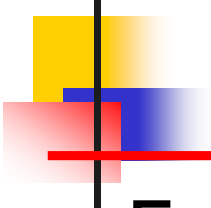
TRIZ: Paradigm shift by using prior wisdom systematically.

- Get out of current operational mode to search for no-compromise results.
=> Jump to another mode of operation: Paradigm shift
- You can still use Optimization to find best operational point on the best operational mode achievable.
- Paradigm shift is many times more powerful than Optimization.

Paradigm Shift w/ Func. Oriented Search

Inkjet printer case:

- Which company dominates the inkjet printer market?
- Which company first invented inkjet technology?
- **BIG question: Why is the first inventor company does not dominate the industry in this case?**

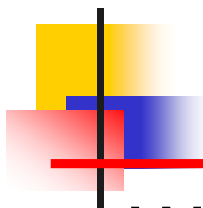


HP Inkjet printhead example

- Func. needed: Miniaturization

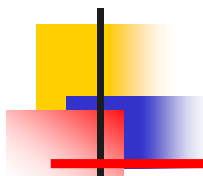
Thermal inkjet technology used “Thick film technology” – screen printing technology. Physical limit (feature size $\sim 100 \mu$)

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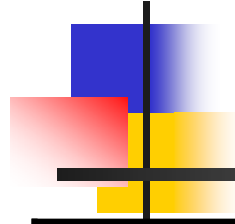
Key Questions & Results

- What Function/Capability is the most important fundamental function/Capability we need for our success?
 - Answer: Miniaturization
- What industry does best in this critical function?
What's method do they use?
 - => I.C. Fabrication, Photolithography (light)
- **Results:**
 - Easily > 30 times smaller feature ($\sim 100\mu$ -> $< 2/3 \mu$)
 - Finer resolution -> higher quality
 - Faster printing speed (More holes in same area & faster cycle time)
 - Less materials/Unit function -> cost less; cheaper.
 - Shorter circuits => faster response time.



A Way TRIZ Helps paradigm shifts

1. Focus on KEY function not current component.
2. ID the fundamental aspect of the key function
(Change from Industry-specific function to Generic function to break out PI)
 - Look into Function/Attribute/**Effect** Database for all existing ways of achieving the function. (Use prior wisdom from distillation of all past patents.)
3. When solution is from a different industry which my industry does not know-> Innovation



TRIZ problem-solving vs Traditional problem solving

Methods	Principles	Improvements impacts
Traditional	Optimization	Tens of %
TRIZ	Paradigm Shift	Times Tens of Times

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- 9) Ideal Final Result
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A Small Question

- What is the main function of a military helmet?
- Helmet protect head insufficiently.

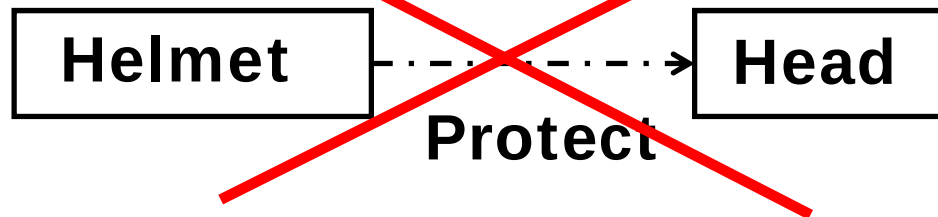


- What can we gain from this Functional Model?



Human view vs Component view

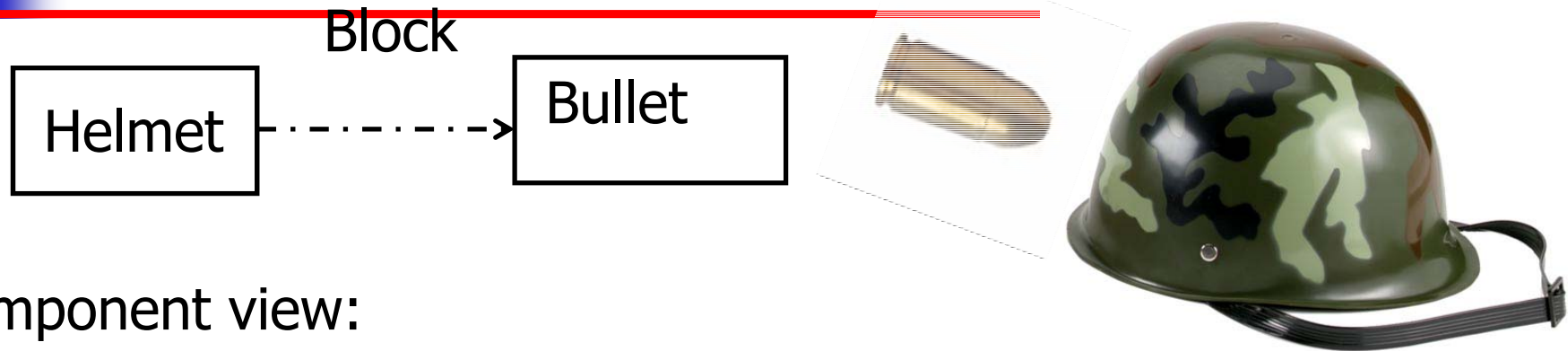
- What is the main function of a military helmet?



Deduced thinking:

- How to improve helmet to protect head better?
- How to improve head to allow helmet protecting head better?
- => unable to lead to right thinking.
- NOT Protect Head (Human' viewpoint)
- The function takes place NOT between **helmet** and **head**, BUT between **helmet** and **bullet**.
- w/o involving Bullet, how can we improve Helmet's function?

Human view vs Component view



Component view:
Value/Goal: Protect head

Tool (Helmet)

Func (Block)

Object (Bullet)

+	Add ?? to tool to resolve problem/ achieve value	Add field/func to resolve problem/achieve value	Add ?? to object to to resolve problem/ achieve value
~	Subst. tool to resolve problem/ achieve value	Use other func/field to resolve problem	Subst. object to resolve problem/ achieve value
-	Remove tool to solve problem/ achieve value	Eliminate field that cause the func.; eliminate func.	Eliminate object to resolve problem/ achieve value.

Human Perspective vs Component Perspective (1/2)

<u>Human</u>	<u>Component</u>
I sweep floor	I move bloom bloom moves dust Floor hold dust
How can I improve to sweep floor better? How can I improve sweeping skill or use other methods? How can the floor be improved to make sweep better?	How can I improve to move bloom more efficiently? How can I move bloom better? Can I not to move bloom but clean better? How bloom can be design better for manipulation? How can bloom designed better to move dust? Can I change how is removed? (suction/blow/burn/chem reaction ...) How can I treat dust to make it easier to remove? How can I treat floor to help move dust? (nano tech floor) What else other than “hold” can floor help to remove dust? (repulse, suck to one place, ...) How can I treat dust so that floor will not hold it?

Human Perspective vs Component Perspective (2/2)

<u>Human</u>	<u>Component</u>
I sweep floor. Only see 3 points to work on.	I move bloom bloom moves dust Floor support dust See 9 points x Add/Substite/Subtract => 9 x 3 = 27 ways of solving the same problem.
■ 『Human views』 often missed true physical situations due to PI. Thus missed many oppr. to ID solutions. ■ 『Component Views』 allows us see the actual interactions among components thus seeing many situations that 『Human views』 fails to see. With TRIZ Systematic approach many ideas can thus be found.	

Major TRIZ Breakthrough Concepts

Principles (All Use prior wisdom)

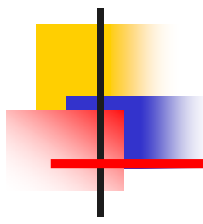
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Trimming (Component / Process)

99 % of the Engineers invariably ADD “+” something to the system or “SUBSTITUTE” something to fix the problem. Trimming uses SUBTRACT “-” something from the system to solve same problem more elegantly.

- Radio interference of components on PCB.
- Dam to protect against floods.



Benefits of trimming Trimming

- Eliminate negative functions(harmful/insuff/excessive)
- Reduce cost
- Reduce complexity
 - Part counts
 - Usage maintenance complexity. Make it easier to use/maintain/repair
 - Less opportunities for errors.
- Patent Circumvention

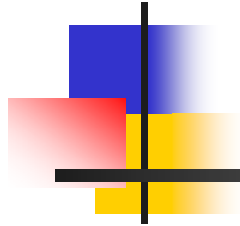


International Society of Innovation Methods

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Self-closing Embedded Slit-valve



Dongliang Daniel Sheu

+886-03-572-3200

Sheu.daniel@gmail.com



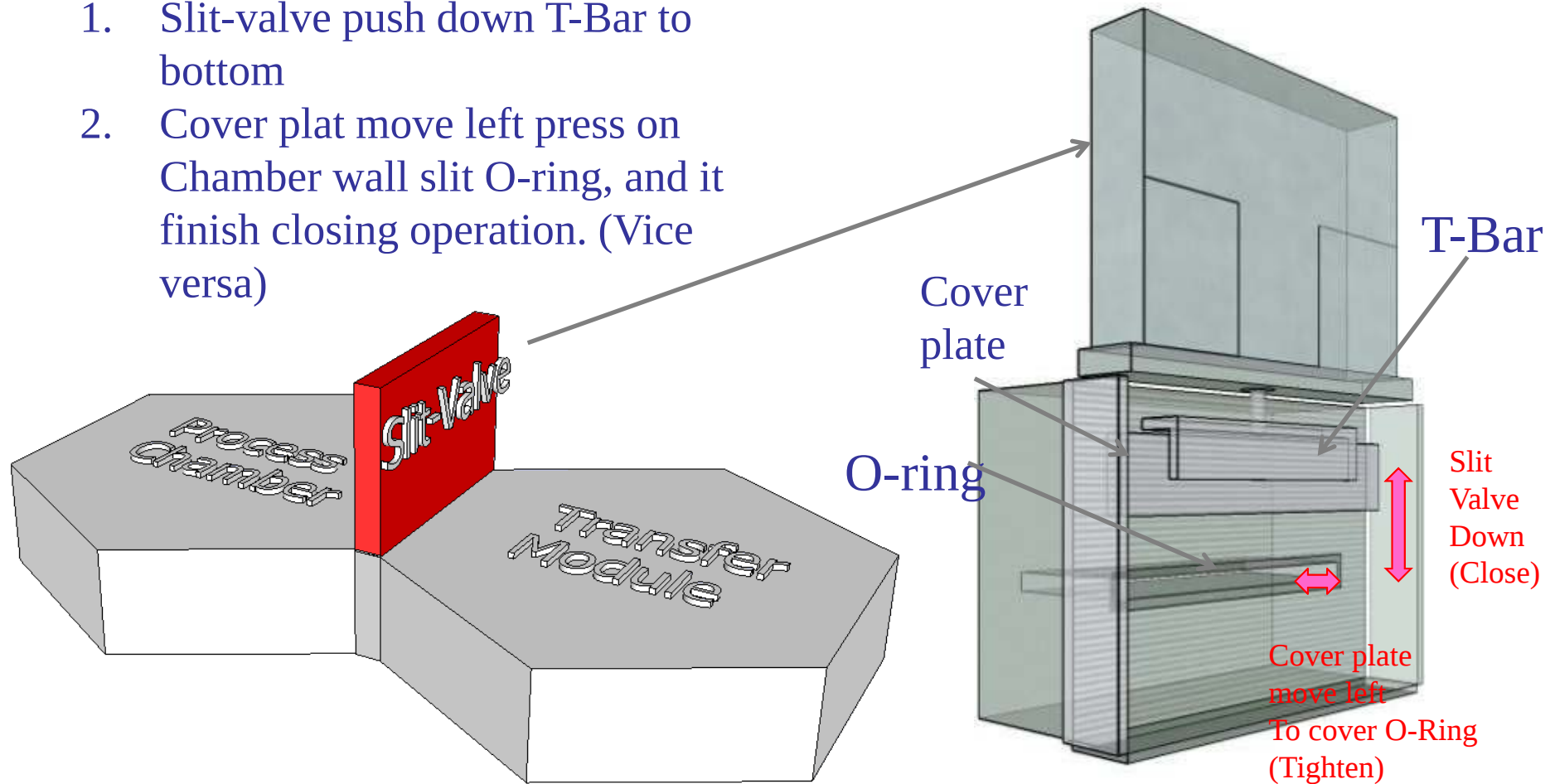
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Case background (Slit-valve)

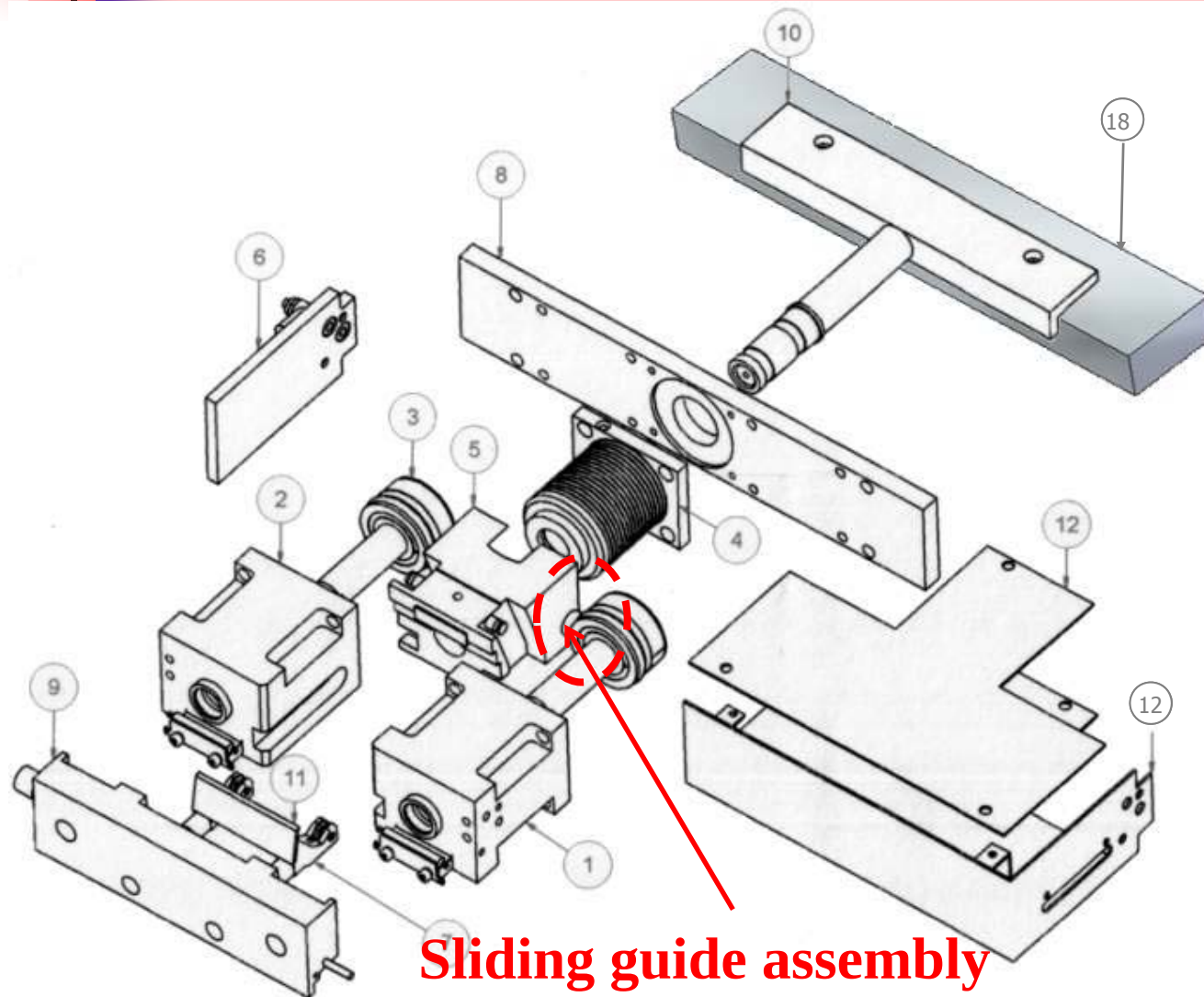
Slit-valve Closing operation:

1. Slit-valve push down T-Bar to bottom
2. Cover plate move left press on Chamber wall slit O-ring, and it finish closing operation. (Vice versa)



Used in CVD, PVD, Implanter

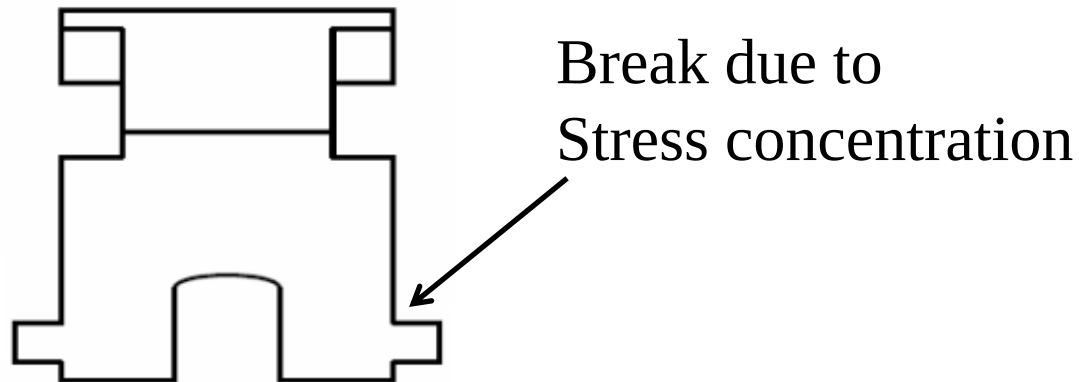
Slit-valve Exploded diagram



item	Parts Name
1	Air pressure cylinder assembly (left)
2	Air pressure cylinder assembly (right)
3	Piston assembly
4	Slit-valve (S.V.) Bellow/ G.V. Bellow
5	Sliding guide assembly
6	Cover assembly
7	Connecting bar assembly
8	Cover the bottom of S.V,
9	Piston fixed block
10	T Bar
11	Slider (Angle plate)
12	Upper and lower cover assembly
13~17	Hexagon screws
18	Cover

Problem Points

The pins of the guiding block assembly (# 5 導引滑塊組合) cracks due to stress concentration causing uneven movements.

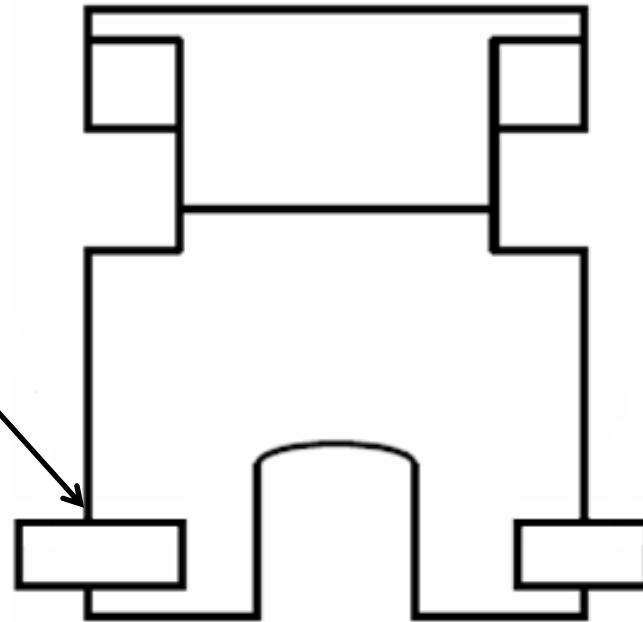


Current Approaches

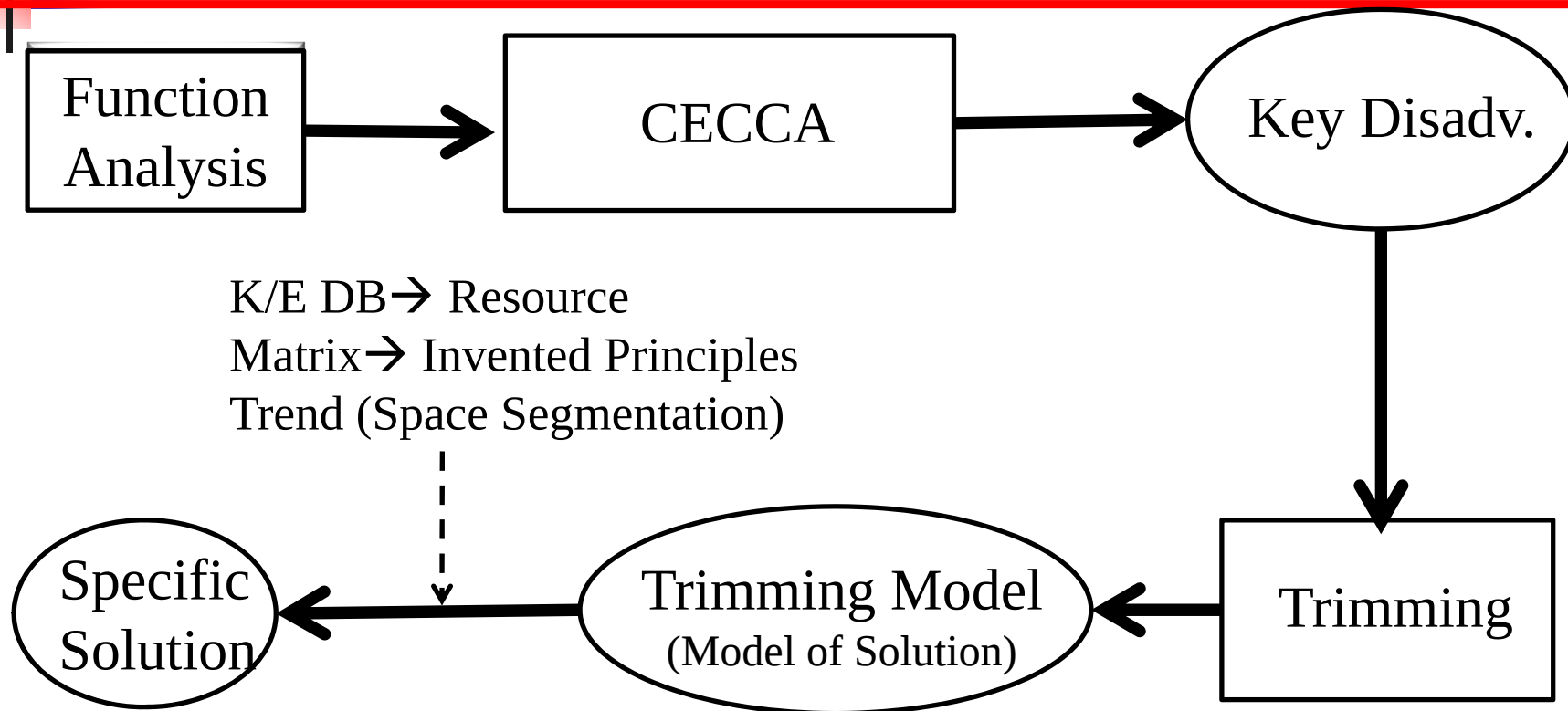
- 1) Replace defective components, or
- 2) Add components to the system

Engineer wish to extend the stem assuming longer pin will provide bigger contact area to reduce stress concentration. ???

Longer pin and contact area =>
Reduce stress concentration ??



Tools Used in this Trimming Case



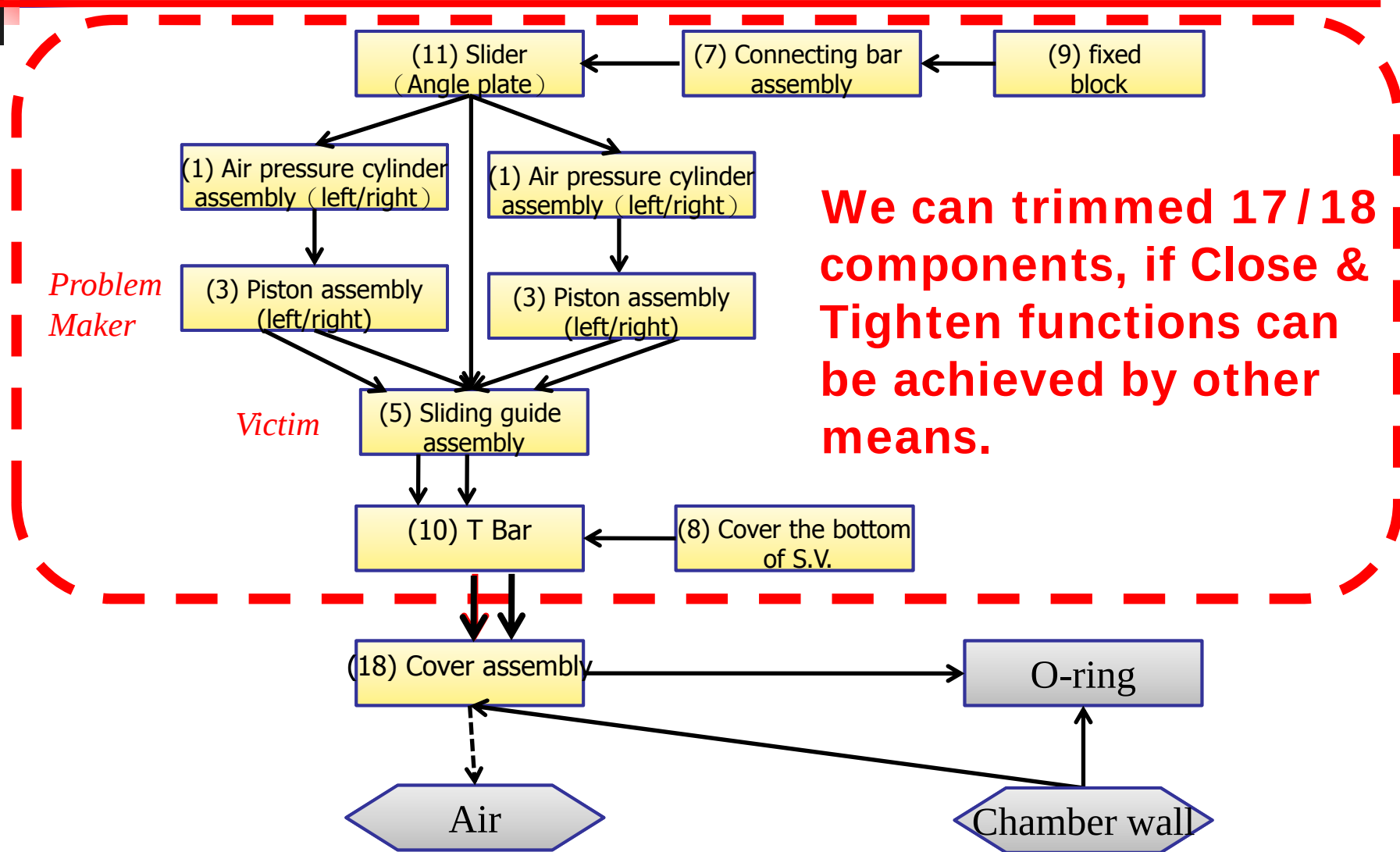
Inventive Principle: The Other Way Around

K/E-Function Data base: Move Solid

Trends: Space Segmentation

Resources: Gravity & Pressure Diffenetial

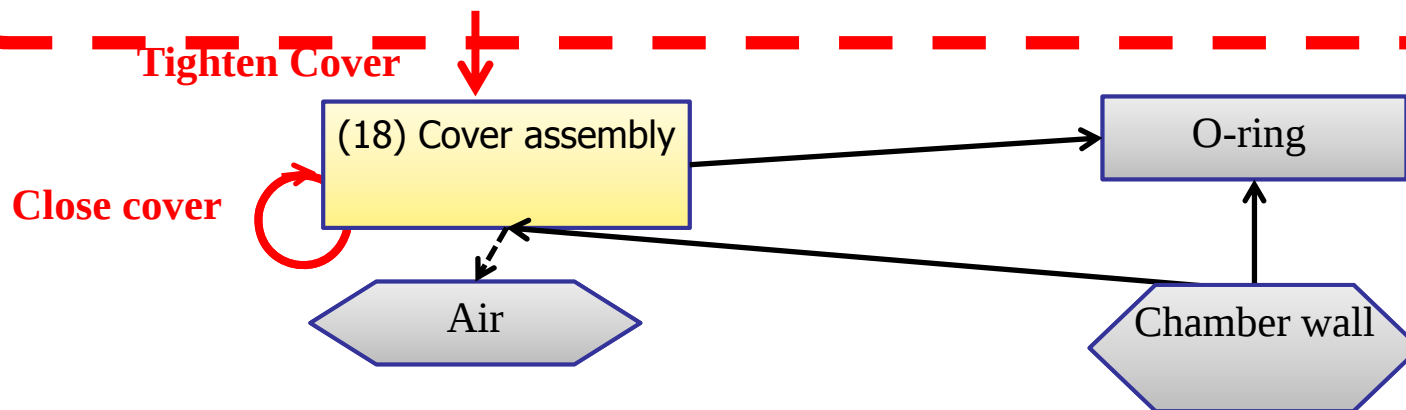
Function Analysis for Slit Valve



FA for Slit Valve

We can trimmed 17/18 components Later add 2 components to perform Close & Tighten functions.

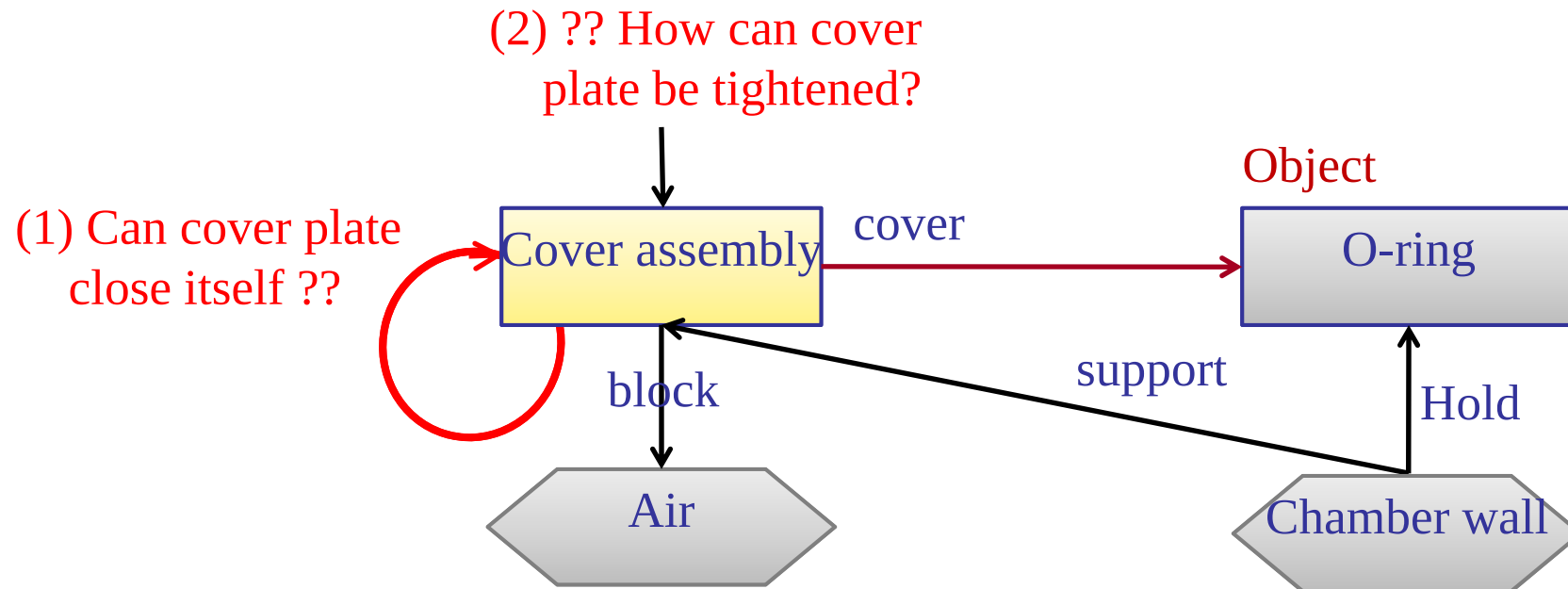
=> net 15 components trimmed.



Final Trimming Model

Trimming Problem:

- How can I make Cover assembly close and Tighten the door by itself?
Are there any resources?



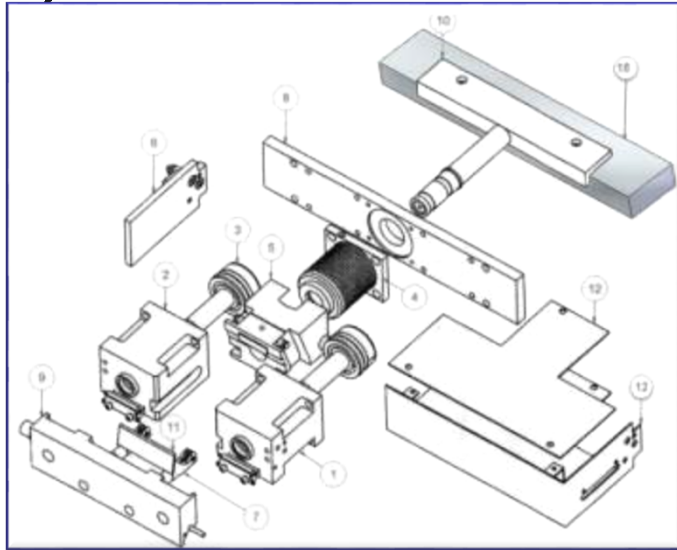
- Fundamental Function needed: **Move Solid**

Function Oriented Search/ Knowledge Effect Database- Existing Ways to Moves Solid

Bird's Beak Effect	Electrets	Gravity	Reuleaux triangle
Boundary Layer Entrapment	electromagnetic induction	Hyperboloid	Shape Memory Effect
Brushes	Electrophoresis	Inertia	Spiral
Coanda Effect	Electrostatic Field	Ion Conductivity	Thermophoresis
Corona Discharge	Explosion	Magnetic Explosion	Torque Oscillator
Coulomb's Law	Ferro-magnetism	Mobius Strip	Triboelectricity
Desorption	Fluidization	Pascal's Law	Vibration
Diamagnetism	Friction, Diffusion	Photophoresis	(Differential) Pressure
Dopant Segregation	Funnel Effect	Resonance	...

Use existing resources. => Gravity & Vacuum

Original case vs. case Solution

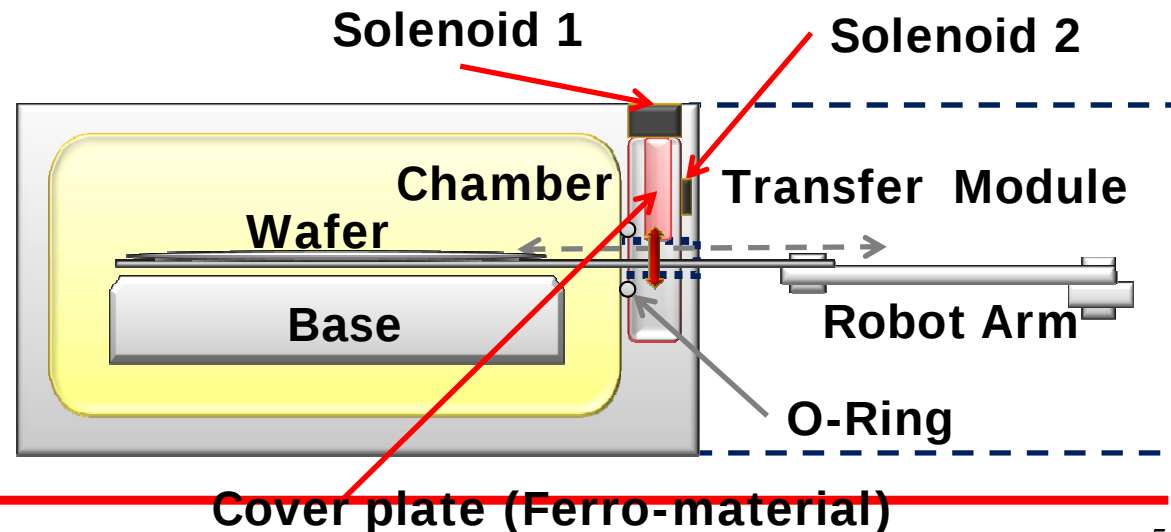
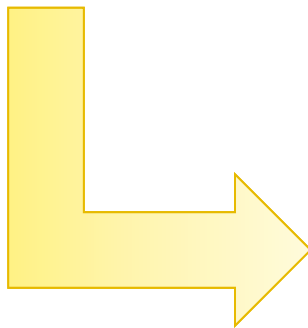


- Original case:

- 18 Components / external valve
- Use mechanism to implementation the two-dimensional movements of the slit valve.
- Need large space, and the original problem will happen after a period of time.

- Our Solution (1):

- 3 components / embedded valve
- Electromagnetism to implementation the two-dimensional movement of the slit valve.
- Substantial reduction of space, the original problem will not appear again. (Designed out)



中華民國專利 發明第I 440788號
USA Patent Pending



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Benefits of this solution

- Savings: 95 % of the component cost, 80⁺ percent of the part count. ~ **98 % Energy savings.**

	Item	Before	After	Improvement (%)
Original Solution	Component Counts	18	20	$(18-20)/18=-11.1\%$
	System cost	229,000	80,000	NA
	Energy savings	120	120	Energy to maintain 6 kg*20 (min)
Our solution	Component Counts	18	3	$(18-3)/18=83.3\%$
	System cost	229,000	<10,000	$(229000-10000)/229000=95.6\%$
	Energy savings	$0.5 * 20 = 60$	$0.6 * 2 = 1.2$	1- (1/60)= 98% from 6 (kg)*0.5* 20 (min) =60 Full Cycle to 0.6 (kg)* 2 (min)=1.2 @ opening pulse

1. The service cost of the original solution is 80K on overhaul, and price for new system is 229K .
2. Slit-valve : ‘Open’ for about 2 minutes, and the whole cycle is about 20 minutes.
3. Slit- valve use electrical pulse only during “open” status. (1/10 of the time)
4. 1/10 time * (0.6/3) weight => need only 2% of original energy level.

Advantage of this design (3 Comp.)

- Eliminate original failure mode
- Original 18 error-prone components => 3 error-prone components.
Solenoid valve is a mature high reliability tech.
- Use existing resources. Greatly reduce materials/space/energy:
 - Close gate: existing weight
 - Sealing valve: existing vacuum
- Use time characteristics, Only 1/10 time of “open” state needing energy. When needing energy, only need to move 1/5 of original weight.
- Greatly reduced 83% of components & > 95+ % component costs & up to 98 % operational energy.
- Embed valve inside Chamber Wall => reduce space
- May further use TRIZ trend to make the cover plate hollow inside
=> even lighter.

Major TRIZ Breakthrough Concepts

Principles (All Use prior wisdom)

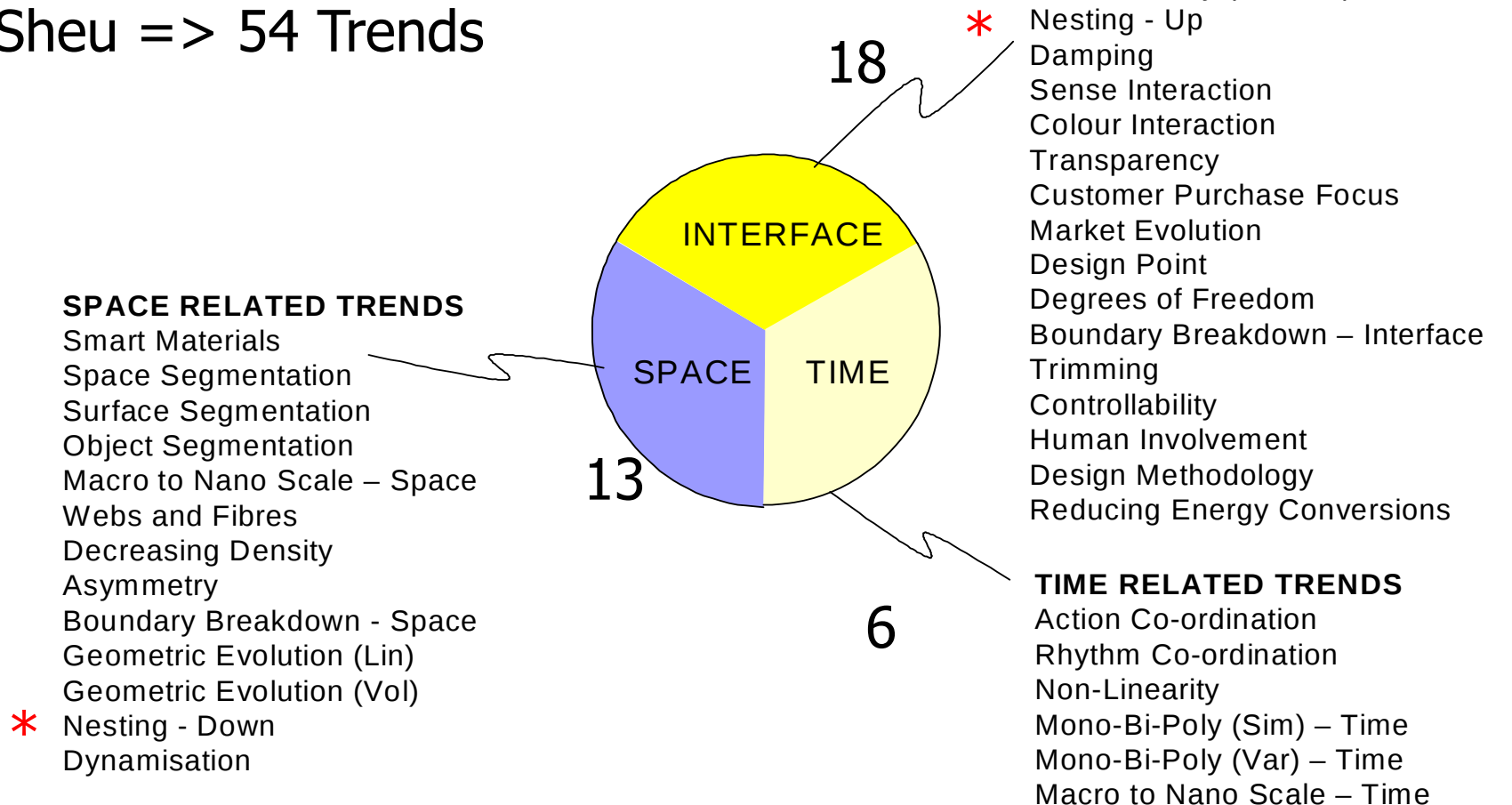
- 1) Don't compromise, **paradigm shift**
- 2) Innovate against **right** product, not current product
- 3) Look from **Component perspective** instead of Human perspective.
- 4) Focus on **value / function**, not physical system.
- 5) **Resources**: Make the most of existing resources. Waste to Wonderful; Harm to Help;
- 6) **Subtract** NOT Add or substitute to solve problem
- 7) Address problem NOT at the initial sore point but **from the causal root** to maximum effect.
- 8) Use **evolutionary trends** for : 1) **Product Problem Solving**; 2) **Patent / Product Enhancement**; 3) R & D strategic Decisions; 4) Forecasting
- 9) Ideal Final Result
- 10) Adapt existing solutions, don't always invent.

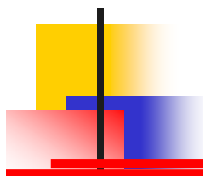
Darrell Mann's Trends

Traditional TRIZ: 9 => 11 trends

Darrell Mann: 37 trends

Sheu => 54 Trends





Usage of Evolutionary Trends

1. Trends as problem solving tool

- The next stages on the trend can be used as solution trigger for problem solving

2. Trend as a tool for ID of innovative products

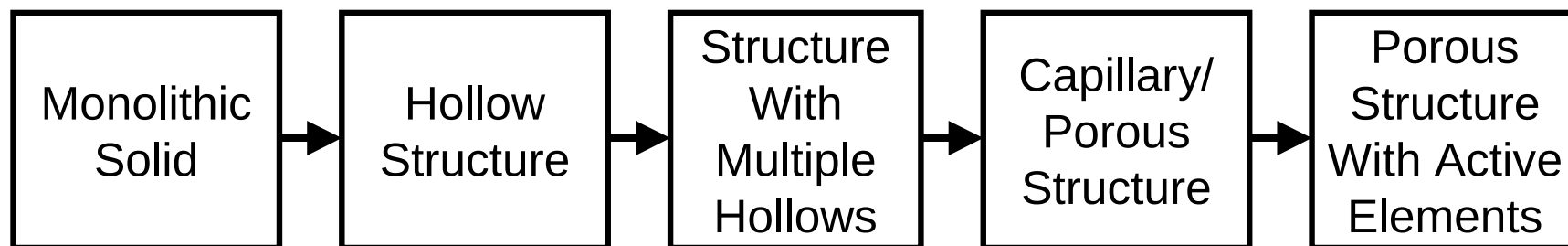
3. Enhance patent strength for bullet-proof patenting.

4. For system evolution strategy

- Used to ID best potential R&D directions to focus on.
- Can improve most ideality for the whole system

5. Product & Technology Forecasting

Space Segmentation Trend



Pure chocolate



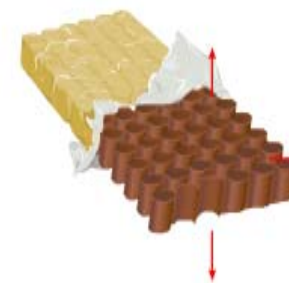
Easter eggs



Porous chocolate



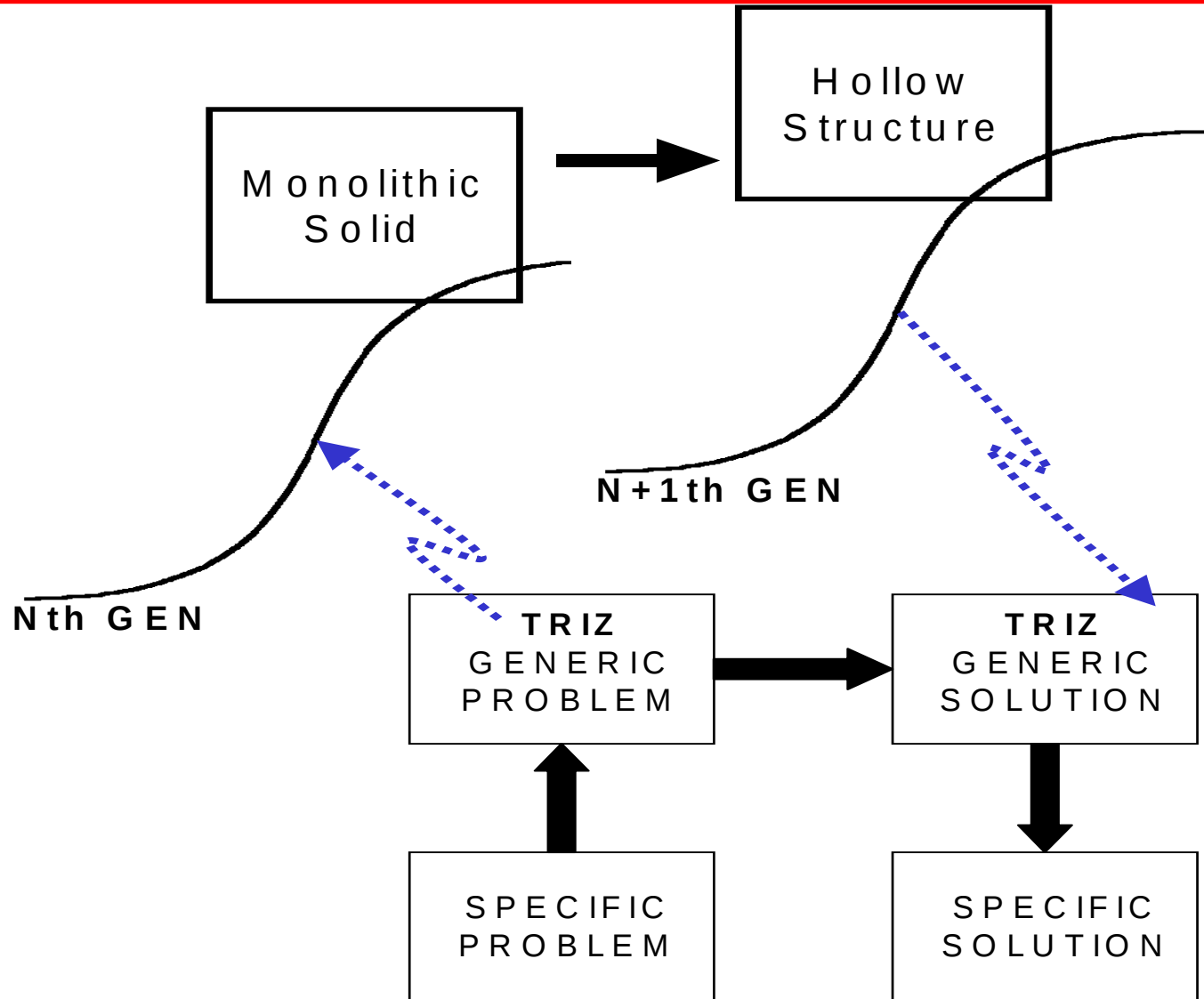
Chocolate with bubbles



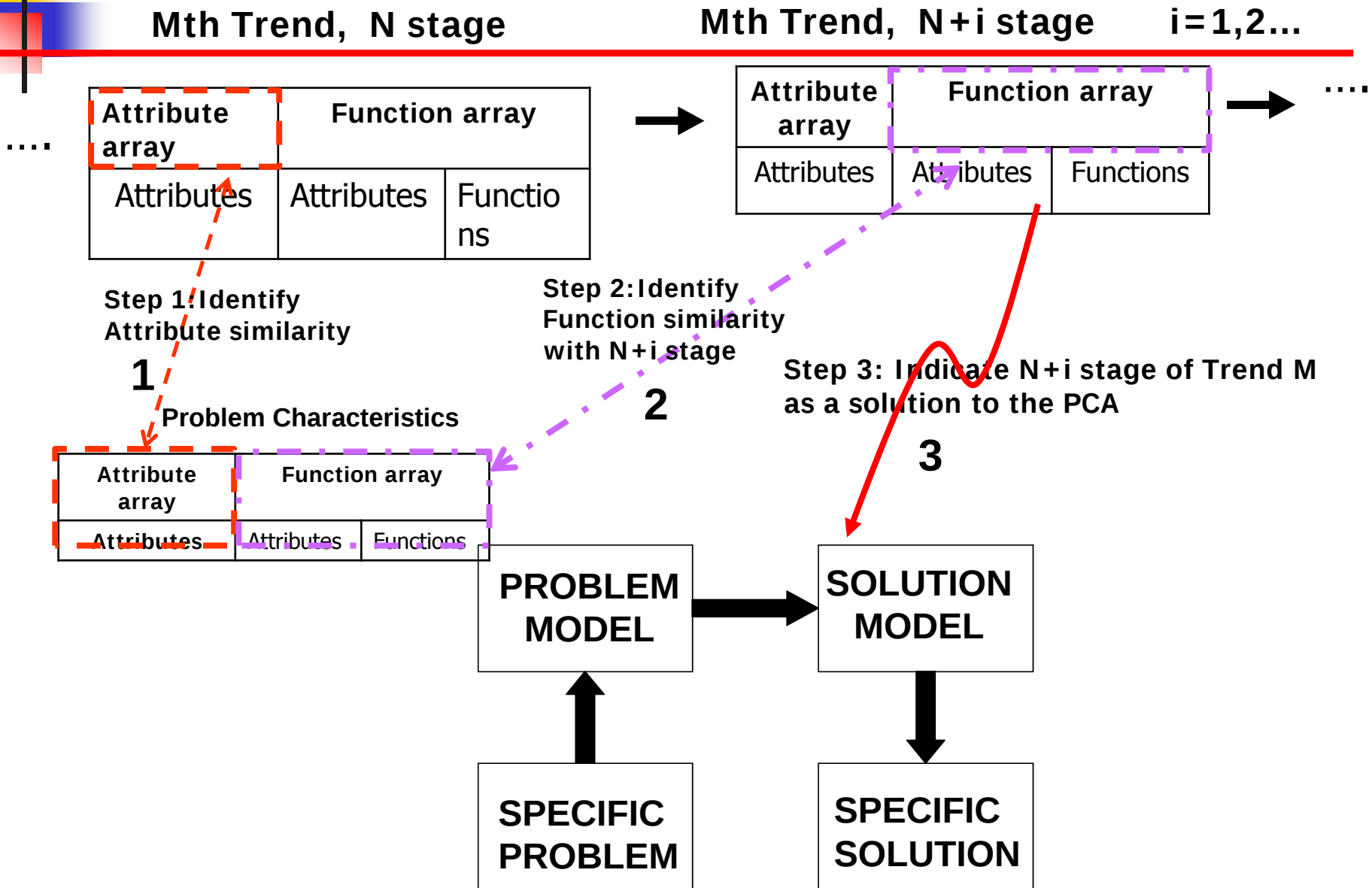
Chocolate with capillaries
and active elements

Vitamin C/
Raisins/...

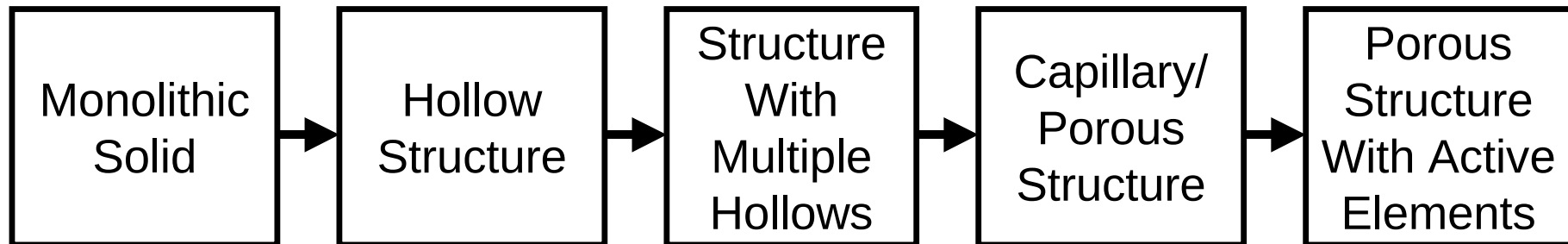
Next stage of the trend may imply solutions



Process of identifying the trend/stage for solution model



Space Segmentation Trend



Insole: (Nike R&D Mgr on the pad.)

Solid Insole -> Hollow Insole -> Porous Insole



Softer,
More comfortable

Better air
circulation,
Less odor

-> Porous +
Active ingredient

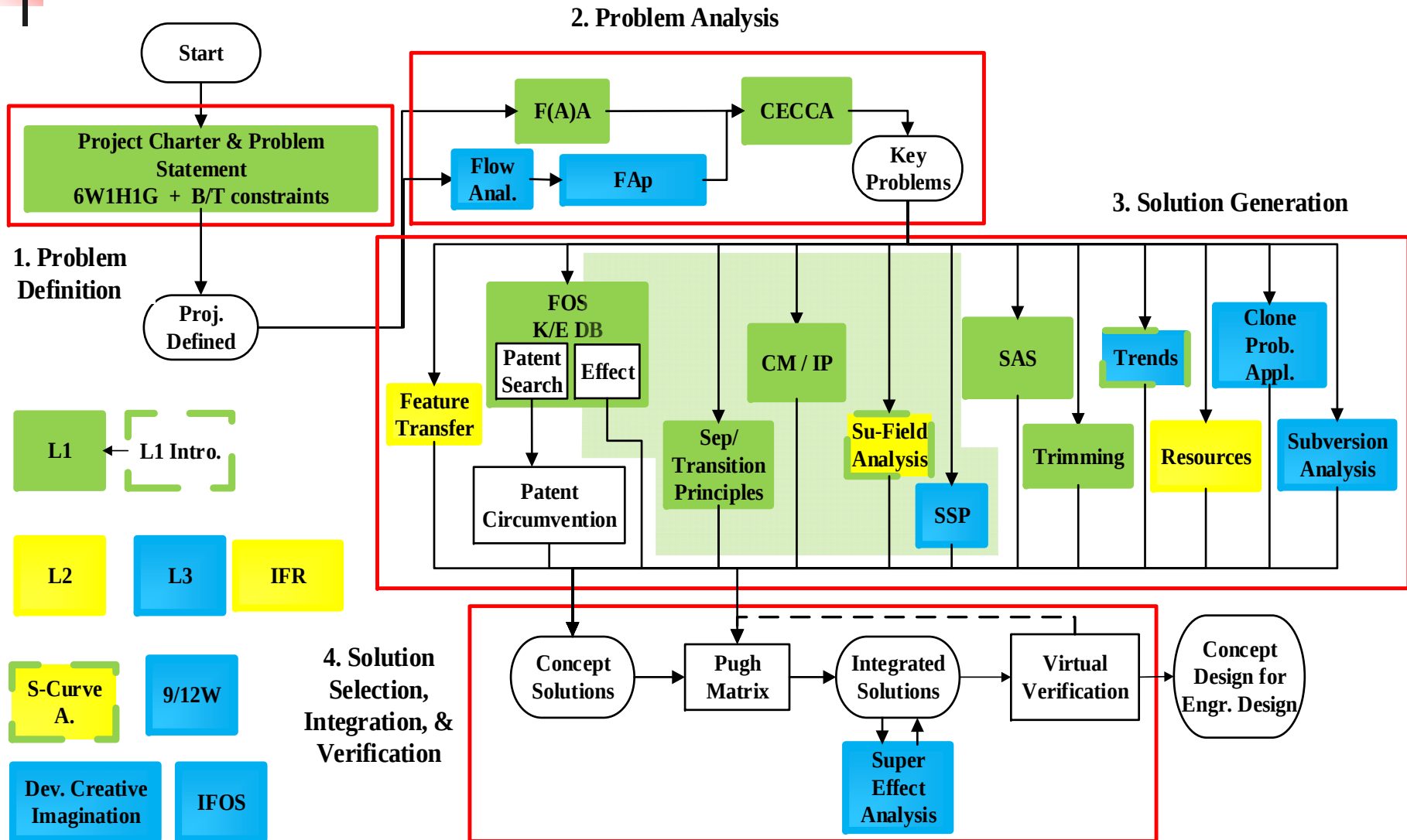
De-odorant,
drug powder for Athlete's foot,
Aromatic powders,
Blood circulation -> Warmer bag
particles,
Small vibrant

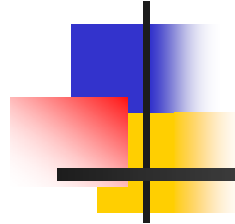
Outline (90m)

- 創新動機：從iPhone 價值分佈圖談起
- 系統化創新 對比 隨機創新
- 萃智系統化創新方法概觀與運作原理：跳出心理慣性
- 萃智突破性創新觀念與案例
 - 典範轉移 對比 優化 (案例)
 - 元件觀點 對比人的觀點 (案例)
 - 資源運用：化無用為有用, 化有害為有利 (案例)
 - 減法 對比 加/換法 解決問題 (案例)
- 萃智解題手法概觀
- 萃智在創新價值鏈中之定位
- 進一步學習資源
- 總結

TRIZ Problem Solving Process

(By D. Sheu. Since 2007)





Position of TRIZ in the Innovation Value Chain

Ref: Sheu, D. D.(2010). A Proposed Classification and Process of Systematic Innovation, *International Journal of Systematic Innovation*,1(1) , 3-22.

Systematic Process of Systematic Innovation (Main Activities)

5 phases:

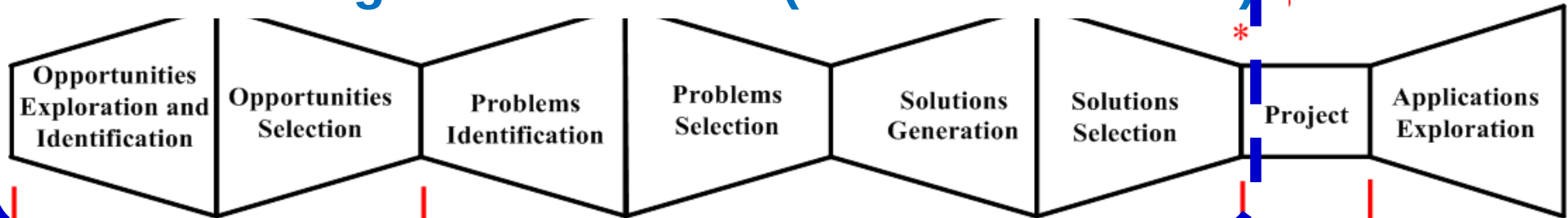
Do the right things

Do the things right

Explore new things



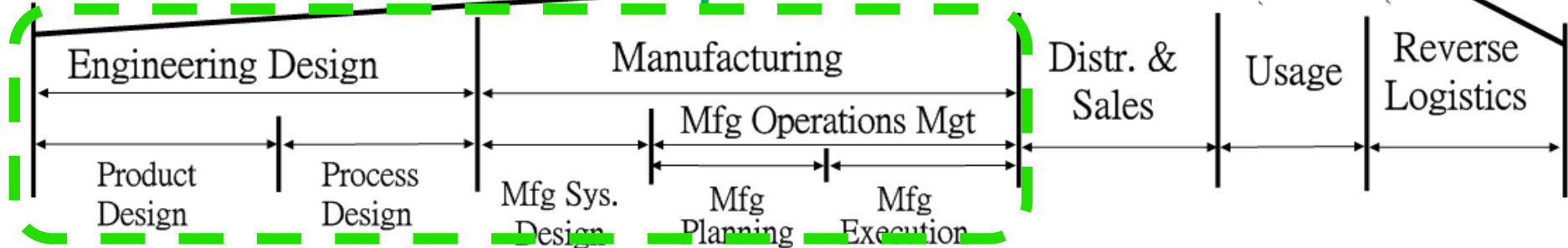
Front-end high value innov. (Det. Prod. & Std.)



Opportunity ID
(New SI)

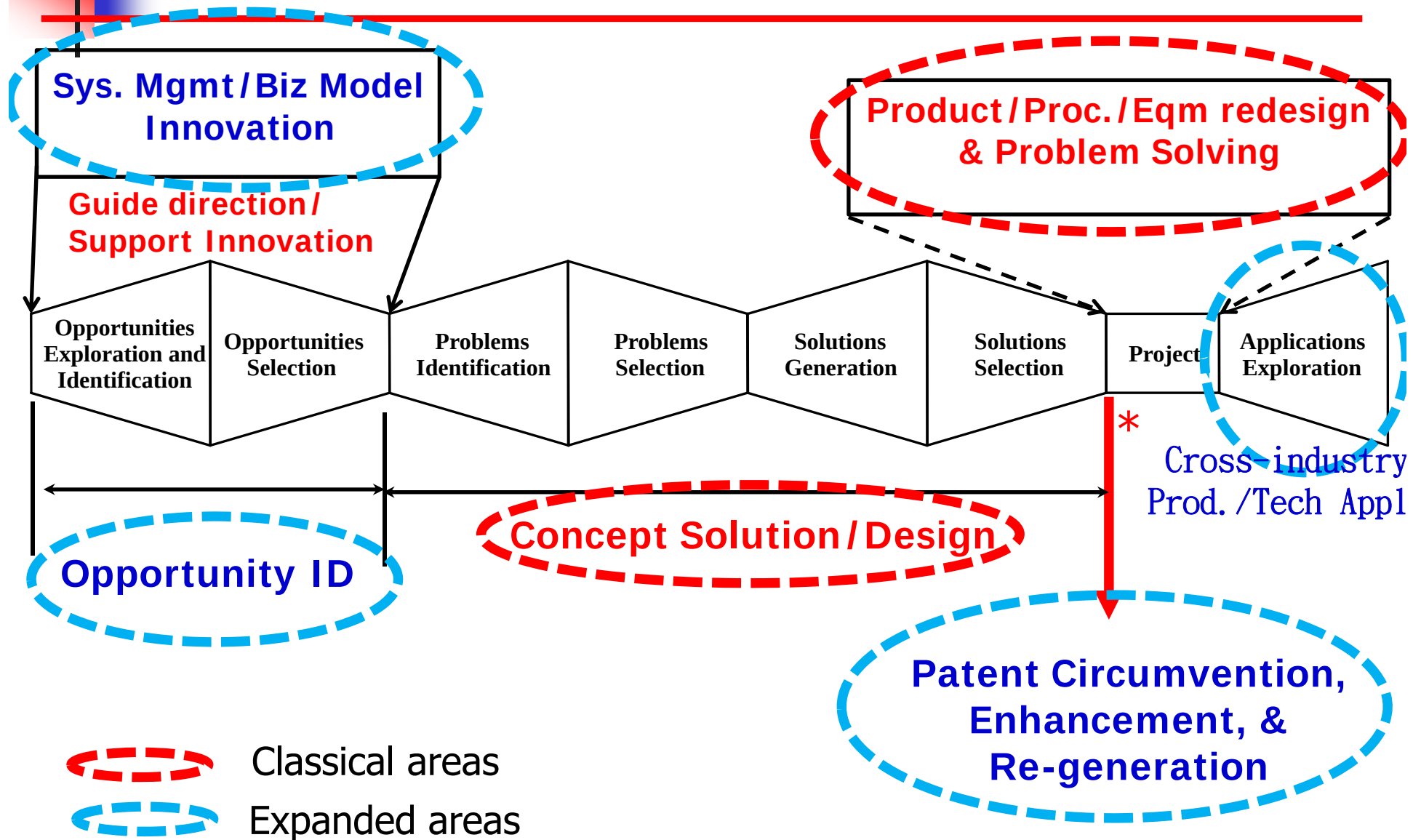
Concept Solution/Design
(Classical TRIZ)

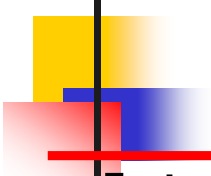
Main thrust of less developed countries.



Oppr. in EVERY stage of process. The earlier the stage, the higher the impact.

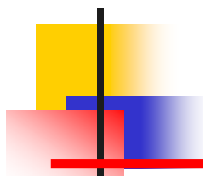
Areas where TRIZ address well





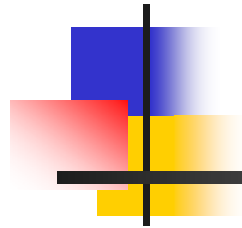
I-SIM Introduction

- International Society of Innovation Methods
 - First non-profit scientific society dedicated to R&D/Appl./Promotion Of Innovation Methods.
 - Just Established @ Bay area. Late 2016/Begin 2017. Begins to Call for Funding Members (www.i-sim.org). Permanent membership USD 100.
- Goals:
 - Provide a platform for Research, Development, and Promotion of innovation methods, tools, systems, and applications.
 - Integrate various innovation methods such as TRIZ, deBono methods, biomimicry, etc., for synergetic usage.
 - Provide complete and in-depth training/consultation/Database of the IM tools/knowledge/capabilities.
 - Organize related experts and organizations for win-win collaborations.
- Membership benefits:
 - 600+ articles/project DB; Training/certification; Free Software usage
 - (www.i-sim.org)



Take-home Points

- Innovation can be anywhere along the Value Chain. But, the earlier stage the higher impacts.
- TRIZ is derived from Prior Wisdom (best patents). It is regarding changing Psychological Inertia to see things from different perceptions and use prior wisdom to solve problems.
- TRIZ key philosophies include: Resources, Contradiction, Function-Value, Space-Time-Domain-Interface.
- TRIZ powerful concepts include:
 - Paradigm shift
 - Component physical viewpoint instead of human view point
 - Turning Non-use to useful & turning Harm to Help.
 - Subtraction is better than substitution/Addition to solve problem.
 - Trends are very useful for new product ideas, problem solving, forecasting.
 - TRIZ is very useful for patent circumvention, Enhancement, Re-generation
- For further learning, you are all welcome to join the I-SIM.



The End.

Thanks for listening !!!

dsheu@ssi.org.tw
dsheu@ie.nthu.edu.tw

Exchange Bz card for sanitized
electronic slides.

