

Creating the engineer's environment for using TRIZ naturally

- The functional approach for connecting methods and 7 solutions-

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2. Promotion of scientific methods in Olympus
3. Seven Solutions meet the wide range of issues
4. Function is the point of contact with TRIZ
5. Connecting QFD by the function
6. Connecting Taguchi-Method by the function
7. Connecting Each Solution by the function
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9. Using TRIZ in various scenes of the project
10. Summary

1. About Olympus

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Medical Business



EVIS EXERA III



Established : October 12, 1919
Head office : Shinjuku-ku, Tokyo, Japan
Capital : ¥124,520 million (As of March 31, 2015)
Consolidated net sales : ¥764,671 million
(Fiscal Year Ended March 2015)
Consolidated headcount : 31,540 (As of March 31, 2015)

Imaging Business



OM-D E-M5 Mark II



PEN Lite E-PL7



TG-4

Scientific Solutions Business



DSX Series Digital Microscopes

EPOCH 650



Series C industrial endoscope



Ultrasonic Flaw Detector EPOCH 650

Surgical Energy Device THUNDERBEAT



Two Therapeutic Support Systems Incorporating Robotic technology

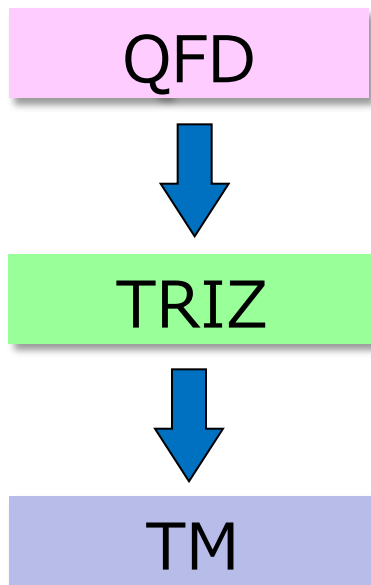
2. Promotion of scientific methods in Olympus (1)

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Providing 7 solutions for the purpose

2009

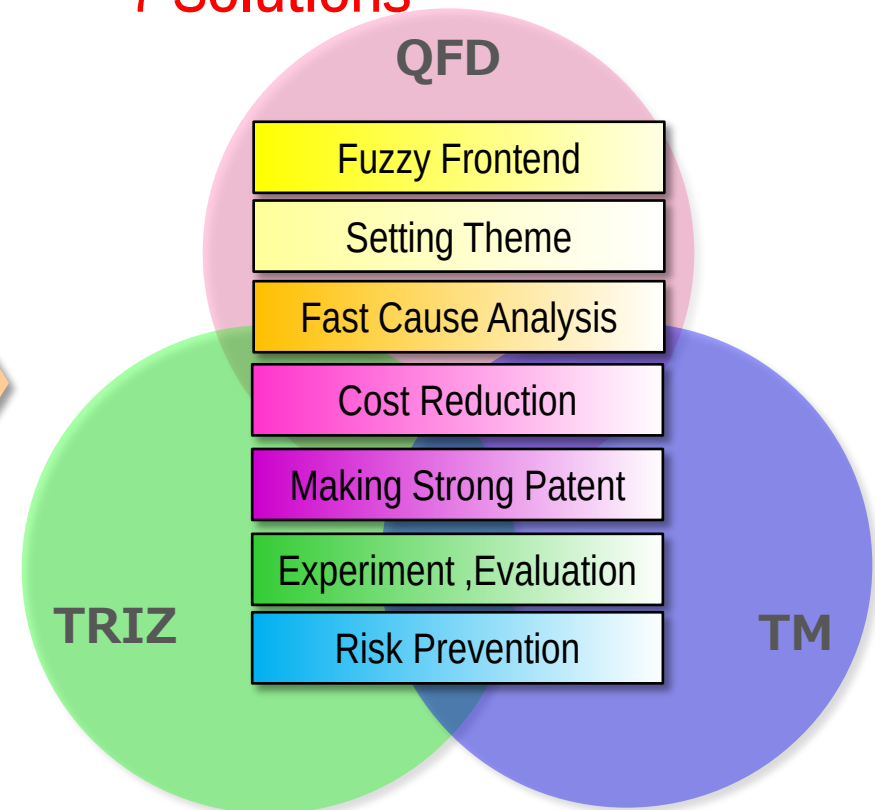
Typical Use of Methods



Using various types
of methods
according to the
problem

2012~

7 Solutions



2. Promotion of scientific methods in Olympus (2)

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Engineers are the customer for us. We've been listening to the voice of the customer without force of methods.



◆ Anyway we are busy. Please shorten training time

- Long time of training can not be accepted. Please set the training in the gap of work and work.

◆ Tell me how to resolve the problem not the methods.

- Tell me what method are available in the scene. Purpose is not the use of method. We want to raise the efficiency in problem-solving.

◆ Stop the hard sell of QFD,TRIZ,and TM

- I have failed at work by using the QFD. So, I do not like to use the scientific method. . (Allergy of scientific methods)

◆ It is difficult to resolve problems by one method.

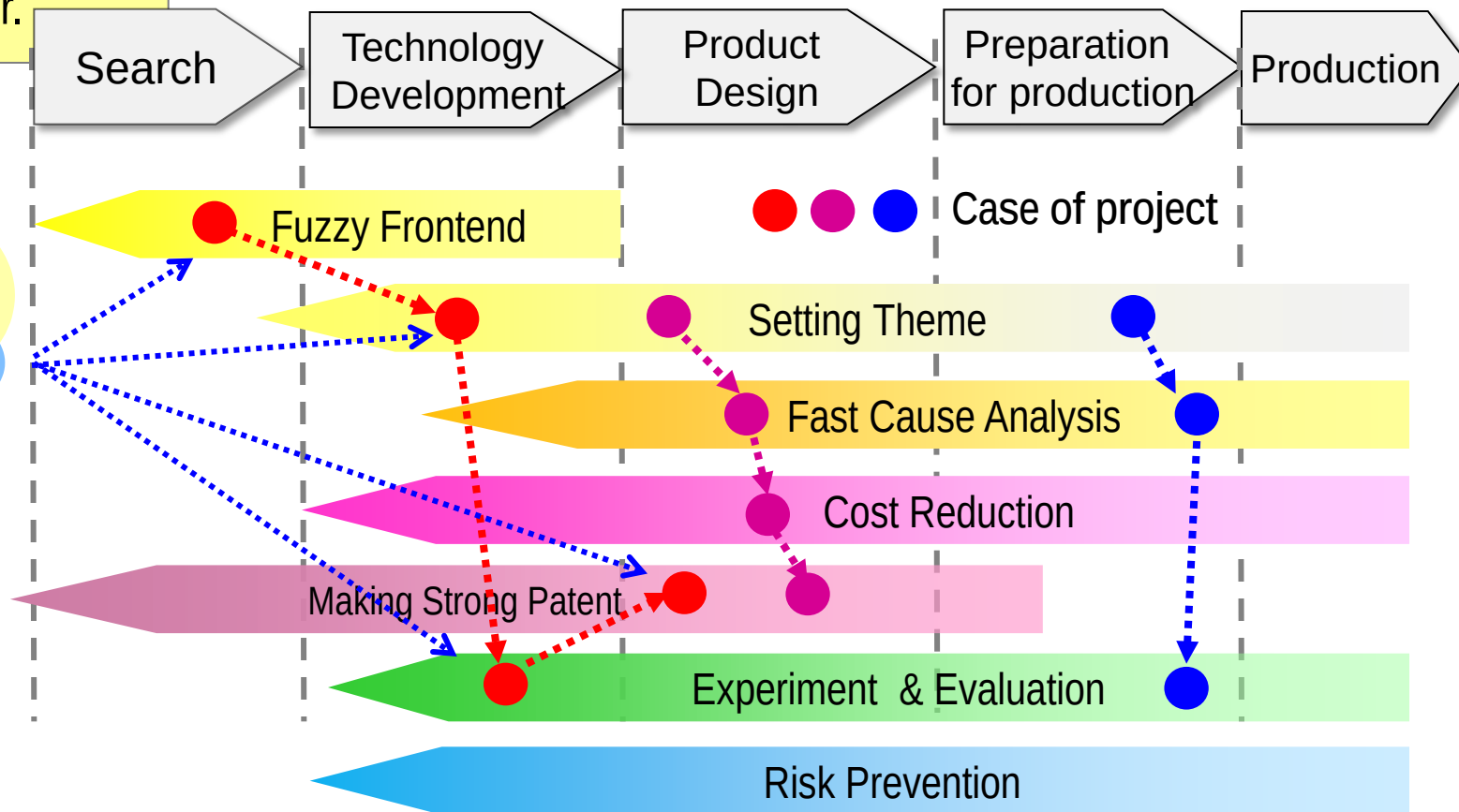
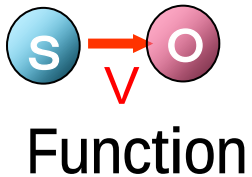
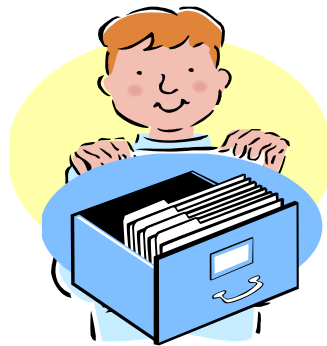
Why do you teach only one method ?

- 1 method can not solve the problem. Please tell me the connection way of methods.

3. Seven Solutions meet the wide range of issues

“ Functional Drawer ” is the Key of connecting 7 solutions

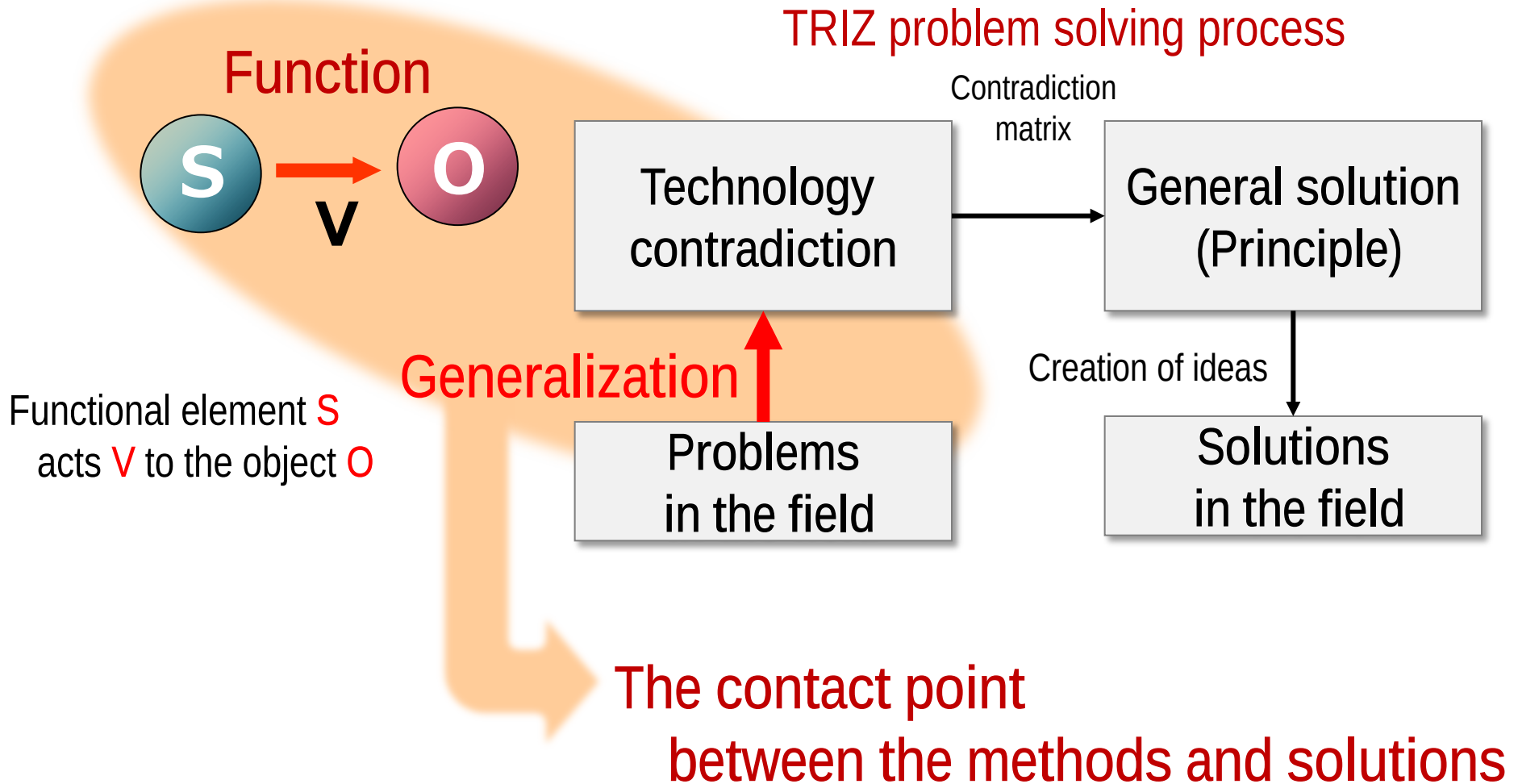
Process is connected by the function wherever I open the drawer.



4. Function is the point of contact with TRIZ

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Good point of TRIZ is to generalize the complex problem



5. Connecting QFD by the function (1)

Connecting the needs and seeds by the function

Needs



Customer Needs are the level of functions and requests for the function system does not have

I want to boil the water in 1 minute

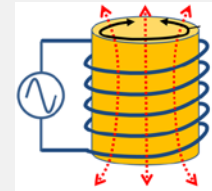
The specifications are the achievement level of the function

Seeds

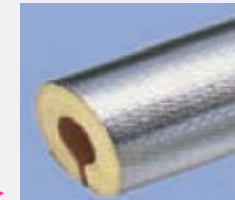
Technique is a means for realizing the functions



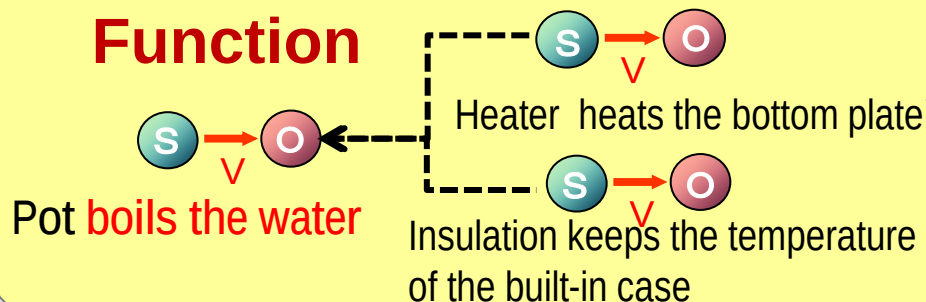
Means of heating
Heater, Induction heating



Means of keeping temperature
Wool insulation, Vacuum insulation



Function



Needs Driven

Seeds Driven

Seeds Driven

Needs Driven

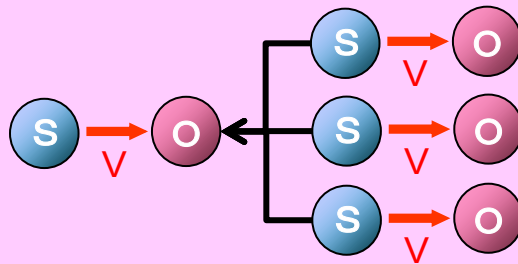


Function connects the seeds and needs !

5. Connecting QFD by the function (2)

Needs survey by the function-based “SN Matrix”

Step 1 Functional expression of the product



Step 2 Listen to the voice of the customer



SN Matrix

Functional Layer	Priority	Functional Level		Function (S+V+O)	Technology of competitors		Needs of Customer
		Target	Current level		Level	Detail	
	◎	1 min	2 min	Pot boils the water.	1.5 min	Technology X PAT No.	To boil the water in 1 min
				Water heats . . .			

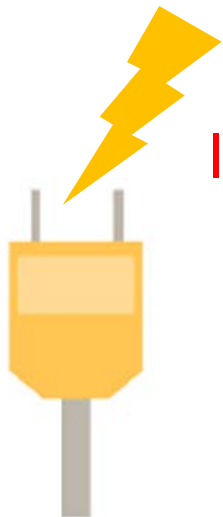
6. Connecting Taguchi-Method by the function

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Determining the factor from the basic function of the system

Affecting the basic function

Design parameter

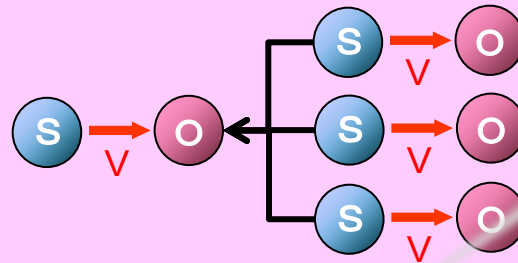


Input energy



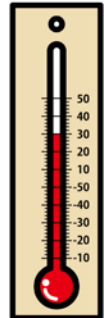
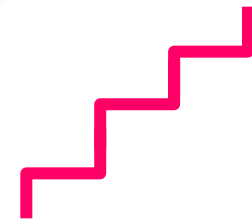
Input power

Basic function



Affecting the basic function

Noise



Output energy

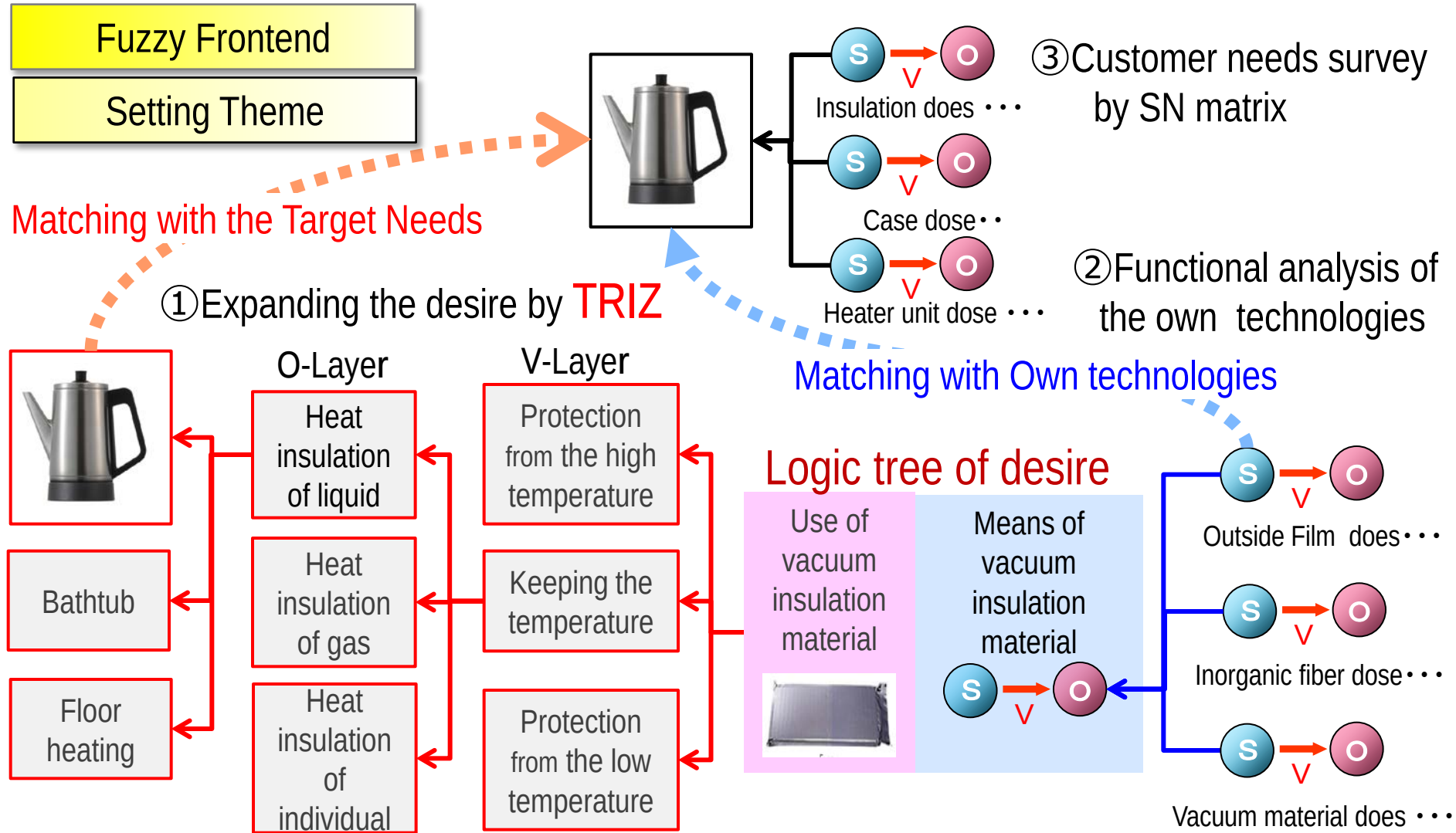


Temperature $\times$ Time

7. Connecting Each Solution by the function (1)

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“ Logic tree of desire” for expanding the technology seeds

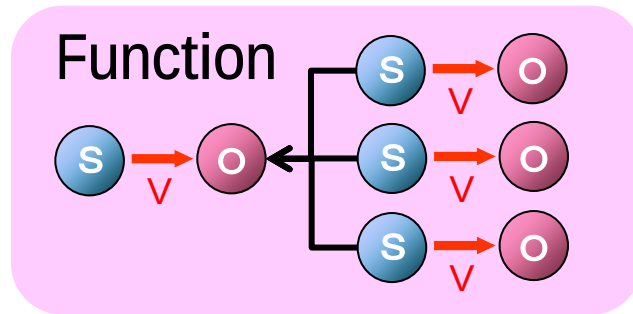


7. Connecting Each Solution by the function (2)

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Cause analysis tree is made in accordance with the function

Fast Cause Analysis



✕ Time functional approach can analyze the production process

Getting ideas by **TRIZ** to break through the root causes

なぜ？

Why can pot not boil in 1 minute ?

Why ?

Because, the heater system is not able to heat water at a rate of ○○

Because, Aluminum top plate does.....

Because, Heater does.....

Because, Heater fixed plate does...

Because, Insulation pedestal does....

- Functional approach can eliminate the leakage of causes
- Write in the form of S + V + O is in the box

7. Connecting Each Solution by the function (3)

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Changing the means by functional analysis of the competing patent

Making Strong Patent

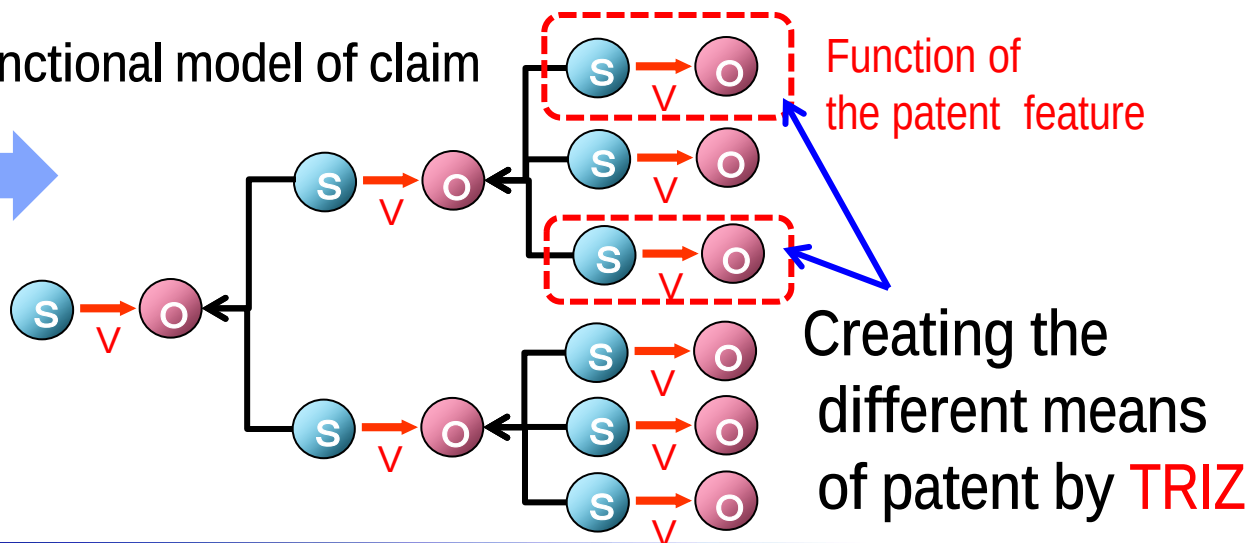
【請求項事例】

外ケース内に収納した内容物の下方部に上記内容物の外部に設けた□□通路を連通せしめ、上記□□通路の途中に直状の□□□部を設け、上記□□□部に外ケース外部に開放された△△を連通せしめ、上記□□□部を設けたことを特徴とする液体容器の液吐出装置。

Claim of patent

Functional analysis (Using SN Matrix)

Functional model of claim



7. Connecting Each Solution by the function (4)

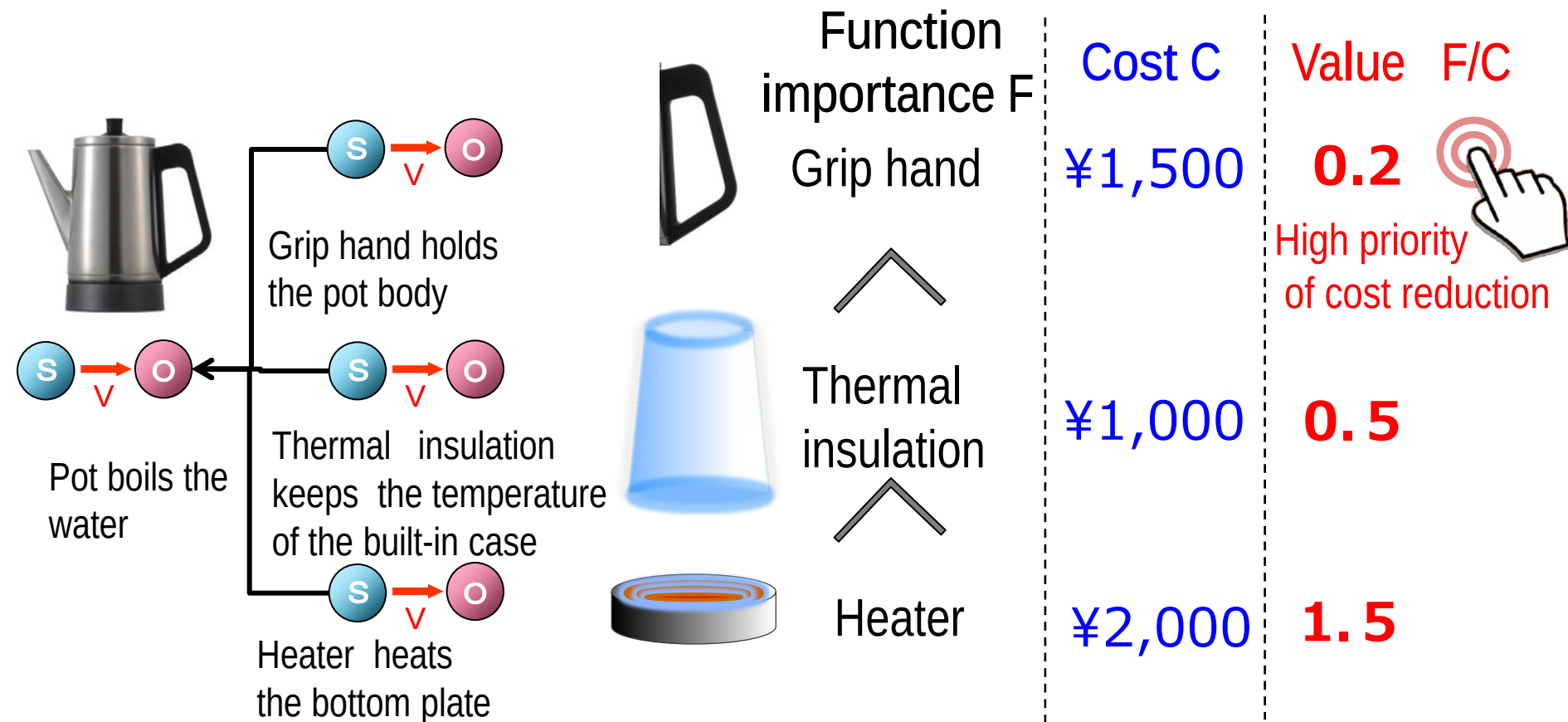
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Cost reduction from a low value (Function / Cost) *

Cost Reduction

Creating Low cost idea by **TRIZ**

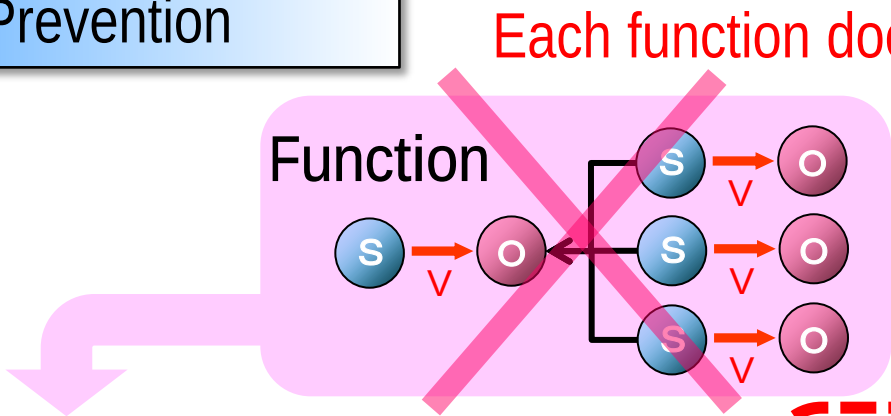
* The concept of the VE and TOC is used to cost reduction



7. Connecting Each Solution by the function (5)

Evaluating and measuring the risk of Safety and function

Risk Prevention



Using the Reverse Thinking Method of **TRIZ** (TRIZ ADF*)

構造階層 (サブシステム ～素材)				機能 (機能系統図からS+V+Oで記載)	機能 種別	リスク評価 RPN				評価
						重大さ	頻度	発見率	RPN	
		23		アルミ上蓋はヒーターの熱をステンレス内層ケース底部に伝えられない	主機能	4	4	5	80	◎
			231	アルミ上蓋がステンレス内層ケース底部に熱を伝えない	主機能	4	4	5	80	
0	0	0	232	ステンレス内層ケースに孔があいて水が浸入する	主機能	4	1	1	4	
0	0	0	233	アルミ上蓋が熱により変形する	主機能	4	3	2	24	
0	0	0	234	アルミ上蓋とステンレス内層ケースの間に酸化物などの異物が浸入する	主機能	4	1	1	4	
0	0	0	235	ステンレス内層ケース底部が熱により変形する	主機能	4	2	4	32	
0	0	0	236	アルミ上蓋とステンレス内層ケースの間に酸化物などの異物が浸入する	主機能	4	2	1	8	

Reverse thinking of
Function system diagram

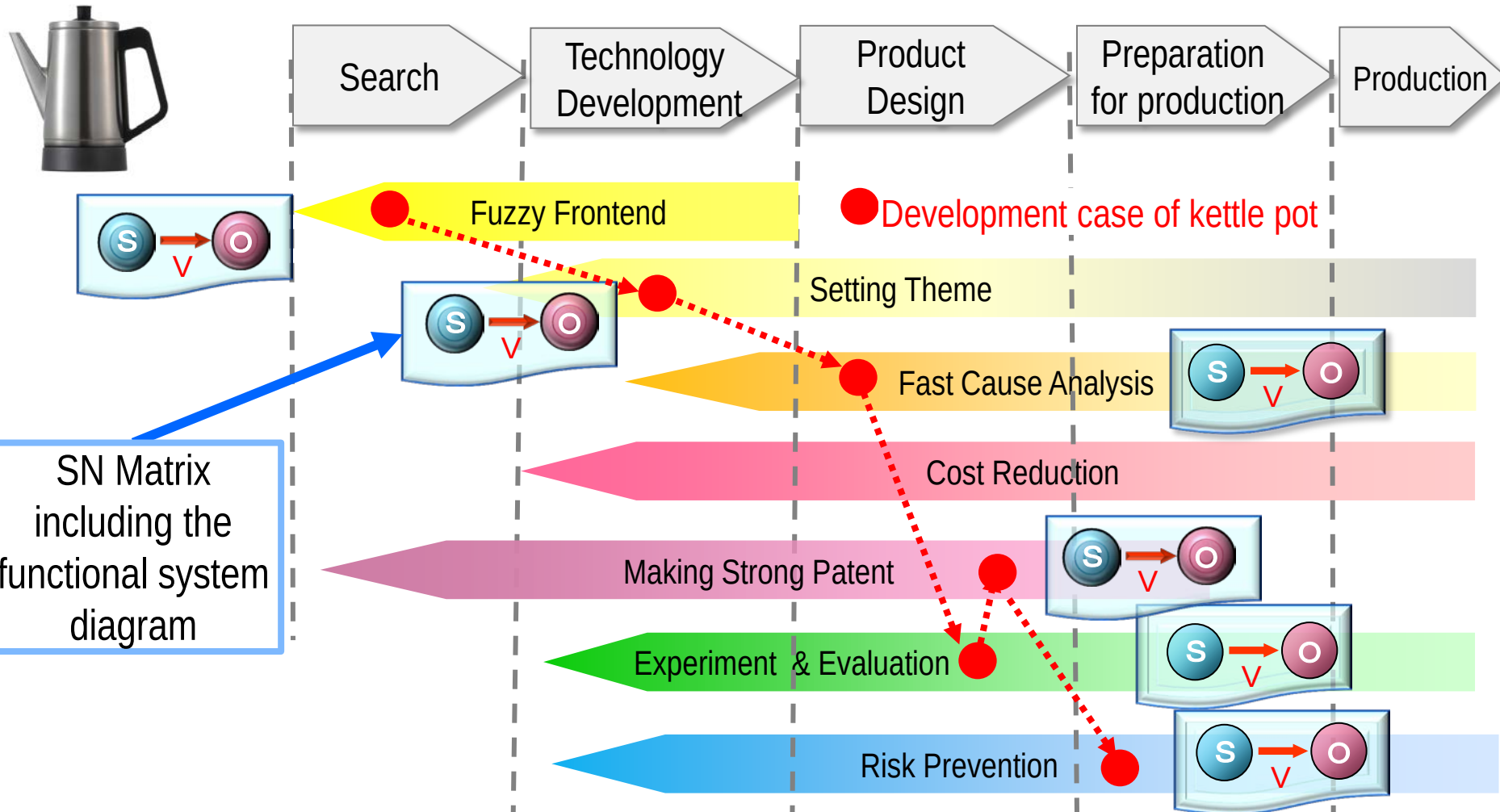
Evaluation of the risk
by RPN

* AFD (Anticipatory Failure Determination)

8. Once analyzed function leads to all steps of the project

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SN Matrix in the early stages can be used to solve various problems



9. Using TRIZ in various scenes of the project

Application from search step to production design (Case of kettle pot)

Fuzzy Frontend

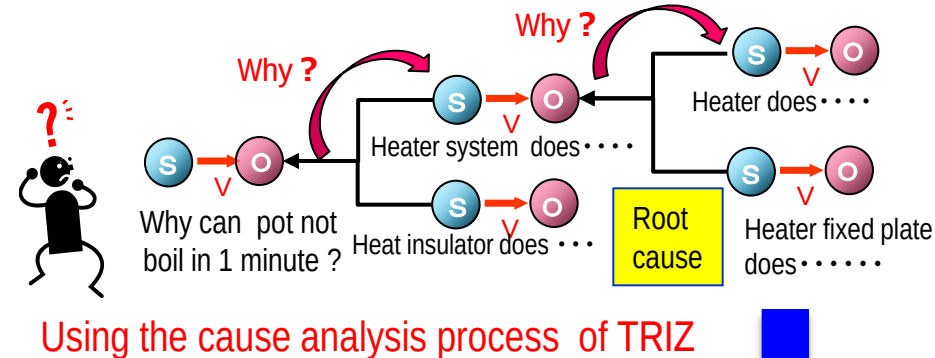
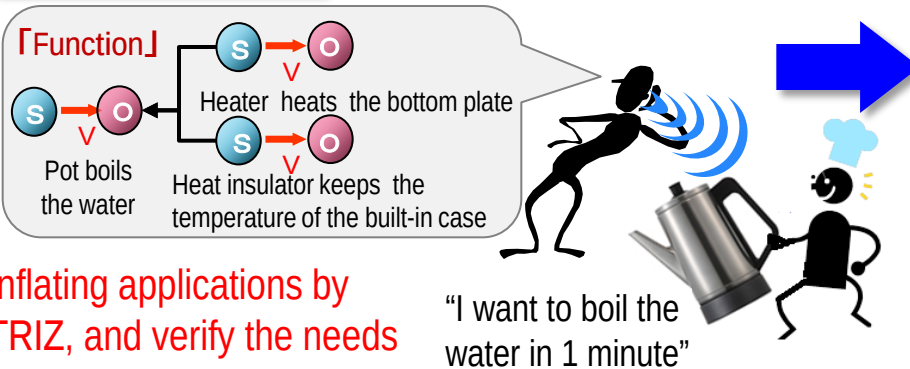
① **Function** analysis of the desire

Setting Theme

② Fitting VOC to the **function**

Fast Cause Analysis

③ Cause analysis according to the **function**



Using the cause analysis process of TRIZ

Risk Prevention

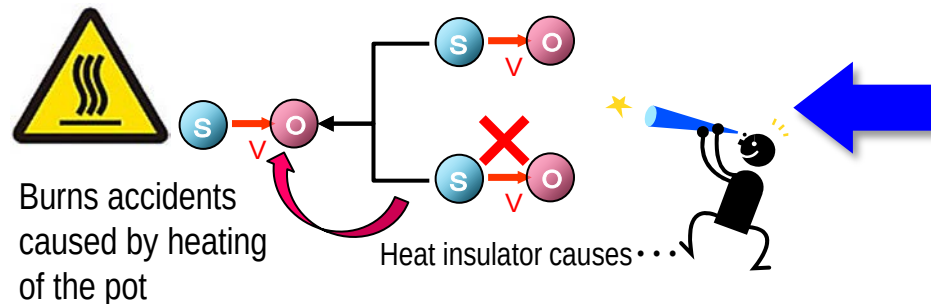
⑤ Predicting the design risk by the **function** comprehensively

Experiment ,Evaluation

④ Representing the root cause by the **function**, and thinking the solution

Making Strong Patent

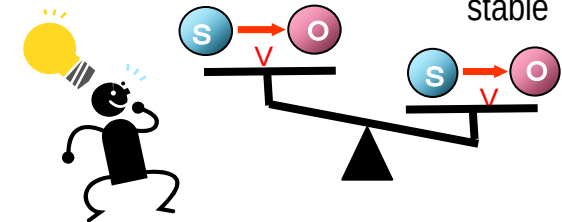
Predict the risk by the Reverse Thinking Method of TRIZ



Resolving the contradiction by TRIZ, or setting the balance point by TM

Prevent heat dissipation of the heater

Fixing the heater stable



- 1 . Generalizing the problem definition process in TRIZ leads to connect seamlessly QFD ,TM and 7 solutions by the functions.
- 2 . By based representations of function in 7 solutions, engineers can **naturally** use the TRIZ process in various situations. And engineers have been **naturally** come to understand the importance of TRIZ.

Thanks to Mr. Mamoru Zenko and Mr. Hajime Kasai of IDEA,INC.
They provided the chance of using scientific methods (QFD + TRIZ)
and support for our activities at OLYMPUS.

Thank you for your attention

OLYMPUS
