OLYMPUS

Your Vision, Our Future

7 Solutions to extend the application of TRIZ

- Including the prevention of design risk -

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Monozukuri Solution Division

Olympus Corporation

Presentation of Today

1. About Olympus
2. Promotion of scientific methods in Olympus
3. Reaction of the developers for scientific methods
4. Aim of providing 7 solutions
5. Possibility of expansion in 7 solutions
6. 3 Key Elements of connecting the solutions and methods
7. 7 Solutions (Introduction)
8. Summary

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1. About Olympus

Established : October 12, 1919
Head office : Shinjuku-ku, Tokyo, Japan
Capital : ¥73,332 million (As of March 31, 2013)
Consolidated net sales : ¥743,851 million (Fiscal Year Ended March 2013)
Consolidated headcount : 39,937 (As of March 31, 2013)

Medical systems

Next-generation gastrointestinal endoscopy system
EVIS LUCERA ELITE

Small intestinal capsule endoscope

Deflectable tip of 3D laparoscope

The World's Only Vessel Sealing and Tissue Cutting Device. Integrated with both Advanced Bipolar and Ultrasonic Energy "THUNDERBEAT"

Imaging systems

PEN E-P5

XZ-10

Life science & Industrial systems

New laser scanning microscopes 「FV1200」

Omni Scan phased array systems

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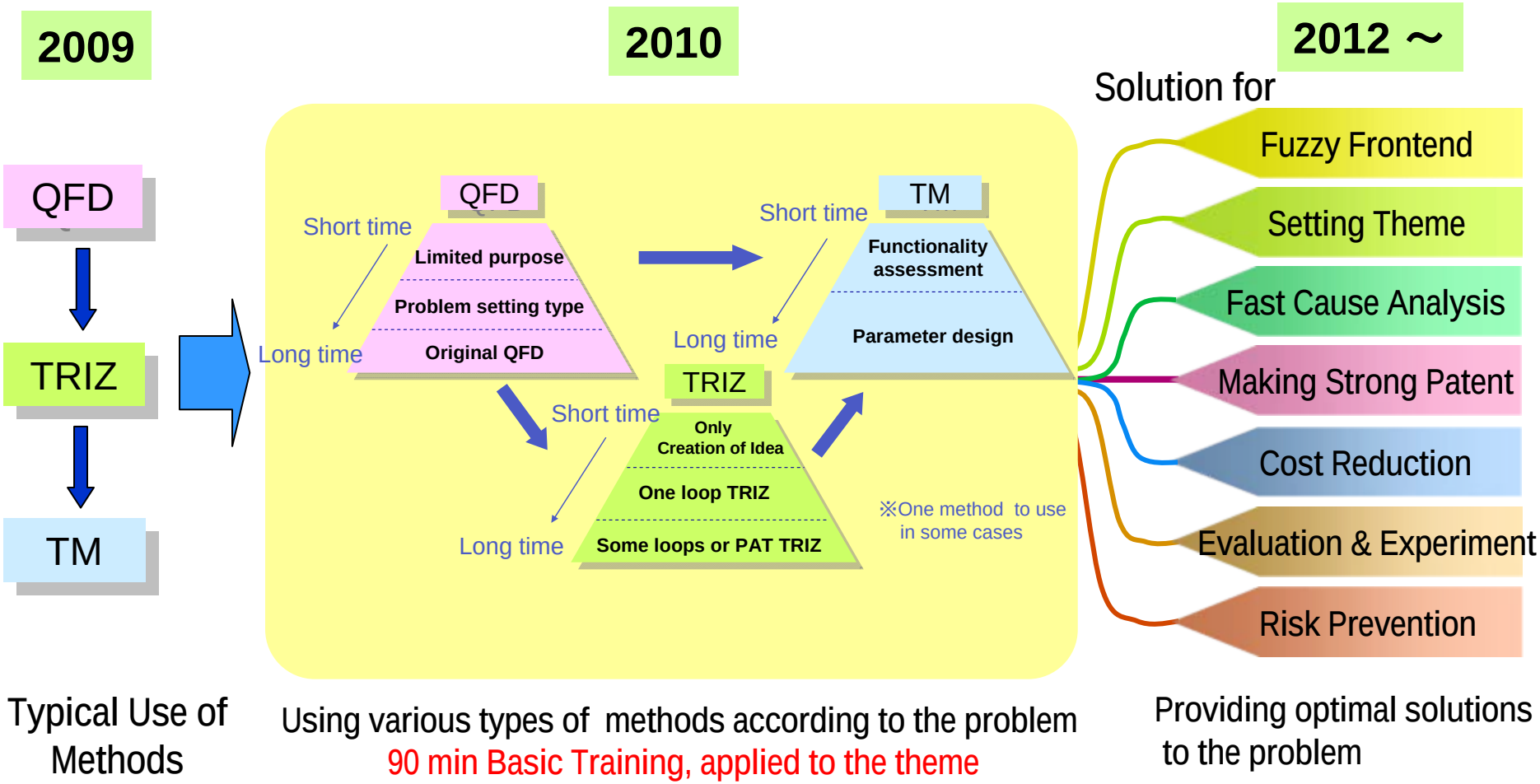
2. Promotion of scientific methods in Olympus

Providing a solution, depending on the purpose and period of the theme



Typical Use of Methods

Using various types of methods according to the problem
90 min Basic Training, applied to the theme

Providing optimal solutions to the problem

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3. Reaction of the engineers for scientific methods

◆Engineers are busy, and have no time for their training.

⇒ They can not have the time for training. 90 minutes training is their limit .

◆ We can not grasp the engineer's heart by the scientific methods. They want the best approach for the purpose.

⇒ Engineers want to know what method is used for their problem.
Their aim is not to take advantage of the method, but to grow in efficiency.
Experienced engineers hope someone will tell them how to solve problems immediately without learning the basics of the method.

◆Many engineers have an allergy to the scientific method.

⇒ Almost all manager class engineers have failed experiences by using QFD, TRIZ and TM in the past.

◆We can not resolve problems by only one method. However, it is difficult for us to connect several methods.

⇒ Evangelists of the method say they can resolve any problem by only one method. But they don't shows us how to connect several methods.

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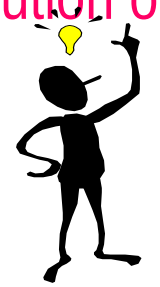
4. Aim of providing 7 solutions

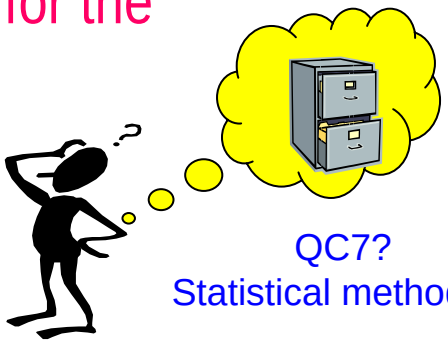
Using various methods naturally while deploying 7 solutions

Engineers should have many “Drawers” for the solution of problem



Mr. A knows the scientific method.

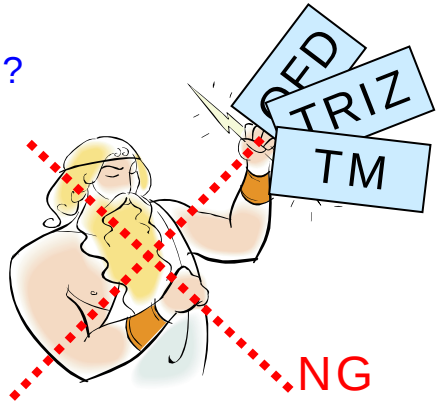
Many “Drawers” for the purpose



Mr. B relies on his knowledge and experience of the past

QC7?
Statistical methods ?

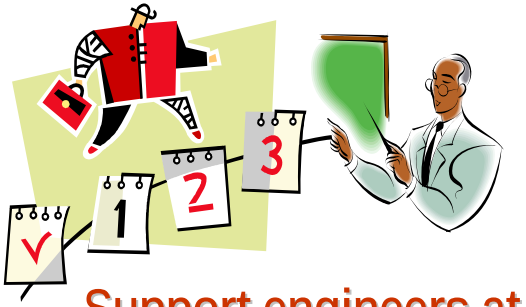
Forcing to use the method is not our purpose!



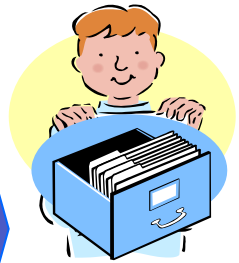
Evangelist of the method is not required.

Learning by practice in close contact with the theme

Training solutions and 90 minutes Basic course



Support engineers at the seams of theme



Get the new “Drawer” !

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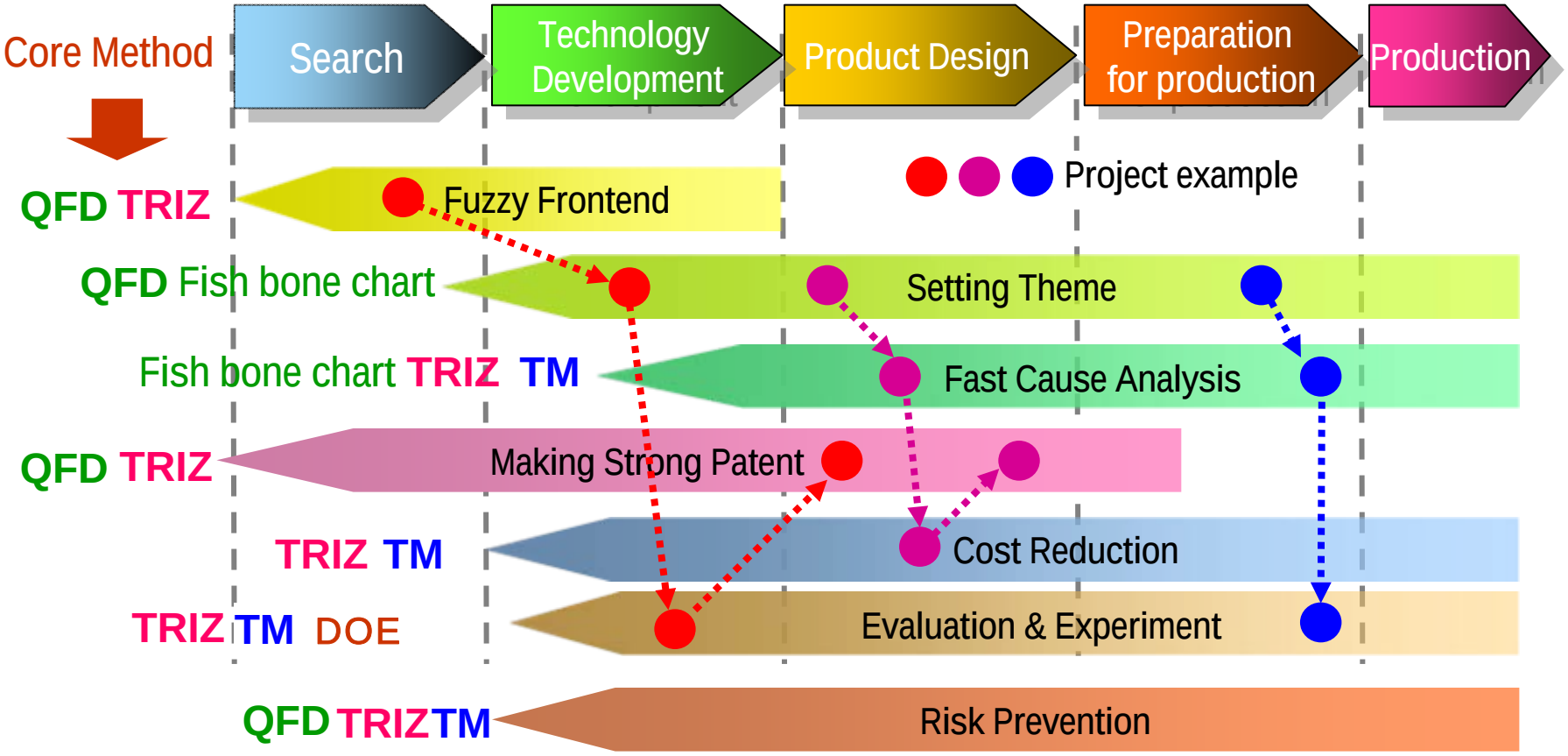
5. Possibility of expansion in 7 solutions

Concept of connecting Methods and 7 Solutions is important



※ TRIZ includes Functional approach and Root cause analysis.

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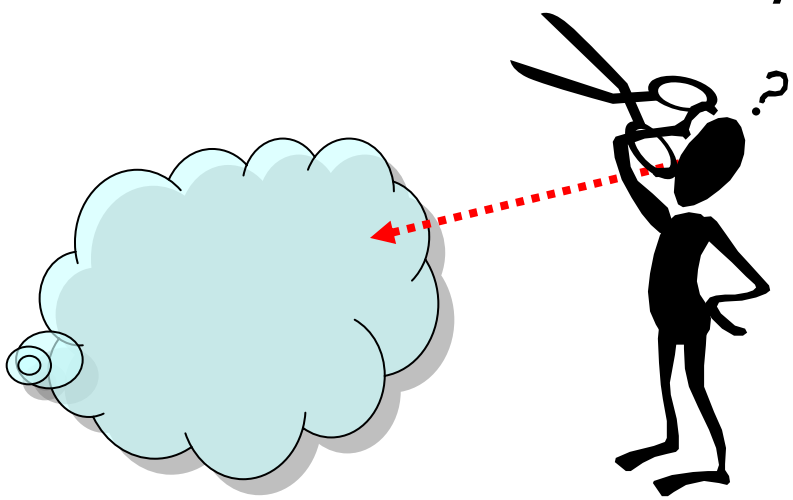
6. 3 Key Elements of connection (1)

【Element 1】 Limit the target area by Time and Space

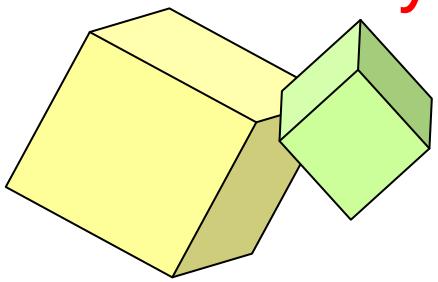
Any theme has constraints of man-hours and time limit.

How can I limit the target area efficiency ?

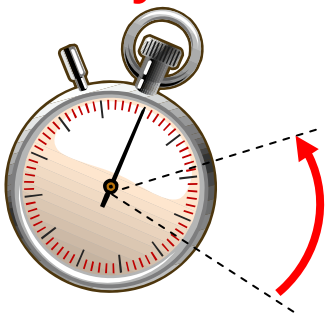


Against the Target area,

? Do you cut out the area by Space ?



Do you cut out the area by Time ?



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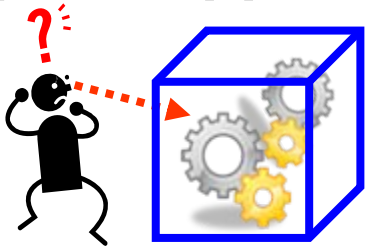
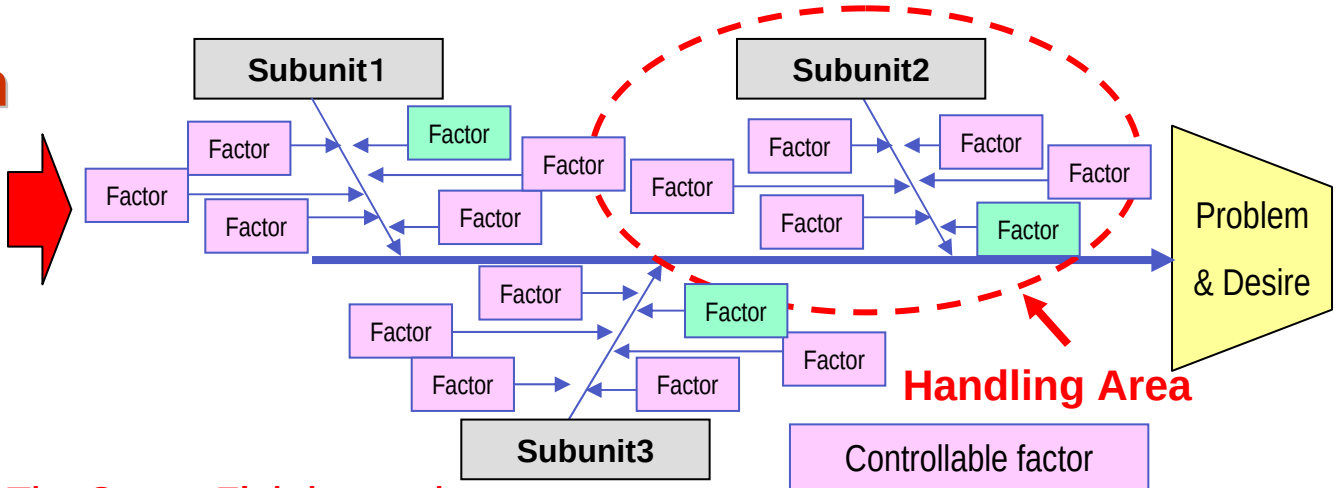
6. 3 Key Elements of connection (2)

The Fish Bone Chart for cutting out the target area by space and time

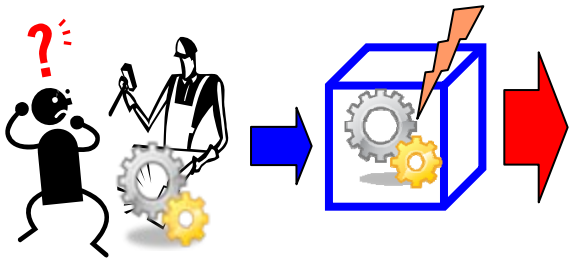
Space Approach

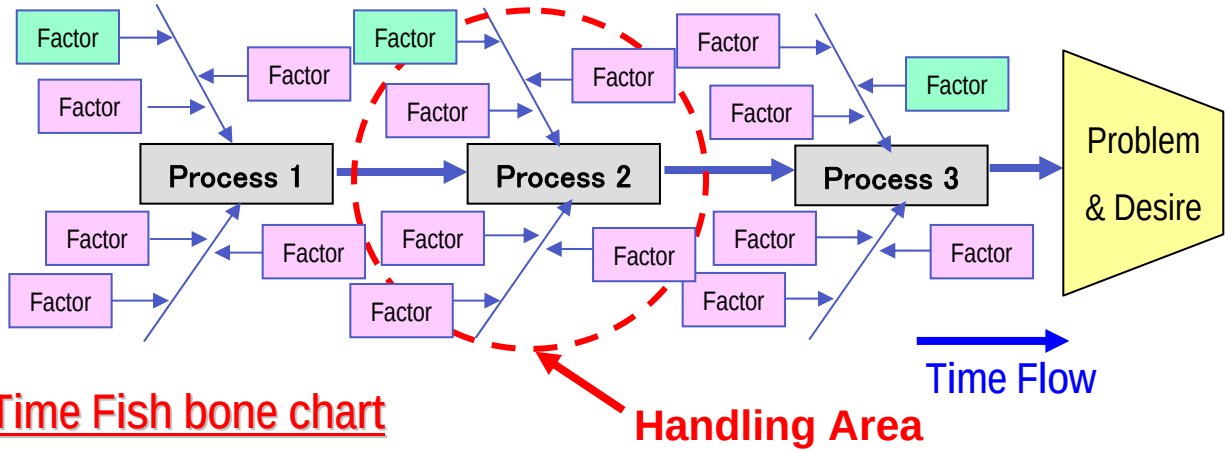




The Space Fish bone chart

Time Approach





The Time Fish bone chart

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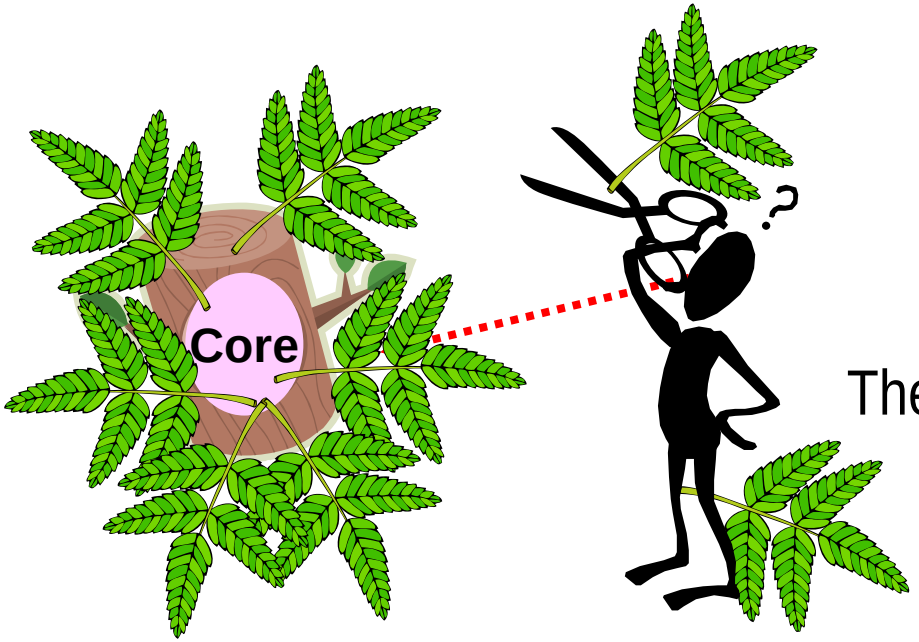
6. 3 Key Elements of connection (3)

【Element 2】 Simplification by functional approach

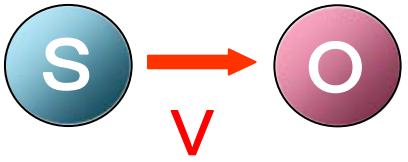
The target system is complex.

How can I simplify the problem effectively ?



Against the Target problem,

Generalizing by Function



The Element S acts on (V) the Element O

Functional approach changes the mind

from "Why?“ to "For what", “For the Customer"

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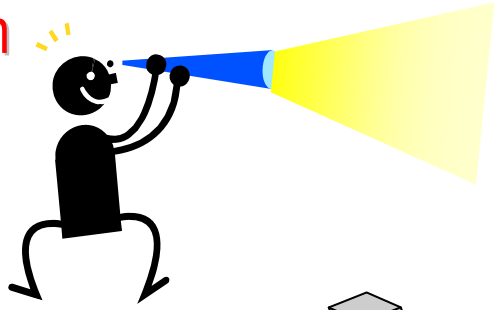
6. 3 Key Elements of connection (4)

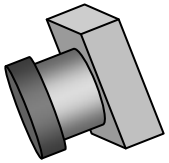
Functional schematic can clarify the function

Functional schematic can analyze the function along the thinking of the engineer.

From the top of the system
I chase the function
step-by-step



Deployment from the main function (Projector)



S+V+O

Projector projects the electronic data on the screen.

Purpose

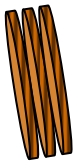
Lens Unit focuses the emitted light to the screen.

Purpose……Means

Shutter switches the light.

Purpose……Means

Actuator moves the lens in the axial direction.



Purpose……Means

Light source irradiates light to the optical Unit.

Purpose……Means

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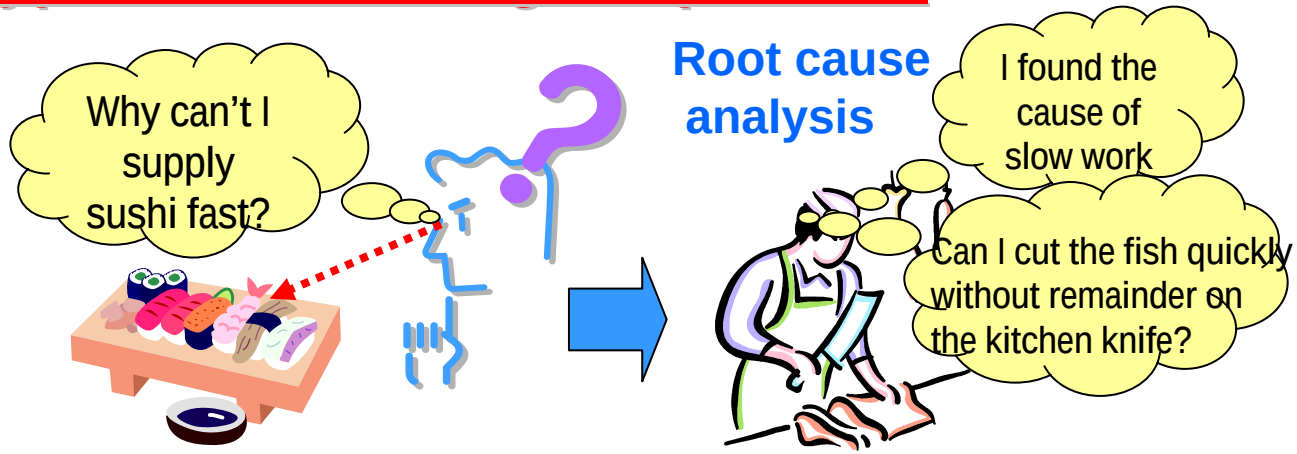
6. 3 Key Elements of connection (5)

【Element 3】 2 types of idea approaches by TRIZ to the purpose

Type of eradicating the problem

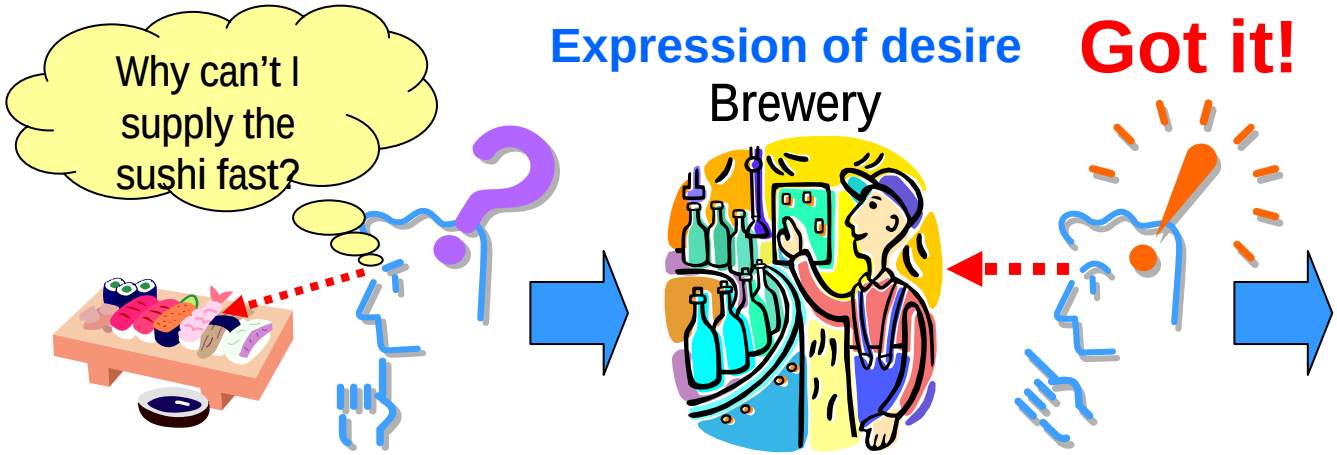


In Sushi Bar

New type of Kitchen Knife

You can solve the problem concretely. However, the range of ideas is narrow

Type of fulfilling the desire



Belt-conveyor Sushi bar

You can obtain a wide innovative idea. However, the idea lacks detail or specifics.

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7. 7 Solutions (1) Fuzzy Frontend ①

Matching Needs and Seeds through the Function

I want you to level up ○○ more

I want you to add △△ more

I want you to eliminate the problem × ×

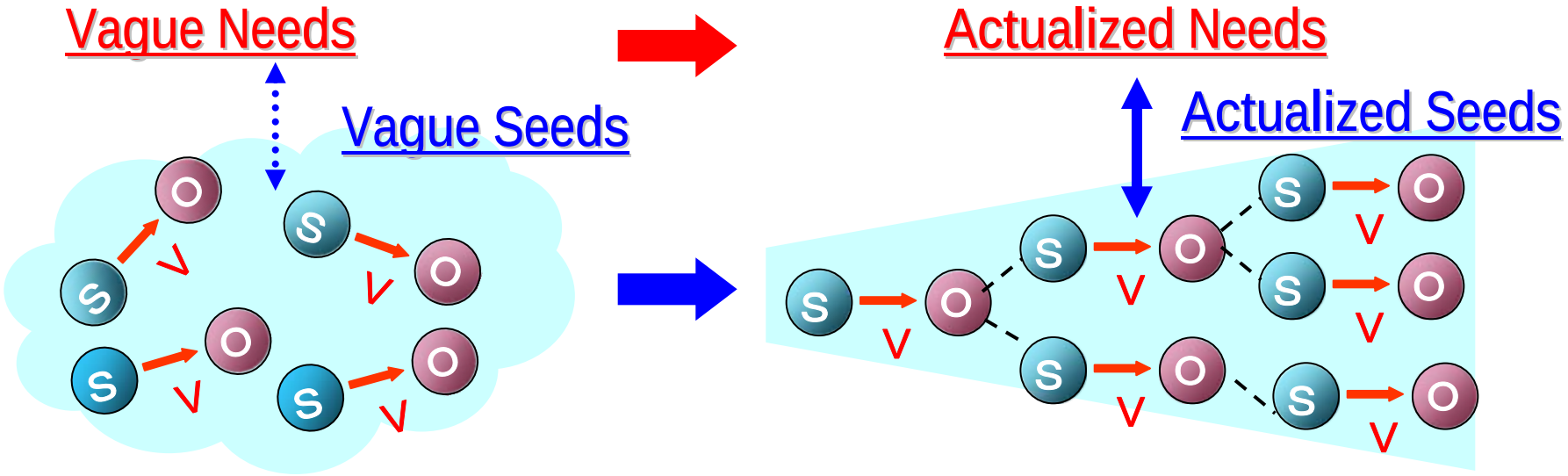
→

Requirement for an accelerated level of the function

Requirement for functions which the current system does not have

Reduction request of the side effects of the function

Matching Needs and Seeds and actualizing them in Fuzzy Frontend



Arranging Seeds (technology) by the Function

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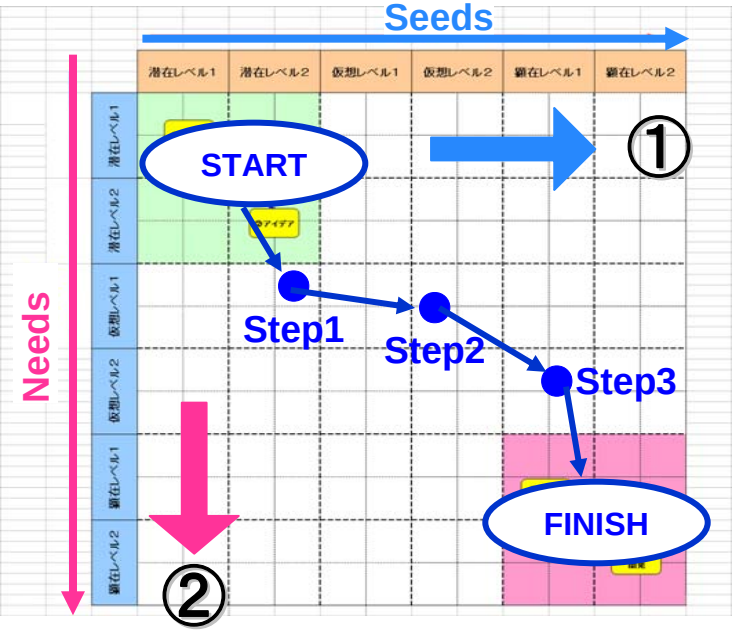
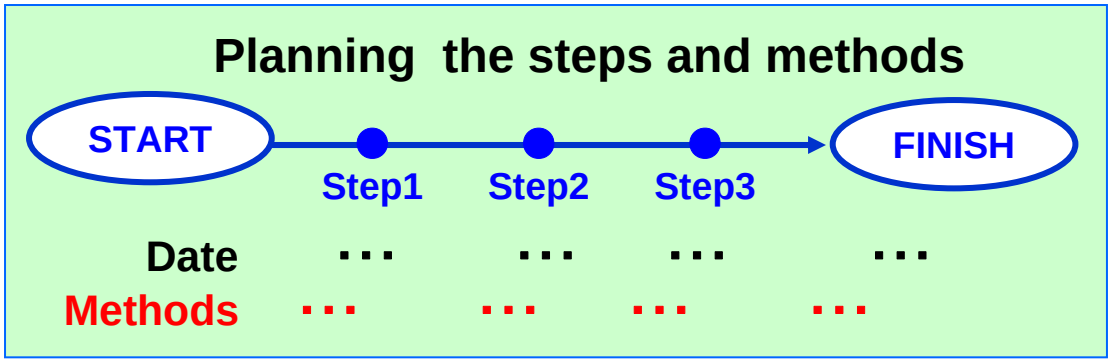
7. 7 Solutions (2) Fuzzy Frontend ②

Visualizing the Fuzzy Frontend process by matching Needs and Seeds



Visualization Map of Fuzzy Front End

① Seeds Push Type
② Needs Pull Type



Methods for Actualization of Needs

① Concept mining **QFD**
② Seeds-driven **QFD**
＋Usability Evaluation, Market research etc.

Methods for Actualization of Seeds

① **TRIZ** 9-Window representation
② **TRIZ** Trend analysis of the evolution
＋Patent search, Technical Tree etc.

*Reference: Toshiba Corporation Dr. Hitoshi Iwama

"A Study of the Mechanism of Customer Value Creation Integrating Market Needs and Technical Seeds in Product Innovation"

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7. 7 Solutions (3) Setting Theme

Matching the vector of engineers while reducing Ambiguity of the theme

The Fish Bone Chart Part 1

Ambiguity Big

Making sure customers and the purpose by the bird's-eye view to set the target area

QFD

Ambiguity Medium

Extracting the priority of technical problems according to customer's needs

The Fish Bone Chart Part 2

Ambiguity Small

Setting the target area of challenges to level up and planning of solution

★ Output of TRIZ is consistent with the expected results by clarifying the issues.

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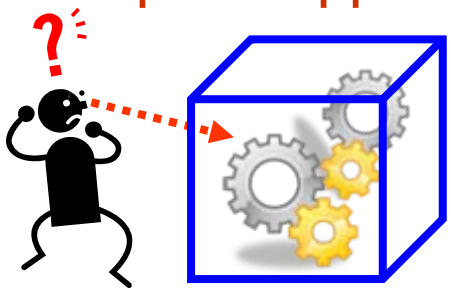
7. 7 Solutions (4) Fast Cause Analysis ①

Combining idea approach and cause analysis for each purpose

Approach of Analysis

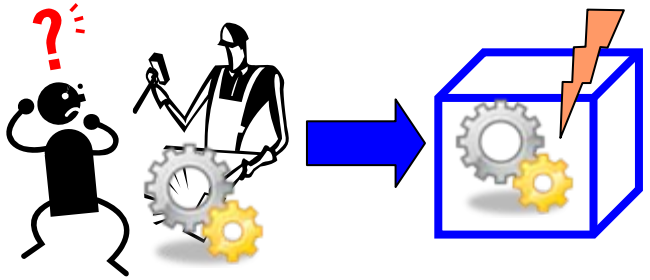
Space and Time

Spatial approach



Study of the factors in the system

Time approach



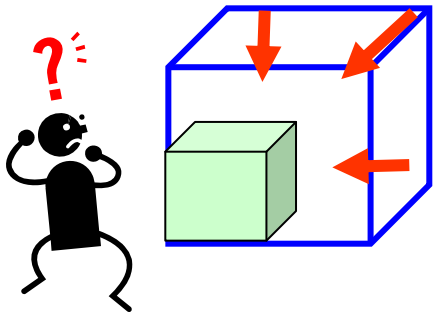
Study of the factors in the process

X

TRIZ Idea approach

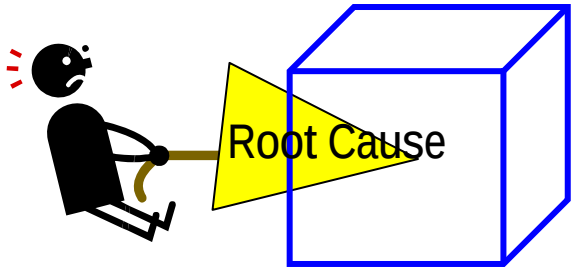
Desire and Eradication

Desire



Smaller, Lighter, Lead time reduction, Cost reduction, etc.

Eradication



Removal of the root cause

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7. 7 Solutions (5) Fast Cause Analysis ②

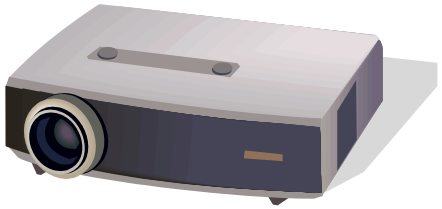
Cause analysis in accordance with the Functional schematic

Case Study: Reducing the noise of the cooling fan to 20 dB or less

Why ?

Why ?

Projector generates more than 20 dB noise during irradiation

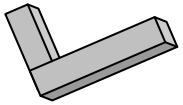


Because, Housing System can neither reduce the noise nor insulate

Because, Light Source System can not send light efficiently to the optical switch

Because, Housing Case has many holes

Because, Structural Parts convey the vibration of the cooling fan to the housing



Because, Cooling Fan conveys the vibration by stirring the air

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7. 7 Solutions (6) Making Strong Patent ①

Destroying the traditional constraints by Functional expression of desire

Attention to only the Function and Achieved level

Projecting
the electronic data clearly
on the screen

Lens wants to converge emitted light efficiently on the screen

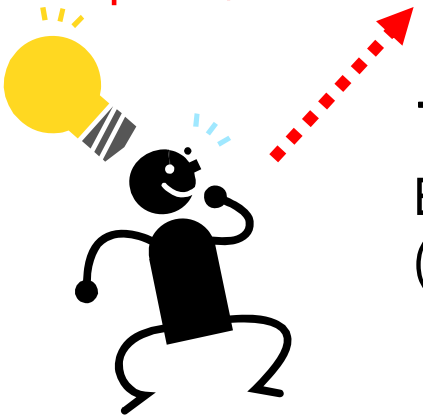
Shutter wants to switch the light efficiently

Case study: Projector

Actuator wants to move the lens at high speed in the axial direction

Light source wants to illuminate the light brightly to the optical system

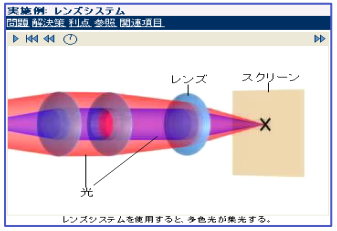
Purpose, Desire

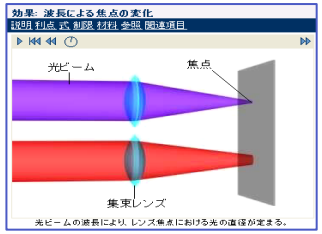


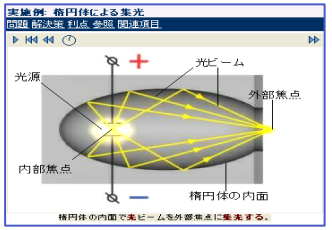
Destroy the conventional systems, and realize the different means.

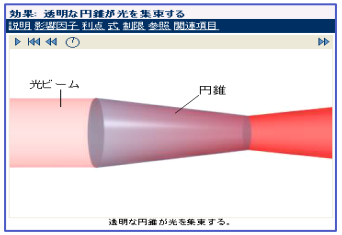
TRIZ

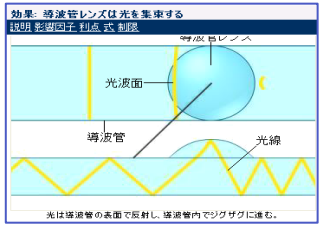
Example of Effects
(Goldfire*)

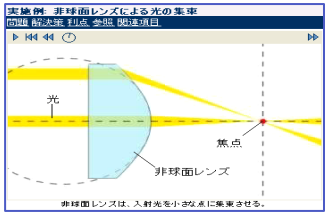












* Invention Machine Corporation
Innovation Support Software

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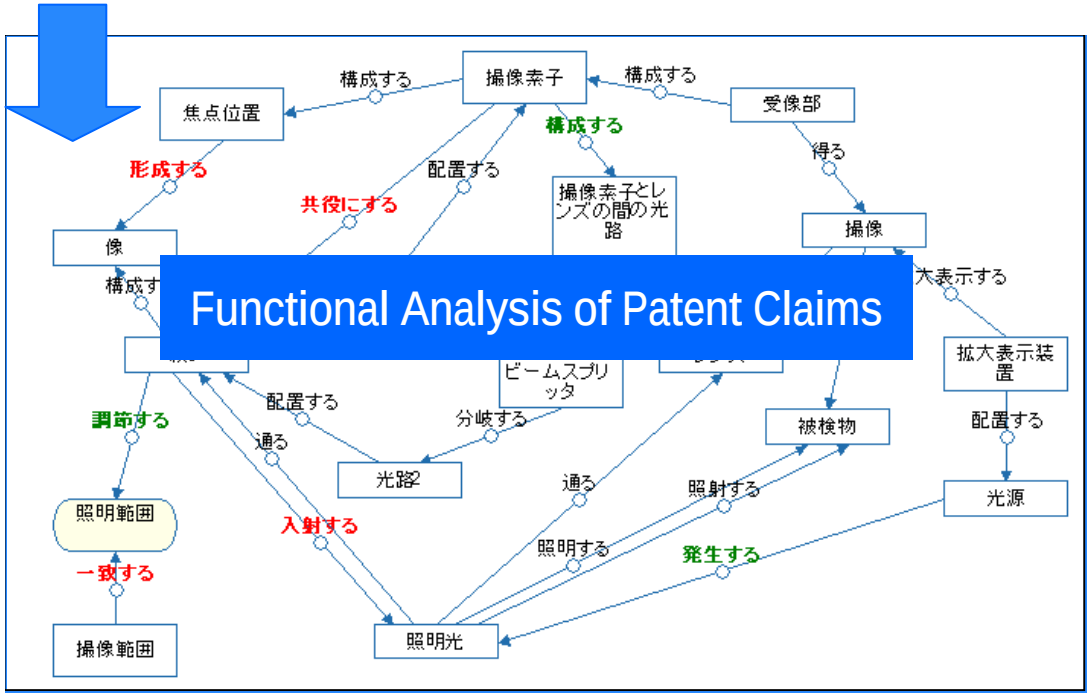
7. 7 Solutions (7) Making Strong Patent ②

Avoidance case by functional analysis of competitors' patent

Patent claim (Example)

撮像素子からレンズを通して得られる被検物の撮像を受像部に拡大表示する拡大表示装置において、撮像素子とレンズとの間の光路中にビームスプリッタを配して光路を撮像素子に、他方の光路を絞りに被検物を照明する照明光は絞り，レンズを通って被検物に照射されれば、絞りの像が撮像素子の焦点位置と同位置に形成され、且つ照明範囲の大きさを撮像範囲と一致させるようにしたことを特徴とする拡大表示装置。

Competitors' Patent Claims



Functional Analysis of Patent Claims

Step1
Separate patent claims into S+V+O, and make Functional Model by using **Goldfire***

Step2
Search the disadvantages of the distinctive features by **Goldfire***, and get many ideas by TRIZ

For example,
a basic patent of another company which consists of 48 claims is replaced by 4 patterns of Functional Model

* Invention Machine Corporation
Innovation Support Software

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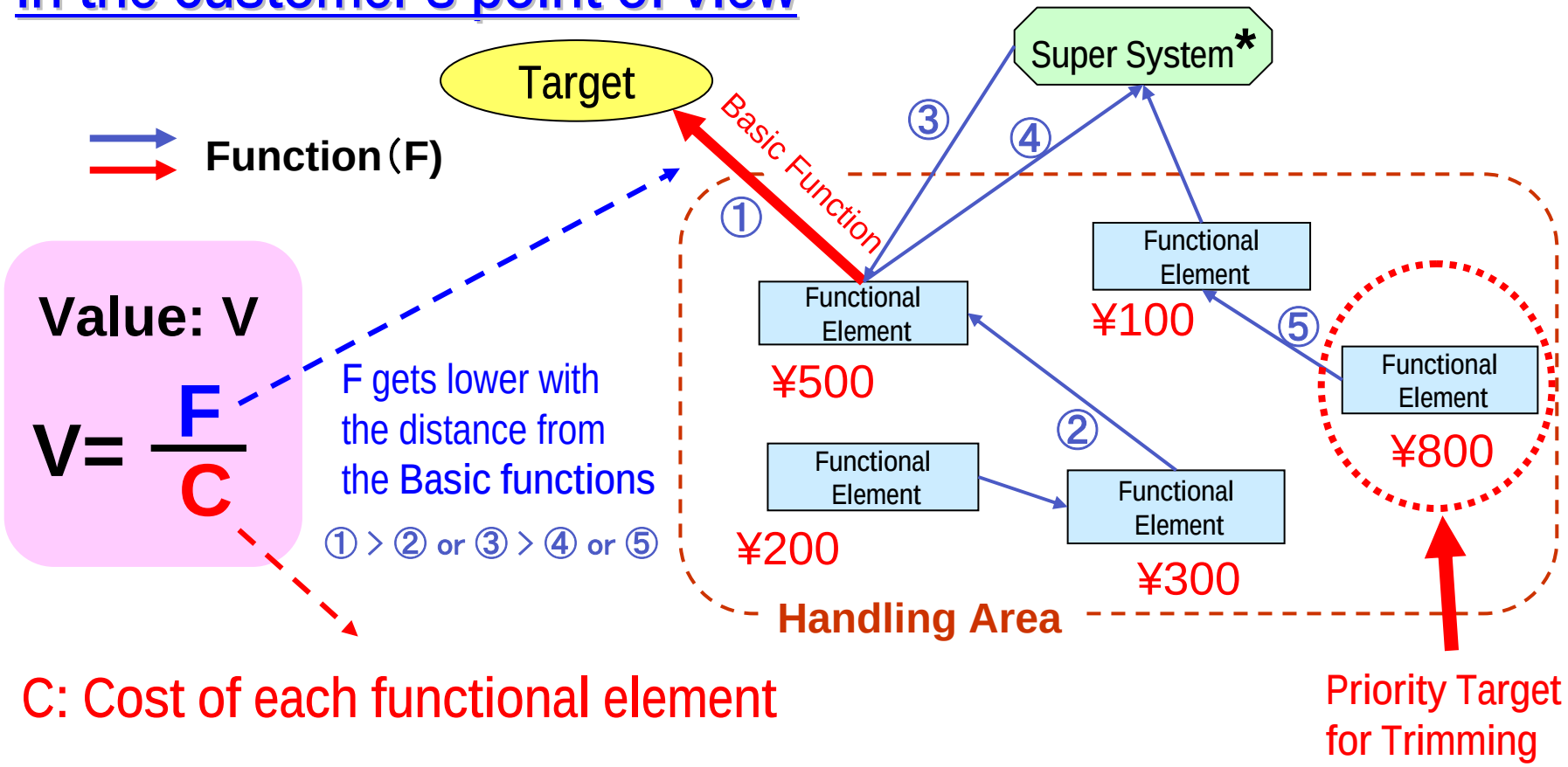
7. 7 Solutions (8) Cost Reduction

Evaluating the cost of each function by the concept of VE in the customer's point of view



Trimming by TRIZ: Value V is low

* Uncontrollable Factor

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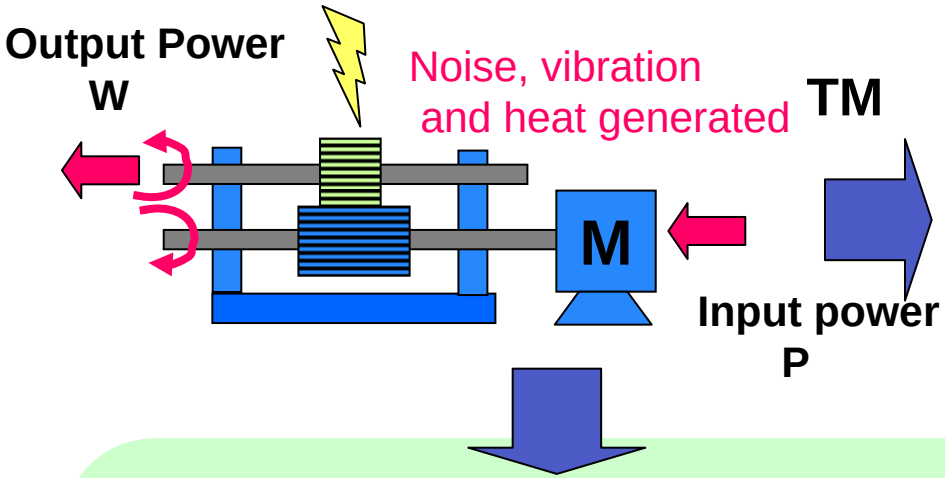
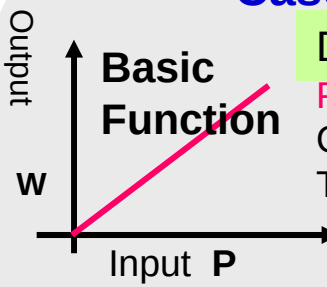
7. 7 Solutions (9) Evaluation & Experiment

Advantage of TRIZ to the interaction removal in experimental systems



Case of TM used directly



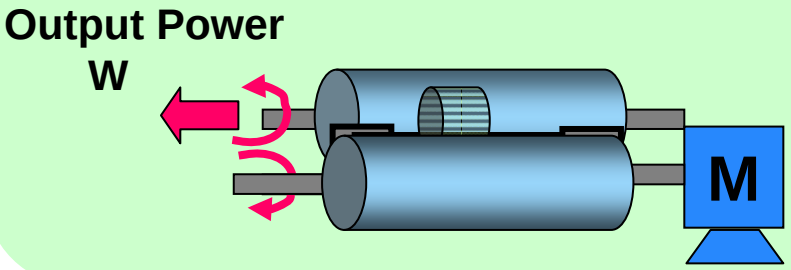
Design Parameter
Parallelism of 2 axes
Clearance between the gears
The shape of the gears

Noise Temperature, Load

Greater interaction between the two axes parallelism and gear shape

Problem solving by TRIZ

Get ideas to improve the parallelism of 2 axes



TM

Optimal design TM

Design Parameter
Clearance between the gears
The shape of the gears

Optimal design can be reliable by using limited design parameters

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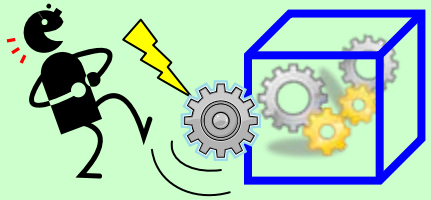
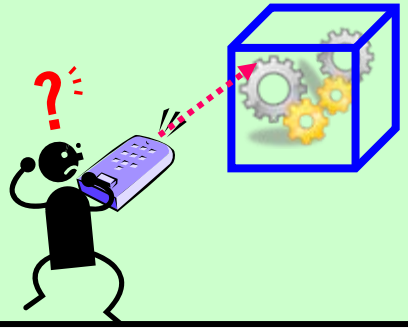
7. 7 Solutions (10) Risk Prevention ①

Risk analysis by purpose

	Product Improvement	New products
Type of Human life priority 	Functional part to handle the large energy And Design change part	Functional part to handle the large energy And Basic Function
Type of Quality priority 	Important Function by the customer (Level up - Function) And Design change part	Important Function by the customer (Level up - Function) And Basic Function

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7. 7 Solutions (11) Risk Prevention ②

Failure mode prediction by TRIZ（Reverse Thinking Method)

Reverse Thinking Method (TRIZ AFD*)
For example, the way to see the security system in the eyes of a thief

TRIZ AFD* Example

Using a Functional schematic for inhibiting the original function in Reverse Thinking Method

Mean function deployment to cause a failure

Stop the projection of electronic data to the screen

Purpose

Lens does not condense the light on the screen

Purpose……Means

Shutter does not switch the light

Purpose……Means

Actuator does not move the lens in the axial direction

Means

The light source does not irradiate light onto the optical system

Means

＊AFD（Anticipatory Failure Determination）

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Summary

① In the promotion of scientific methods, the point of view of efficiency and time for engineers is important.
And, providing solutions is effective for them to encourage the learning of scientific methods.

② For connecting smoothly between solutions and methods,
the concept of customer thinking and objective thinking is important with a focus on the function of the system.

③ In 7 solutions, the range of TRIZ application spreads by using Type of fulfilling the desire and Type of eradicating the problem for each purpose.

Next challenge

In promoting the solution, it is a challenge how we systematically hand our knowledge and know-how on to promoters in our company.

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Thank you for your attention

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