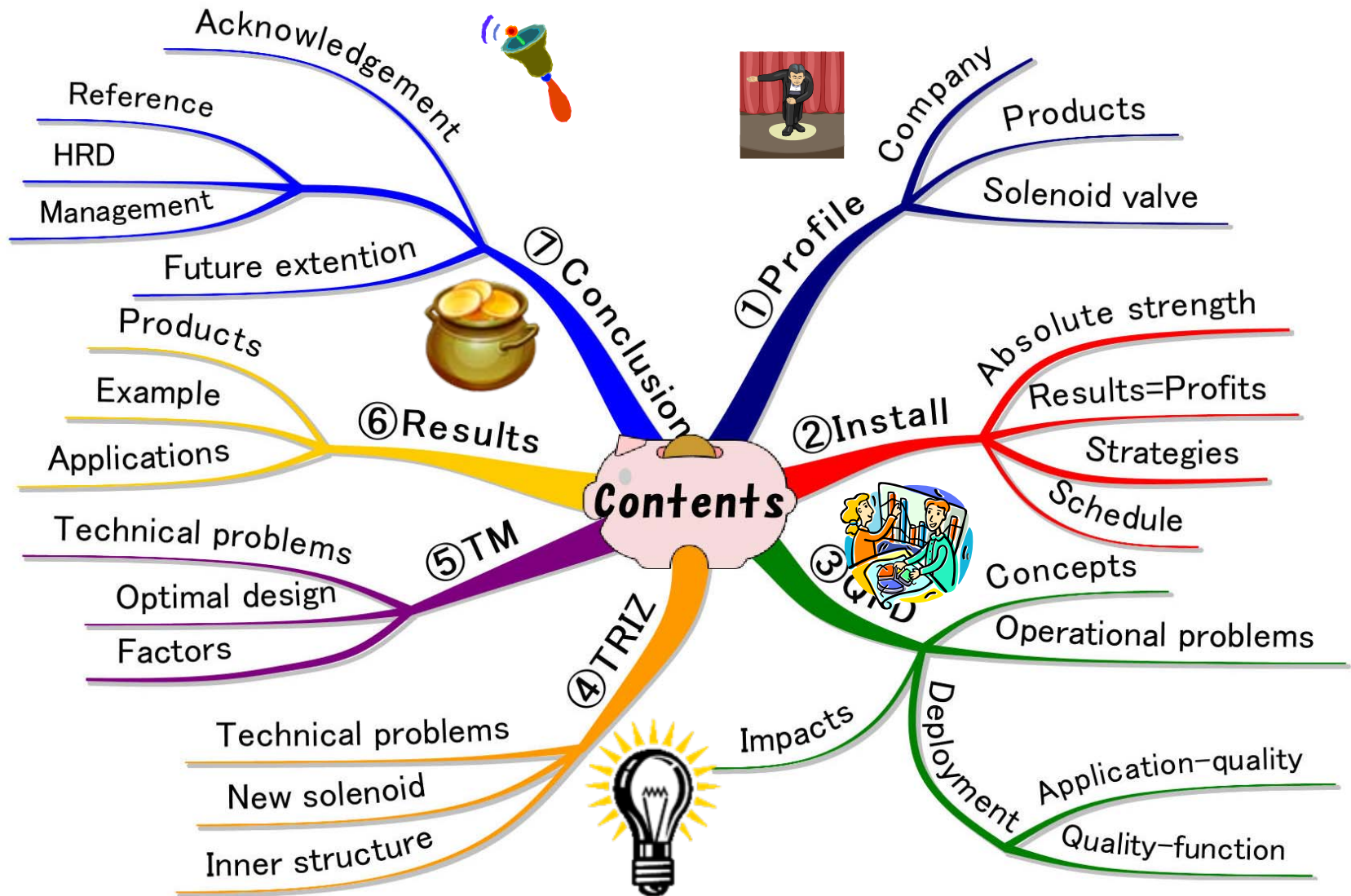


**Case Study of Introducing and Applying
TRIZ to Real Projects
for Obtaining Results (= Profits) (Part 2):
Having Used QFD → TRIZ → TM, What are the Results?**

**Tomohiko Katagiri, Toshiaki Tsuchisawa, and Shuichi Hosaka
(Koganei Co., Ltd.)**

English translation: Toru Nakagawa (Osaka Gakuin Univ.)

Contents



Mind Map®

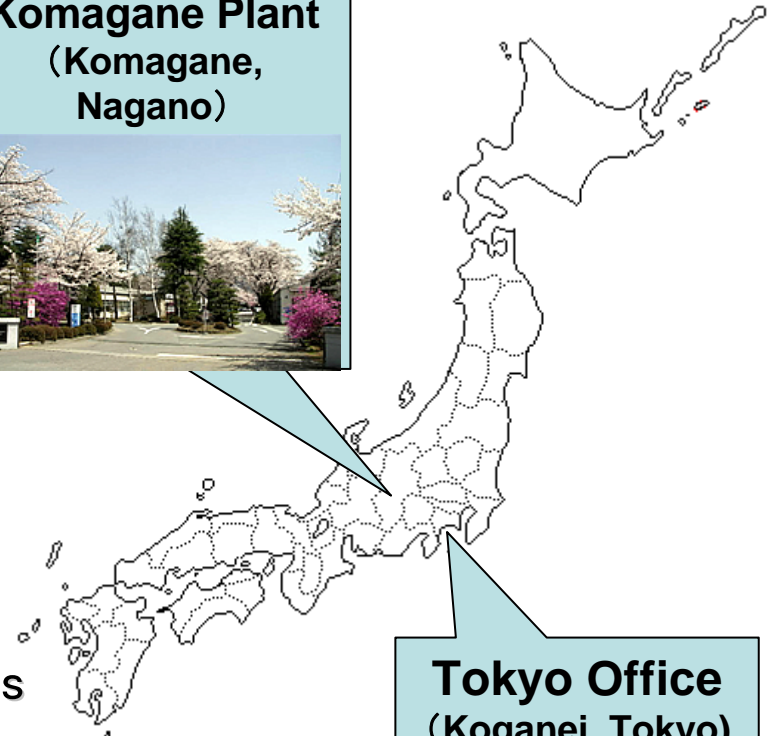
① Company Profile

- Name : Koganei Corporation
- Established: Feb. 7, 1934
- Capital: 640 M yen
- Employees: 750
- Sales: 22.9 B yen (2007 FY)

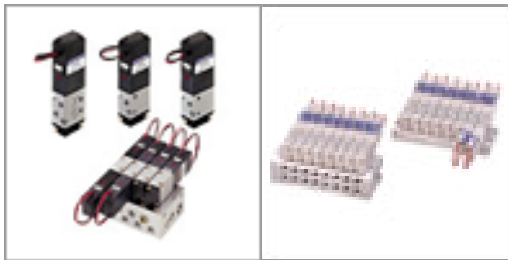
Business areas :

- Aeropneumatic equipments and related products: manufacturing & sales
- Fluororesin products: manufacturing & sales
- Integrated lubrication systems: manufacturing
- Electrostatic equipment, electrical equipment, fluid control equipment, etc.: manufacturing & sales

<http://www.koganei.co.jp/en/>



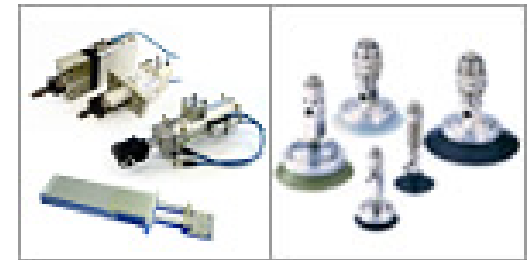
① Product Line Out



Air valves



Air cylinders



**Vacuum devices
& pads**



**Regulators,
Filters**



**Electric
actuators**



**Static electricity
removing unit**



**Fluoresin
equipments**



**Constant
delivery pump**



**Fluid control
equipments**

**300,000
types**



**Joints,
speed controllers**

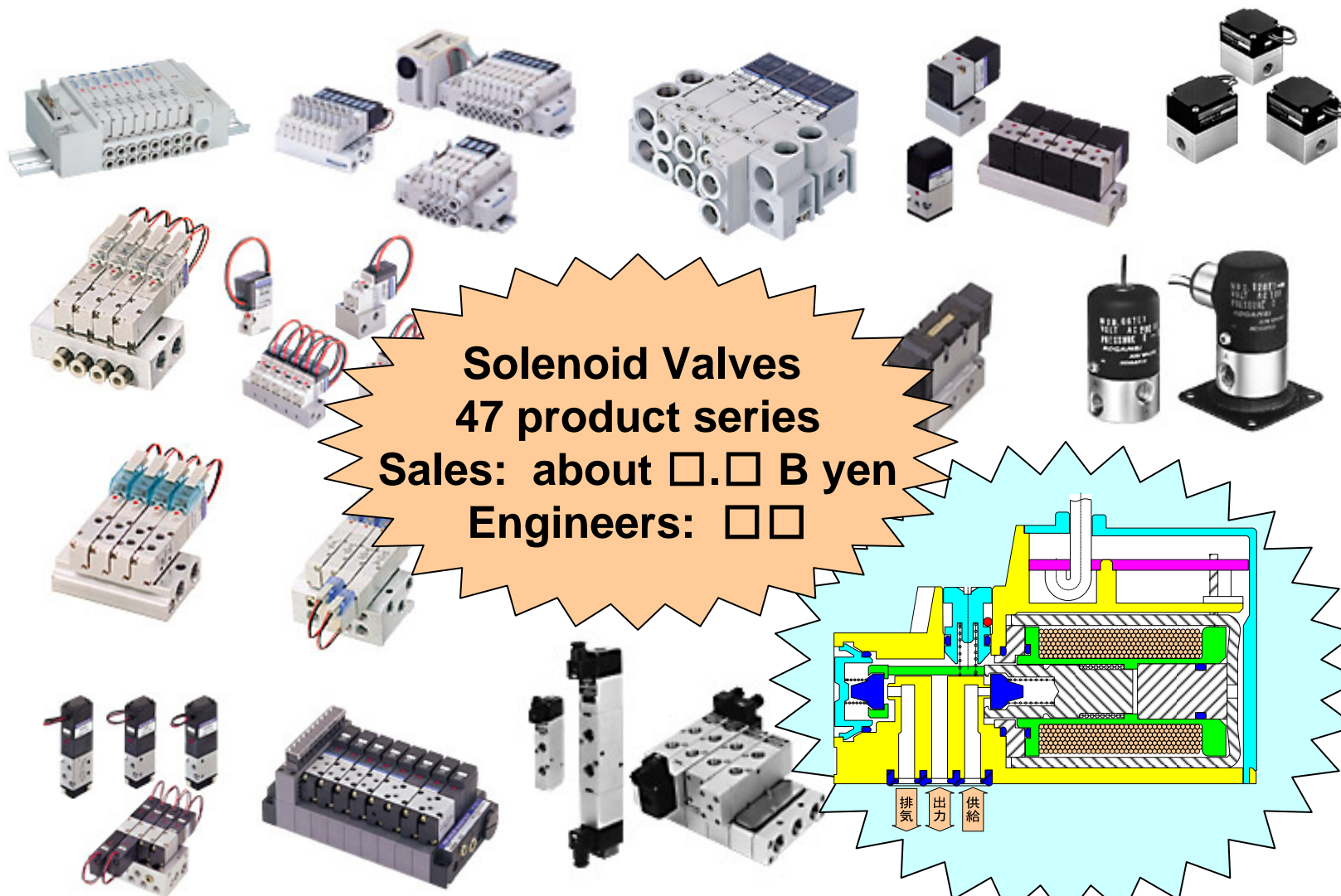


**Clean system
equipments**



**Education Kits,
Books**

① Solenoid Valves



② Introduction: Establishing "Absolute Strength"



【Our Goal】 . . . Establishing "Absolute Strength"

Continually supply differentiated products which provide our customers with profits. . . --> 3 Schemes for achieving the goal.

1. Recognize the real essence of customers' requirements and meet with customers' satisfaction

QFD

- Evaluating customers' requirements with Kano Method.
- Planning the products which surely sell well.
- Sharing information and language among divisions and customers.

2. Generating unique solutions

TRIZ

- Unrivaled competitiveness and no compromised solutions
- Achieving goal requirements without compromise
- Communication language among engineers

3. Minimizing the risks for new unique solutions

TM · other

- Preventive verification for new technologies and solutions
- Reducing the required R&D period
- Accumulating design know-how and sharing knowledge

② Introduction: Achieving "Results = Profits"



Changes in business environments

- Drastic changes --> Needs the results quickly
- Higher risks in new product development --> new products with less risks
- Changing employment styles --> 'Outsourcing and temporary employment in place of educating ...'

Changes in engineers

- 'Performance and goal management' --> Avoiding high risks
- Market saturation --> Sales saturation --> sense of stagnation

Conventional ways

- 'We learned much, thanks.'
- 'We would like to use the method in future product development.'
- 'We have filed a number of patents.'
- 'We have evaluated the impact as xxx Million yen.'

Hence, we ...

② Introduction: Our Strategy



■ Not only TRIZ but also QFD and TM (Taguchi Method):

Apply to the whole process of R&D. --> Optimize as a whole.

■ Have applied to 3 real on-going projects:

Training schedule is synchronized with the project development.

2 projects: development of valves; 1 project: thermal refining equipment

■ Related divisions, related tools and methods:

Reorganized and implemented in synchronous to the projects.

■ The new products should have Results (= Profits) in 3 years

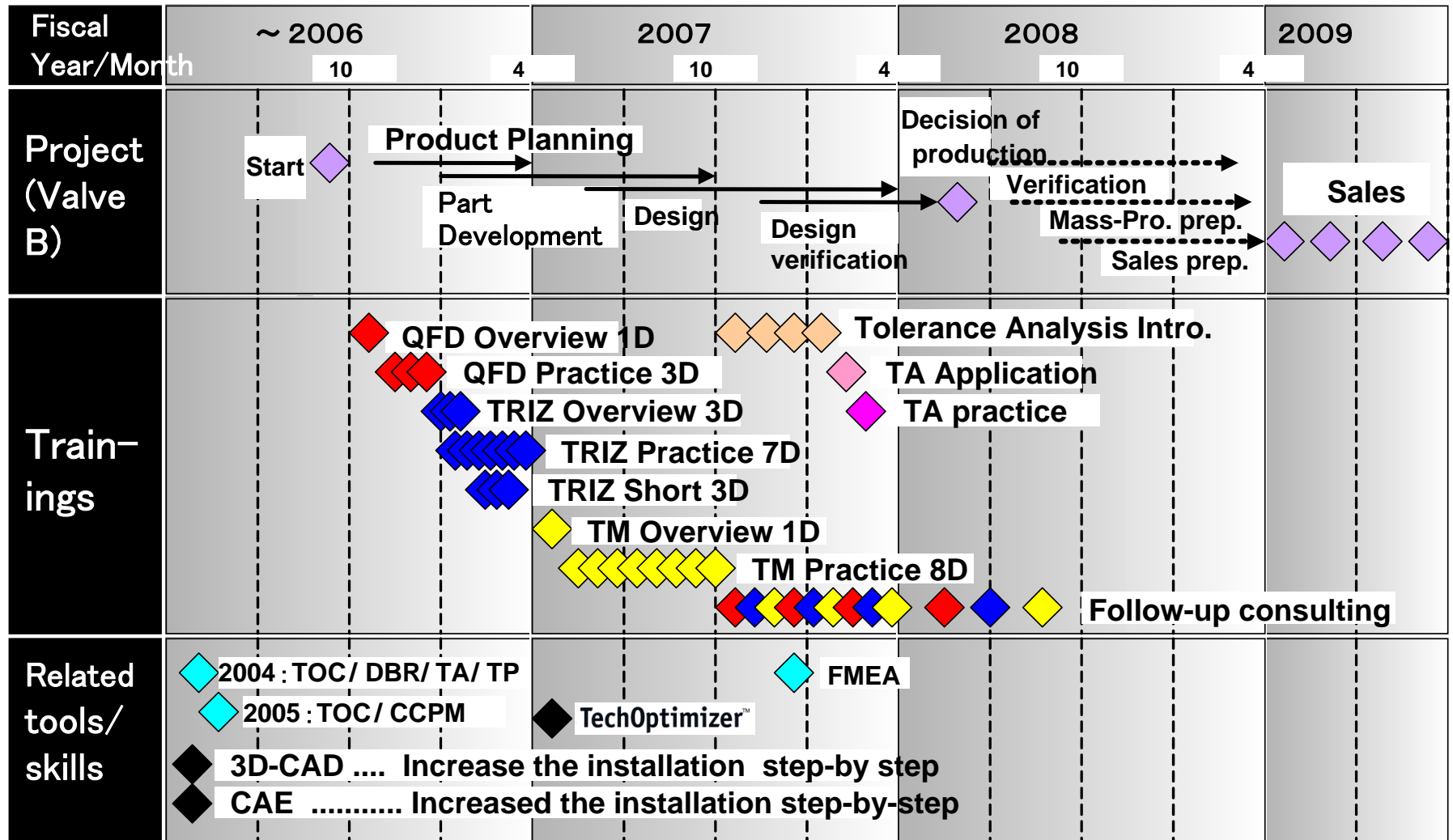
from the start of the projects.

==> Verify the effectiveness.

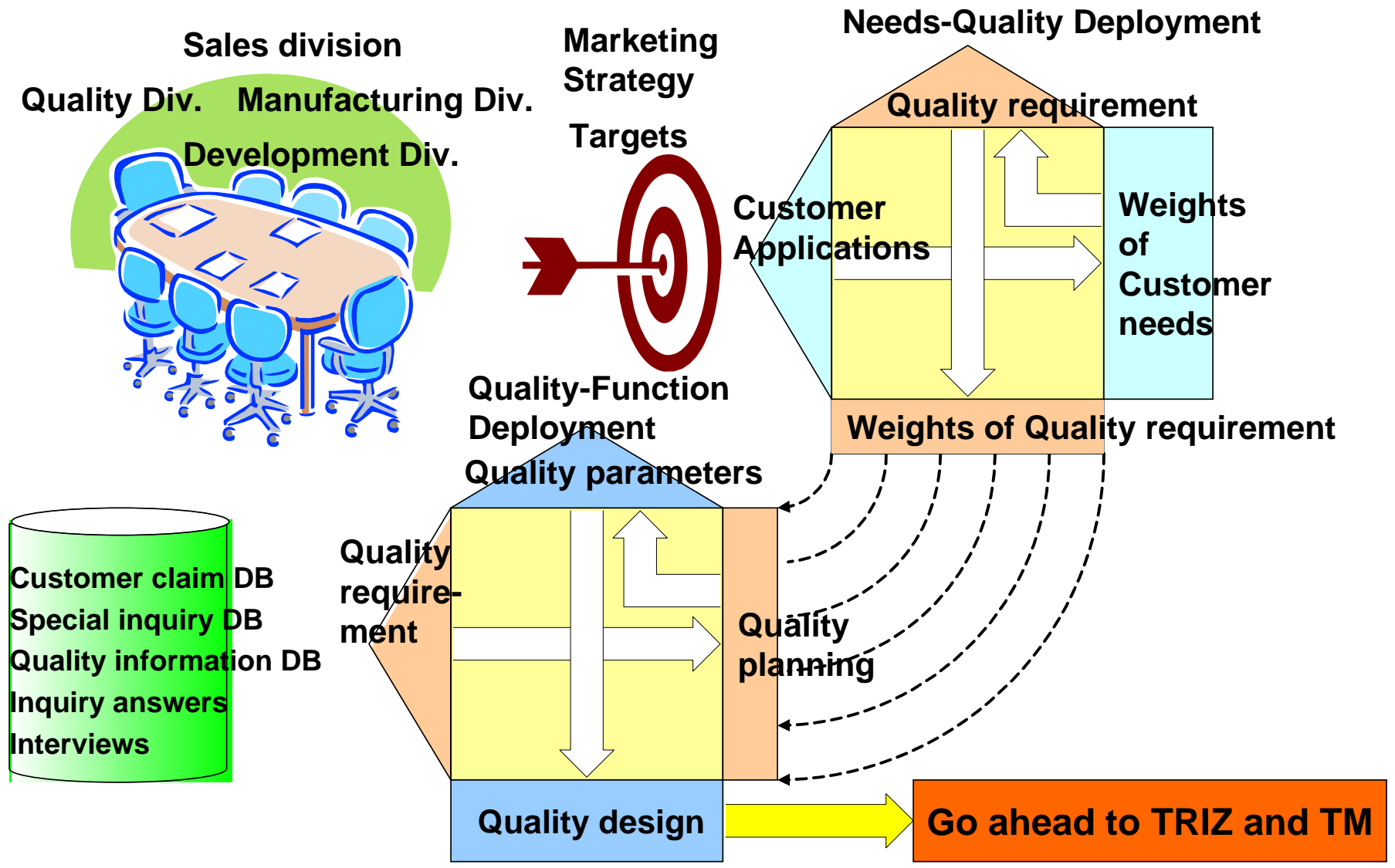
■ Requested the consulting by one instructor all the way through QFD -> TRIZ -> TM -> Results.

A team of common fate and work for the same target.

② Introduction: Training & projects together

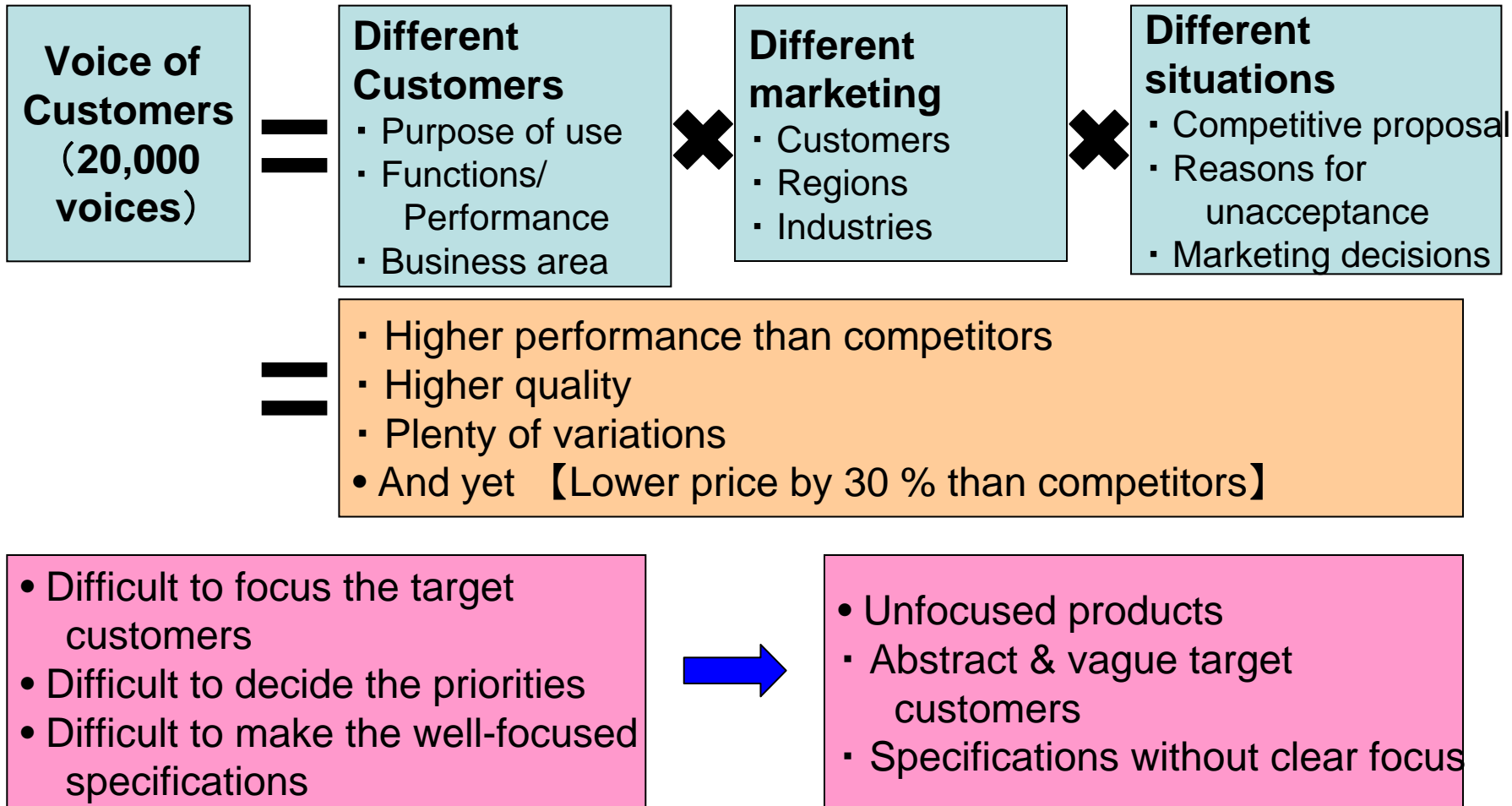


③ QFD: Concepts of Products which surely sell well



③ QFD: Problems in Practice

QFD: Problems in constructing the Quality Table



③ QFD: Application - Quality Deployment



Needs (usage) of customers			Customer quality requirement													Market Evaluation																	
			Functionality						Stability							volume of use	importance	areas of use	extensibility	attractiveness													
Purpose	Usage, Process, Equipments	Object	basic						Stability																								
			Quick start	Quick stop					small variation																								
																	b	c	a	b	12												
																	a	b	c	a	14												
																	b	c	c	b	8												
Brow off	Extracting a bad	chip part	○	◎	◎	★	◎	★	◎								◎	★	◎	★							a	a	a	a	20		
																												a	a	b	a	18	
																												a	a	b	a	18	
																												b	a	c	b	12	
																												a	b	a	b	16	
																												a	b	a	a	18	
																													c	b	a	c	10
																													a	a	a	a	20
																													b	b	a	b	14
																													b	b	a	b	14
Customer quality requirement		General	13	30	13	20	24	20	18	0	7	8	9	18	17	14																	
Evaluated importance		Target market	7	15	7	20	11	20	12	0	7	8	9	18	13	14																	
			C	A	C	A	B	A	A		C	B	C	A	B	A																	

③ QFD: Effects of Introduction before the TRIZ Process

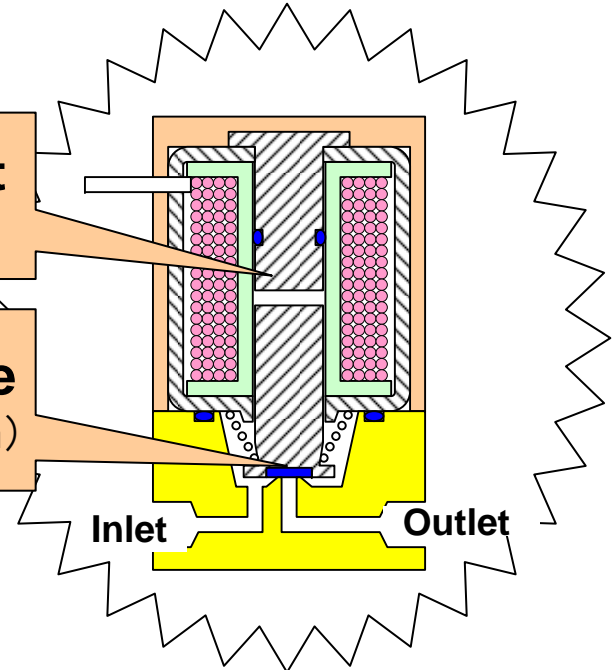
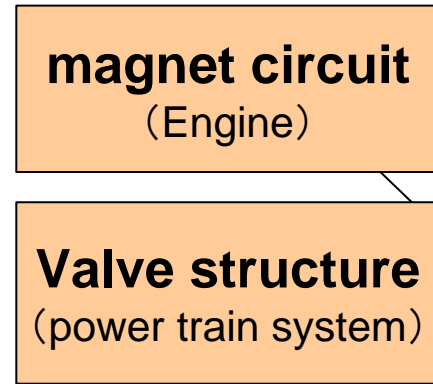
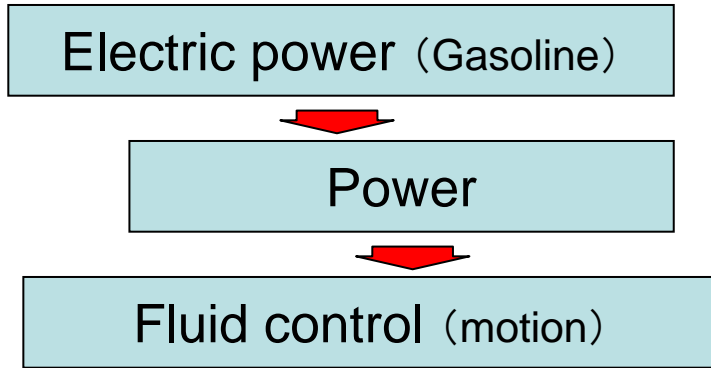


- While constructing the QFD tables, we can see we should sell what quality, to whom, and in which way.
- All the members of sales and development divisions decide together clear and convincing target specifications.
- We realize the importance and priorities of technical problems we must solve from now on.
- We must solve these problems by all means, even though no techniques and means are known so far.
--> High motivation

Go ahead to TRIZ and TM

④ TRIZ Technical problems to be solved

Function of Electromagnetic valve (In case of application to car engines)



Technical problem (Target specification)

- New solenoid structure, having large flow rate, high speed response, and yet low power consumption, and long duration
(==> New engine, having high power, high speed response, and yet low fuel cost, and long duration.)
- New main valve structure which can extract max. features of the new solenoid.
(==> New power train system which can extract max. features of the new engine.)

④ TRIZ: New solenoid structure

Target specification



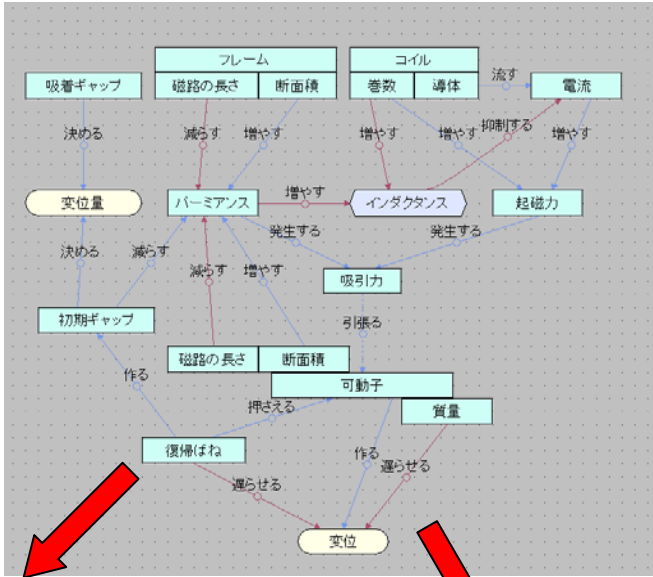
Function-Attribute Analysis

High-speed response

Large flow rate

Low power consumption

Long duration



TRIZ

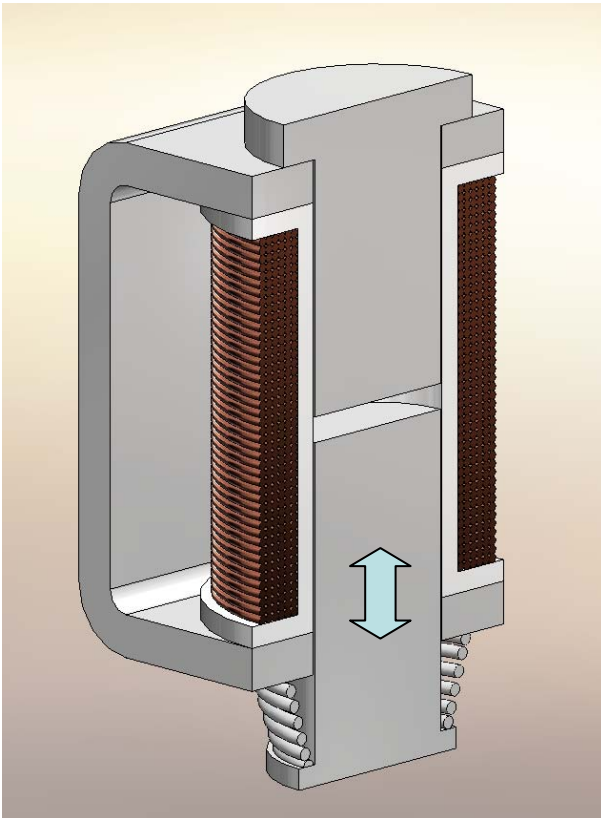
Prediction,
Principles,
Effects,
Trimming

TM (Taguchi Method)



Optimized design

④ TRIZ: New Solenoid structure

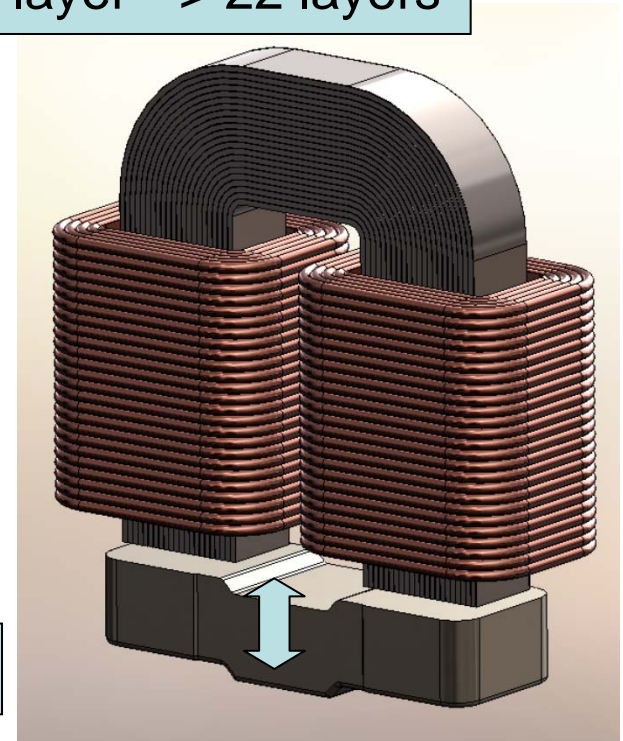
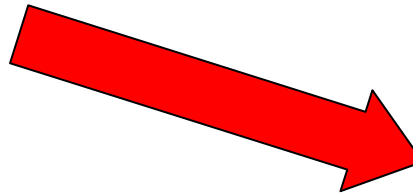


Single cylinder --> Double cylinders

Extremely-short stroke

Directional electro-magnetic steel plates

Single layer --> 22 layers



Square frame "コ" --> "U" frame

"I" shape armature --> flat plate armature

no sliding motion

⑤ TM: Deployment to Taguchi Method (TM)



Technical Problem (Target specification)

- New solenoid structure, having large flow rate, high speed response, and yet low power consumption, and long duration
(==> New engine, having high power, high speed response, and yet low fuel cost, and long duration.)

New Horizon

- Unknown structure for us
- No experiences and know-how available or effective
- No expert existing
- Long period and high cost foreseen in the prototyping
- So many parameters to verify in the design

Target task: Optimal design of the new solenoid structure

- Want to find the optimal conditions as quickly as possible ...
- Verify the stability in the mass production

⑤ TM: Deployment to Taguchi Method (TM)



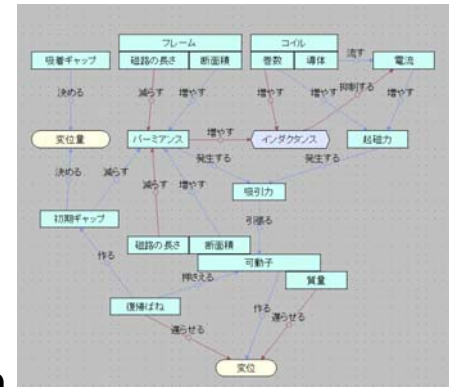
Task: Optimal design of the new solenoid structure

1. Analysis of the theme

- Function-Attribute Analysis

2. Identify the target function

- Function-attribute analysis --> Fishbone diagram

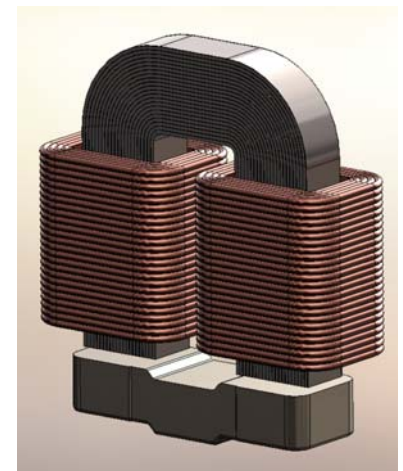


3. Identify the ideal function

- $y = \beta M$, where y : effective work, M : power consumption

4. Identify various factors

- error factors: accuracy in size, increasing temperature
- control factors: design parameters, L18 orthogonal matrix

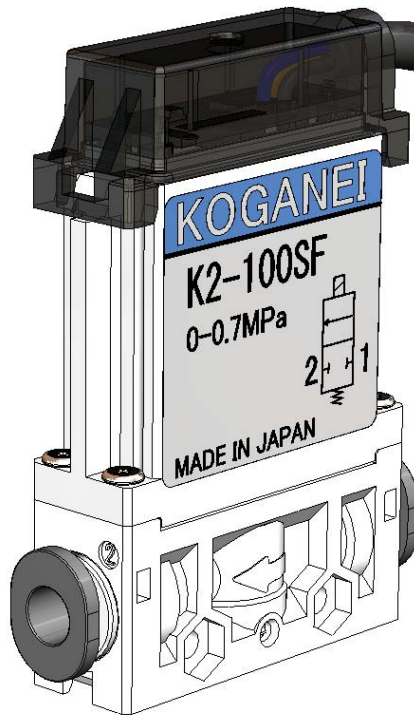


CAE: Simulation with Electromagnetic analysis software

⑥ Results: New Products we developed



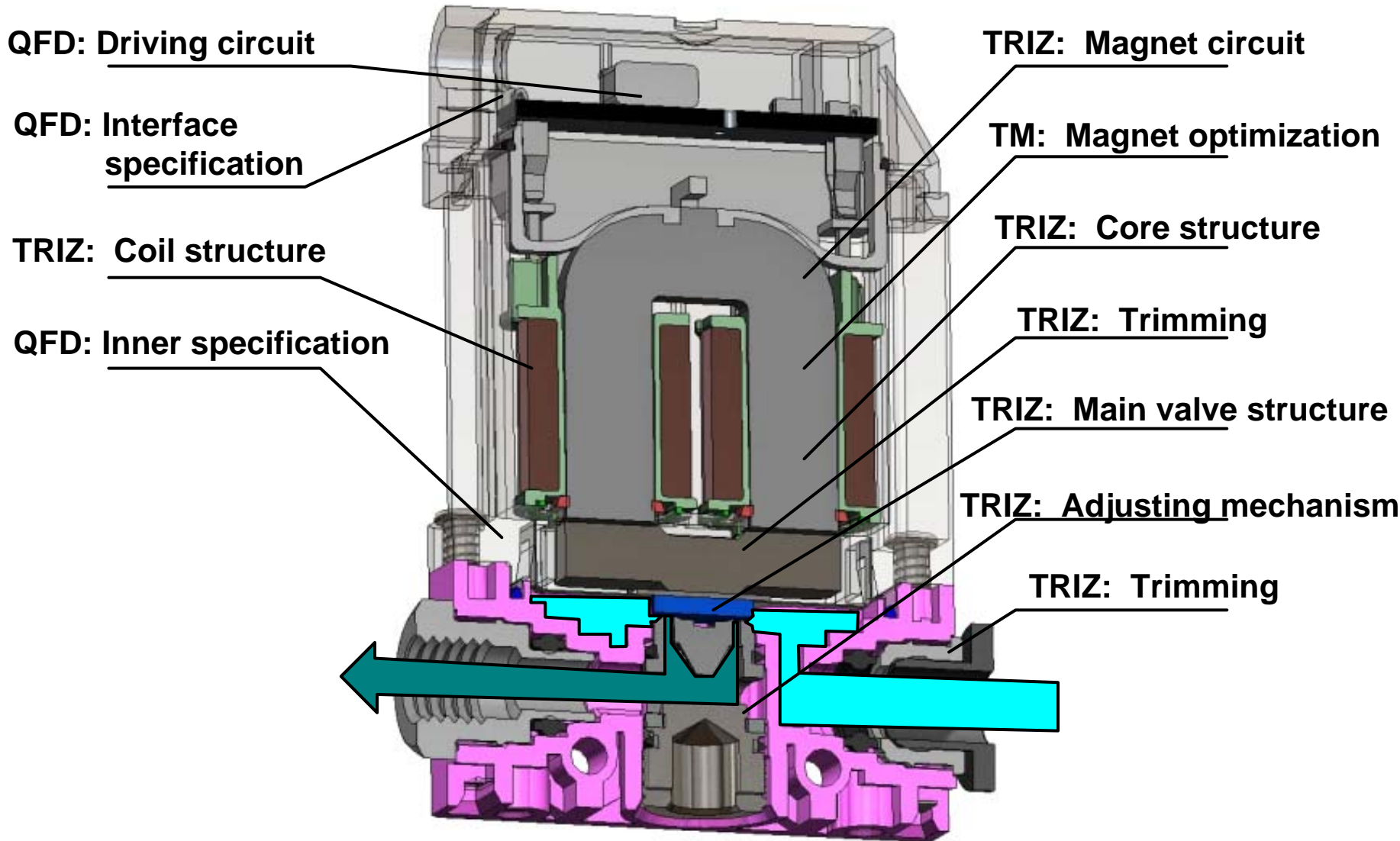
IMPACTV Hi-Speed 2port Solenoid Valves



High-speed response 2-port valve

【Industry top performance】	【Comparison with our conventional products】
High-speed response	less than 1/2 in response time
Compact and large flow rate	over 3 times in flow rate
Low power consumption	less than 1/2 in electric power consumption

⑥ Results: Application examples

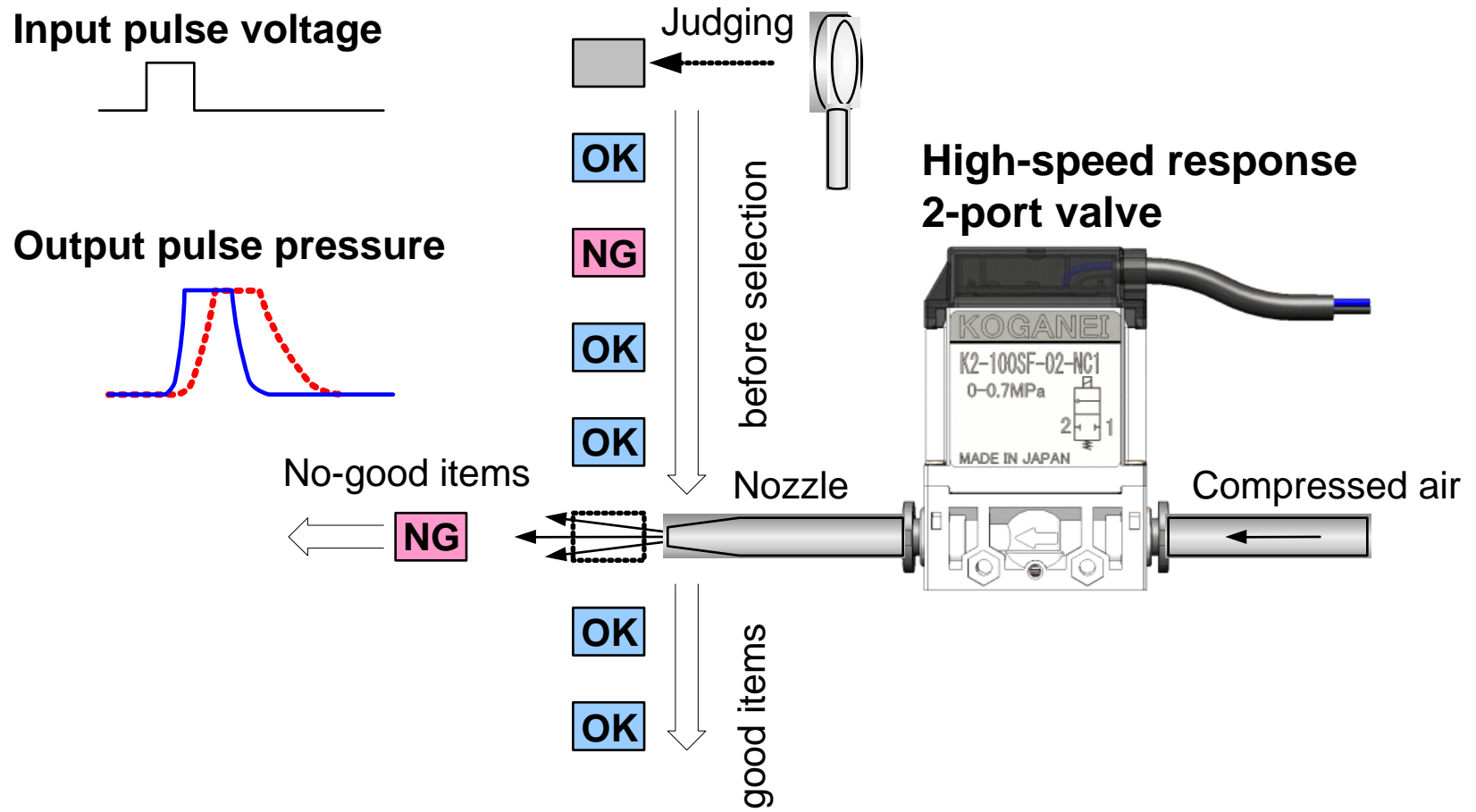


⑥ Results: Usage example of the product (1)



Selection process

High-speed response + Large flow rate
 --> Shorter tact time, Better selection accuracy



⑥ Results: Usage example of the product (2)



Blowing process

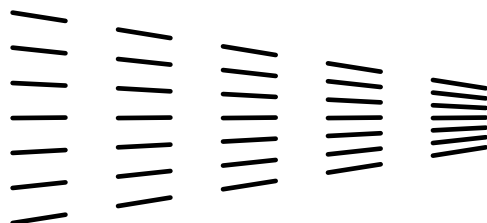
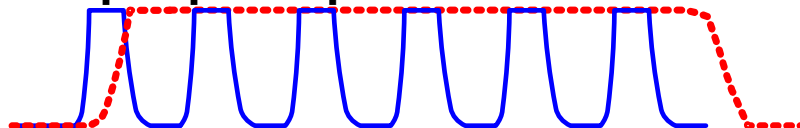
High-speed response + pulse drive

--> Better blowing effects, reduced air consumption

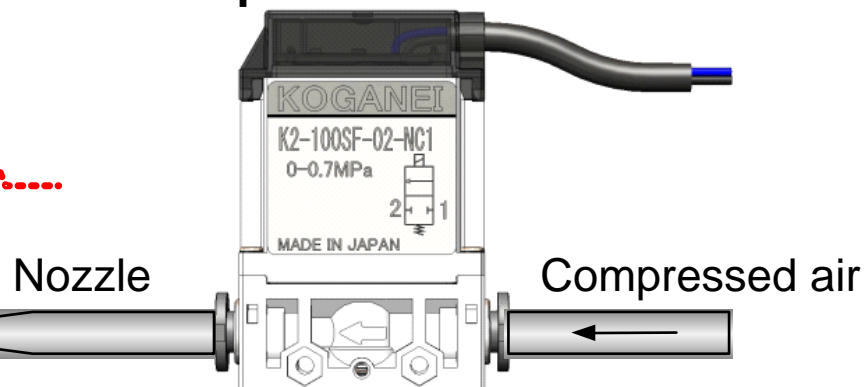
Input pulse voltage



Output pulse pressure



High-speed response
2-port valve



Nozzle φ (mm)	Area (mm ²)	Pressure (MPa)	Flow rate (m ³ /h)	Cost of Comp. air (¥/h) ¥2.5/m ³	Electricity cost saving		【ref】 Electricity (kW/h) ¥16/kWh	【ref】 Saving power /yr (kWh)	【ref】 Reduction CO2/yr (ton)
					8 hr/d, 20d/mo working				
					1/2 pulsing monthly	1/2 pulsing yearly			
0.8	0.5	0.4	1.69	4.2	338	4,052	0.26	253	0.7
1.1	1	0.4	3.38	8.4	675	8,104	0.53	507	1.4
1.6	2	0.4	6.75	16.9	1,351	16,209	1.06	1,013	2.8
2.0	3	0.4	10.13	25.3	2,026	24,313	1.58	1,520	4.3

⑦ Conclusion: Product extension in future



Sales situations

- Apr. 2009: Marketing research to a limited range of customers
- May 2009: Delivery of sample products for customer evaluation
- Jul. 2009: Sales to the open market
- Trade inquiries much larger in volume than the expected ones.
--> Short in supply!

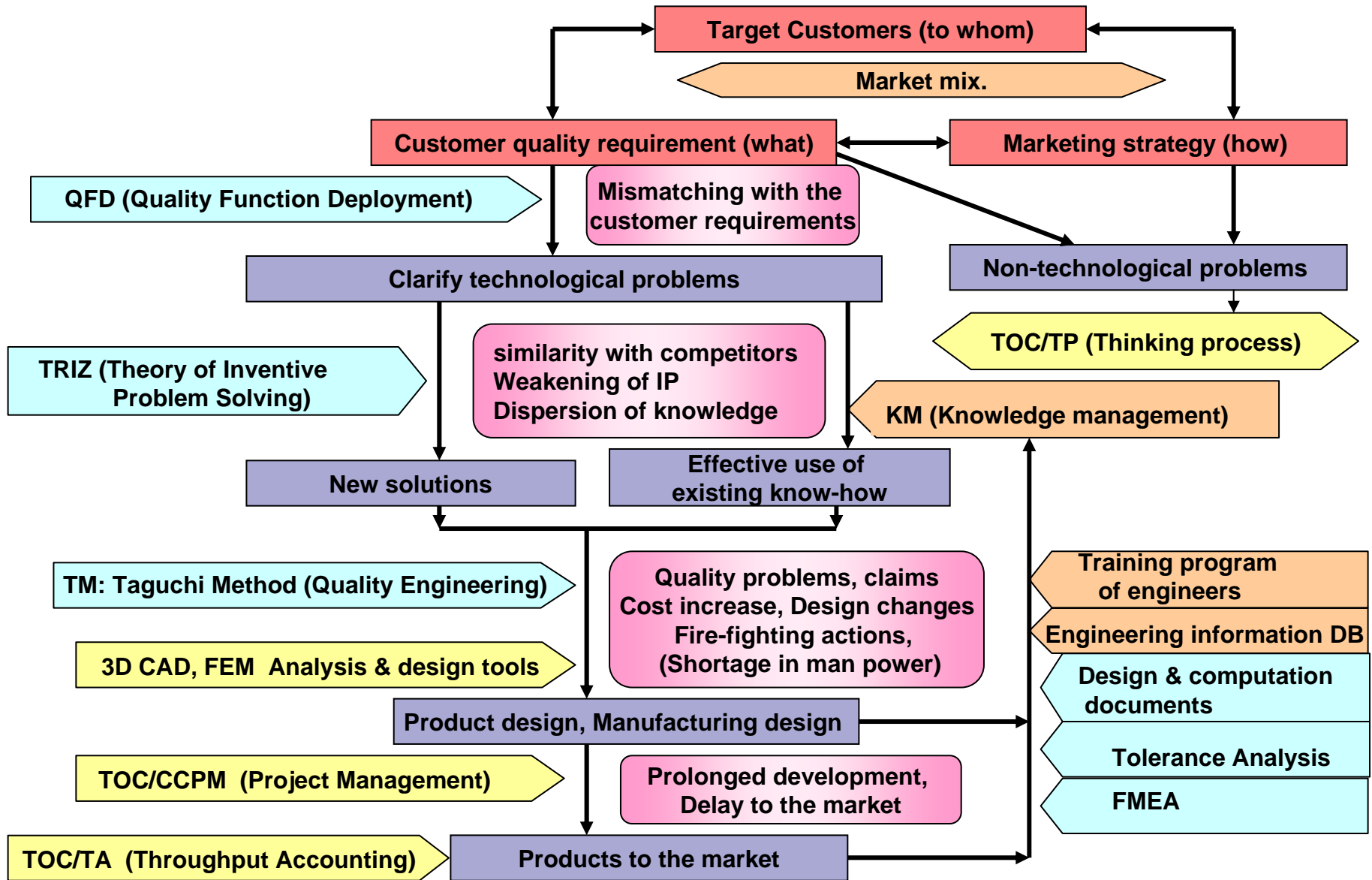
Extension of the product series

- New variants installing with pulse blowing circuit.-- Less air usage
- New variants installing with power saving circuit -- Less energy consumption
- Super high-speed response type -- Challenging ever.

Development of applications

- New applications with effective use of high-speed response.
- New aeropneumatic devices with effective use of high-speed response.
- New devices with effective use of high-speed response solenoid technology

⑦ Conclusion: Human resource development plan



⑦ Conclusion: Aspects of Management



8 Steps for Innovation (John P. Cotter)

1. Raise the sense of crisis

Kano method

2. Build the innovation team

Mission of wild pikes

3. Create the vision and strategy

QFD: Needs-quality deployment

4. Familiarize the vision for innovation

QFD: Quality-function deployment

5. Encourage members voluntary actions

TRIZ and TM

6. Achieve short-term success

Sales of new products --> Profits

7. Promote further innovation

Applying to other products

8. Establish the new ways

Install in the production system

⑦ Conclusion: Reference

New Product Information

[HOME](#) > [Products](#) > [New Product Information](#)

Products Guide

[Actuator](#)

[Valve](#)

[Air filter / Regulator](#)

[Speed controller / Fitting / Others](#)

[Vacuum equipment / Vacuum pad](#)

[Clean system equipment](#)

[Automotive welding process equipment](#)

[Electric actuator](#)

[ECO Equipment](#)

[Static electricity removing unit](#)

[Fluororesin equipment](#)

2009.08.05 **NEW** **Expanded range of Mini Guide Slider MGA Series!**

The product range has been expanded with Cylinder with Rear piping ports, Long Stroke Cylinder for bore sizes 12-20mm, and Stroke Adjusting Cylinder with Stopper, etc.

[Detail](#)



2009.07.22 **NEW** **Industry First! Using new solenoid technology. New release of Hi-speed 2-port Solenoid Valve K2 Series!**

Compact, high speed response, large flow rate, low power consumption are achieved. Enabling shorter tact times, Energy saving of air consumption.

[Detail](#)



2009.06.15 **NEW** **Announcement of "2009 Koganei Products Guide"!**

We have made "2009 Koganei Products Guide".
If you want the guide, click the "Detailed page" and the photo to



Acknowledgement

For introducing TRIZ to us: Mr. Masayasu Fujimori (PronoHearts)

For encouraging us to install: Mr. Mamoru Zenko (IDEA)

For instructing us in the team: Mr. Hajime Kasai (IDEA)

For many surprise chain: All the members involved

Thank you for your attention