

Promotion of scientific methods including TRIZ Part 2

- Provide a variety of solutions in the field of development -

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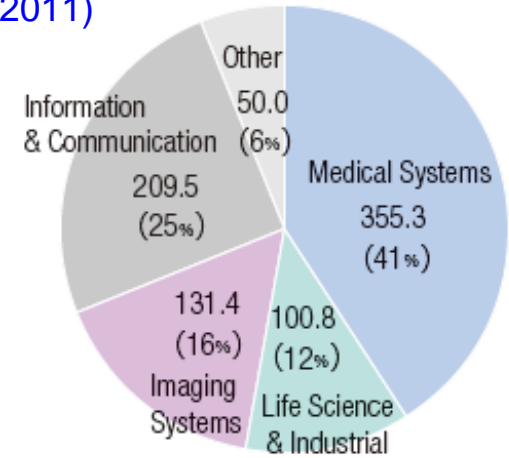
Olympus Corporation

1. About Olympus
2. Promotion of scientific methods in Olympus
3. Approach for saving time of scientific methods
4. Solution to the problem by scientific methods
5. Visualization of the Fuzzy Front End process
6. Visualization of the problem-solving process
7. Application example of the Solution
8. Application of methods in the development process
9. Summary

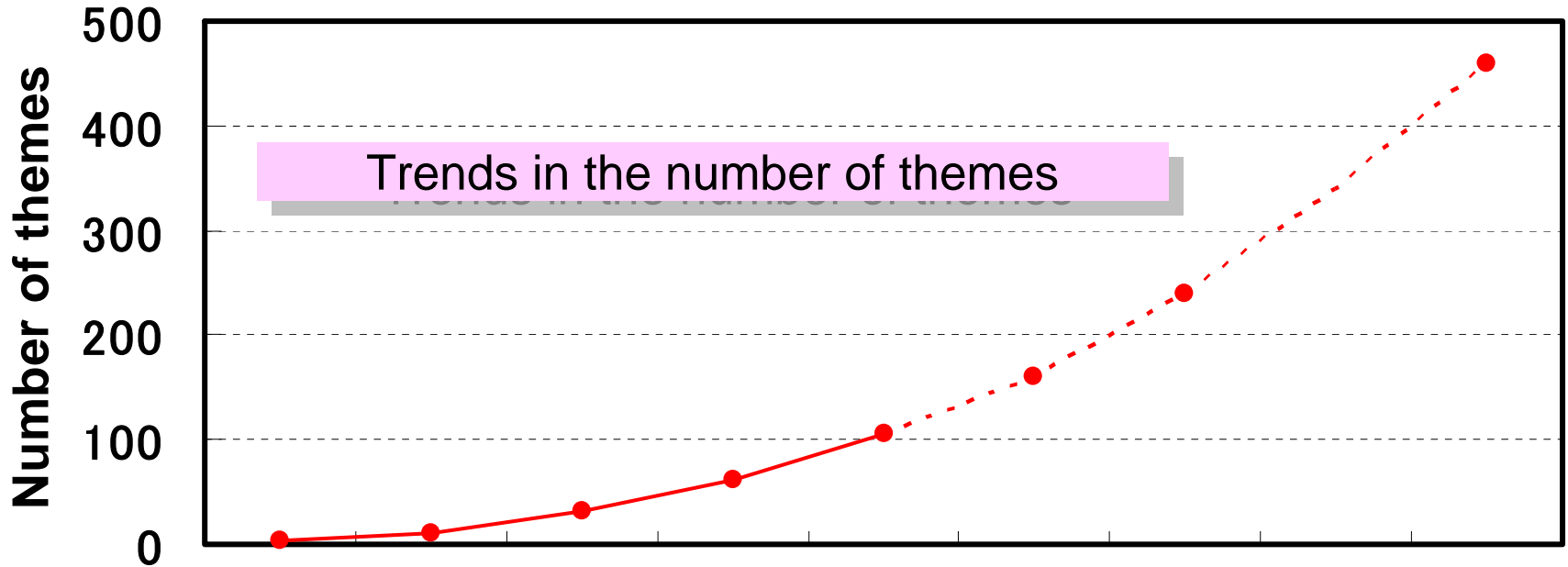
1. About Olympus

Established : October 12, 1919
Head office : Shinjuku-ku, Tokyo, Japan
Capital : ¥ 48,332 million (As of March 31, 2012)
Consolidated net sales : ¥ 848,548 million (Fiscal Year Ended March 2012)
Consolidated headcount : 39,121 (As of March 31, 2012)

Sales by Business Segment (billion yen)
(Year ended March 2011)



2. Promotion of scientific methods in Olympus



Year 1996~	2009 H2	2010 H1	2010 H2	2011 H1	2011 H2	2012 H1	2012 H2	2013 H1	2013 H2
Taguchi Methods and QFD consultation	QFD and TRIZ Group seminar & Training			Individual technical problem support + QFD, TM, TRIZ 90min Basic Training					
							Solution support for technical problem		

TM: Taguchi Method

3. Approach for saving time of scientific methods

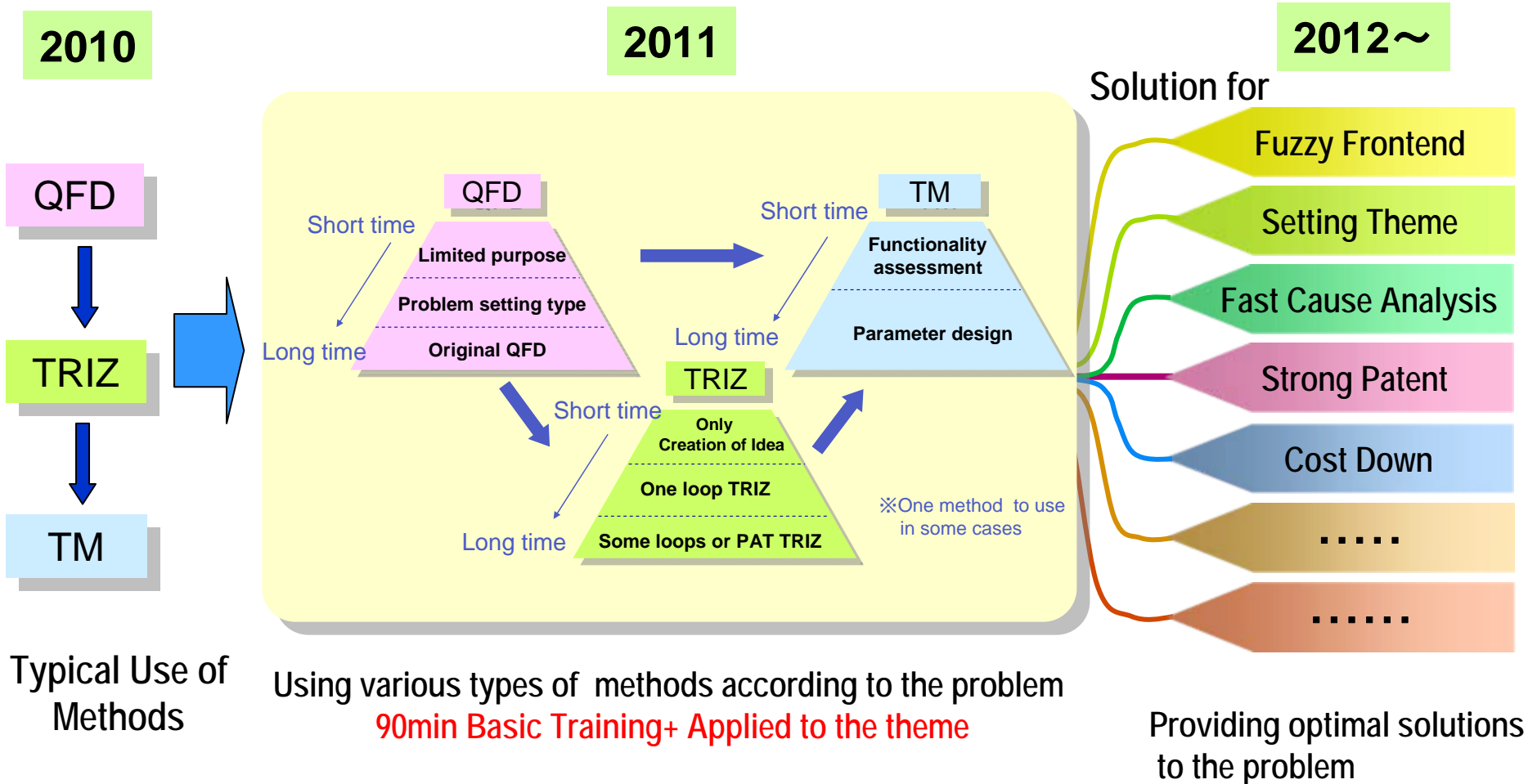
(TRIZ Symposium 2011)



- ◆ **Saving time in learning process**
⇒ 90min Basic Training (QFD, TRIZ, TM)
- ◆ **Optimal selection of process for the target**
⇒ Using various types of methods according to the problem.
- ◆ **Reduced loss in the methods**
⇒ Improving the efficiency of setting theme and root cause analysis in TRIZ.
- ◆ **Improved efficiency by combination of methods**
⇒ QFD specialized for setting theme before TRIZ .
Effective TRIZ before TM

4. Solution to the problem by scientific methods (1)

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



4. Solution to the problem by scientific methods (2)

Customizing the method based on the voice of engineers

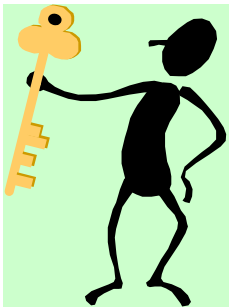
Step1. Solution by the process of "QFD → TRIZ → TM"

- "QFD→TRIZ→TM" process does not always match to the start of the theme
- Believer of the method says that this method can solve all of the problems. But, we can not solve them by one method.
- We want to check the effect by the first trial of method.



Step2. Customizing QFD, TRIZ and TM by the purpose

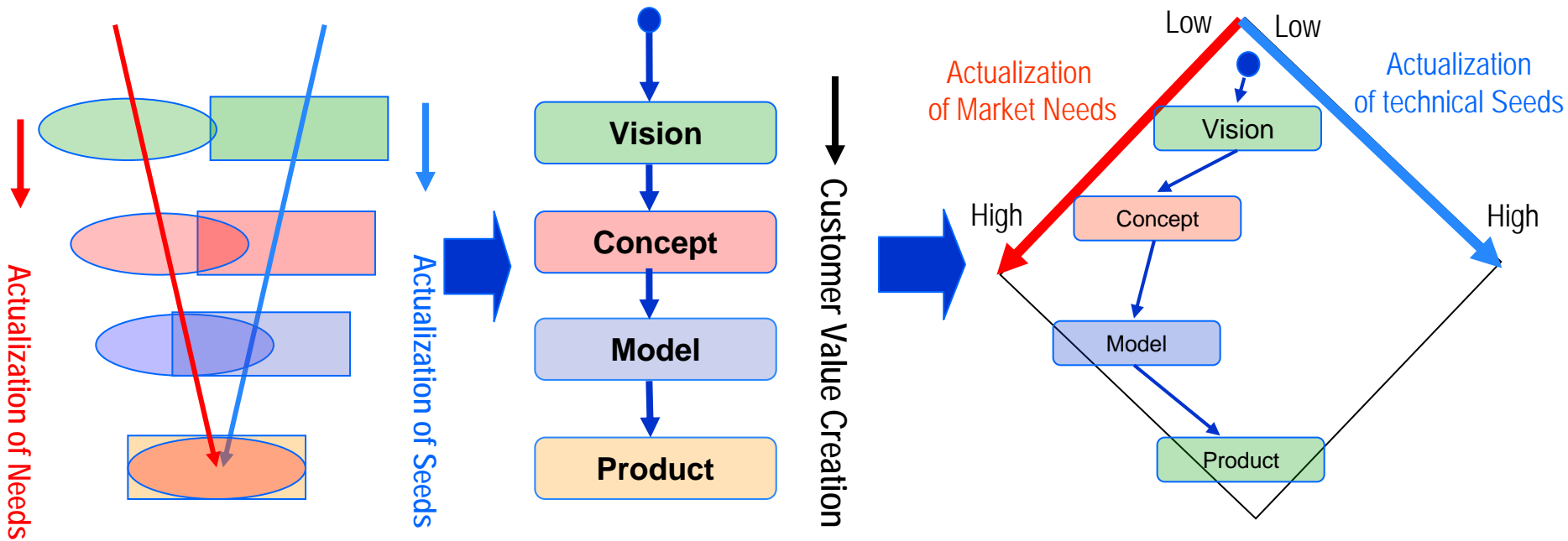
- Engineers would like to know what is valid method in each scene of development.
- My purpose is increasing the development efficiency ,not using the method. Please show me the solution and effect to the problem.
- Managers and engineers have the experience of failure by QFD, TRIZ and TM in the past, have a allergy to the method.
- Why is the only solution QFD, TRIZ and TM ? I think to use plenty of other methods.



Visualizing the development process by **functional chain**. And providing **Solutions** to the target of problem by various methods.

Fusion process of customer value in the Fuzzy Front End process

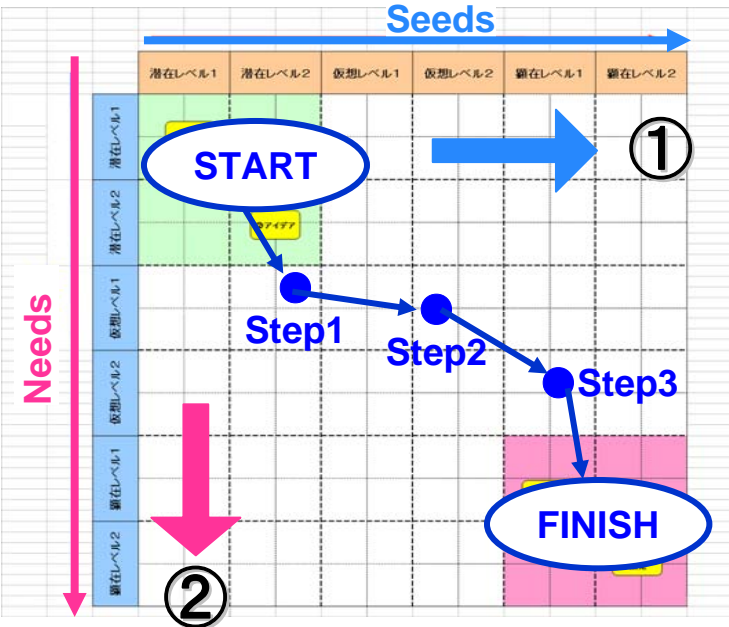
It is important to visualize the function of creating the customer value by combination Technical Seeds of technology to Needs from QFD. Needs and Seeds are fused and embodied each other under the influence. The process is different by products or systems.



*Reference :Toshiba Corporation Dr.Hitoshi Iwama

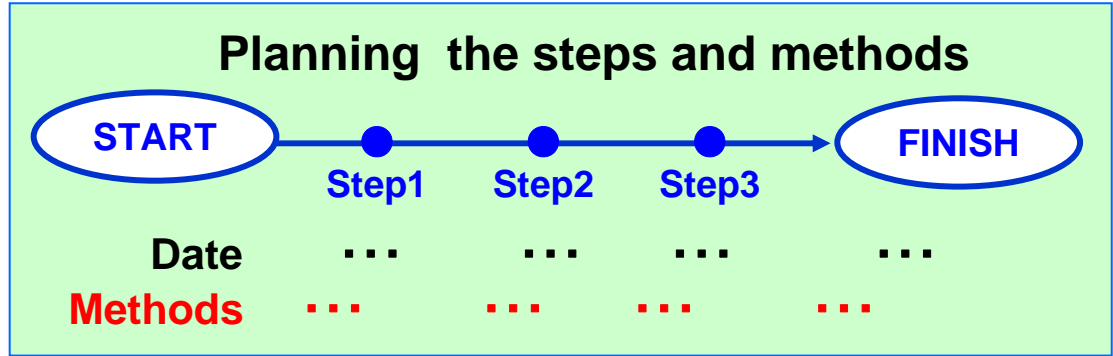
"A Study of the Mechanism of Customer Value Creation Integrating Market Needs and Technical Seeds in Product Innovation"

Visualizing the process and provide various solutions by Scientific methods



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.

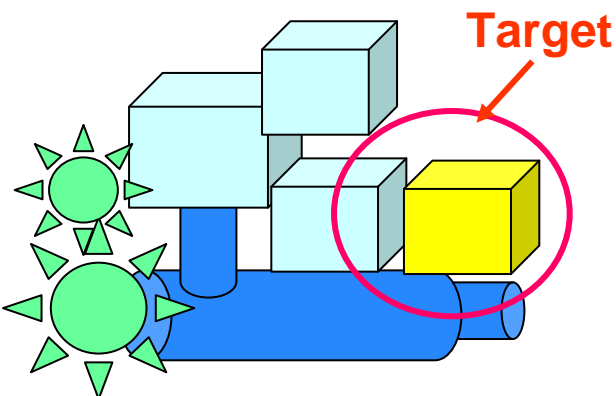
Methods for Actualization of Seeds

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

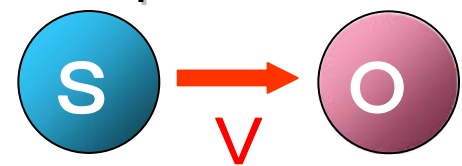
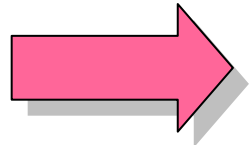
$$\boxed{\text{Seeds}} = \boxed{\text{The evolution of technology without strategy}} + \boxed{\text{The Technology policy with strategy}}$$

6. Visualization of the problem-solving process (1)

Functional Approach makes TRIZ effectively (TRIZ Inventive Principles and Effects)



Function simplifies the complex system



Functional Element **S** provides the function **V** to the Object **O**

At first glance, it looks complex system...

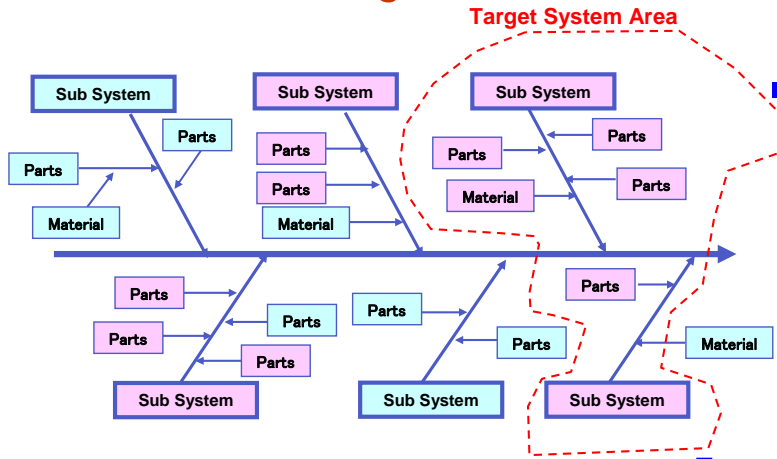
Visualization of system based on the **Function**



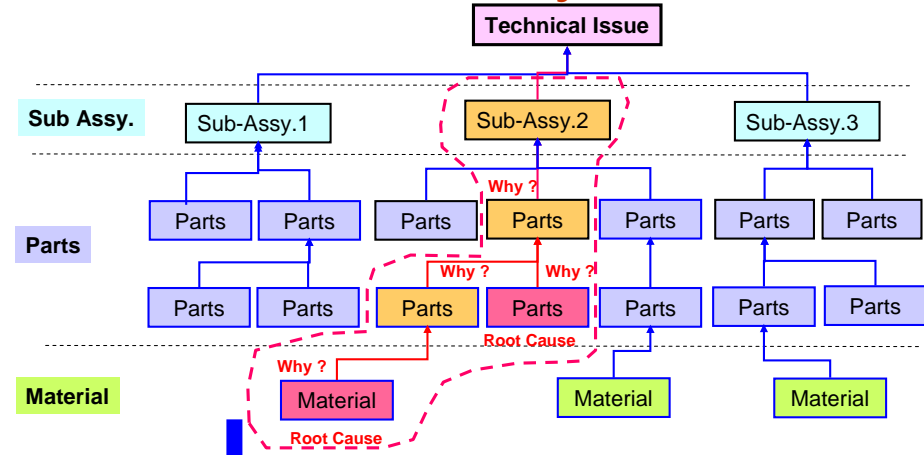
- ◆ Cause-Effect Diagram visualizes **Functional** Factors
- ◆ QFD visualizes the basic **Function** of Requirements
- ◆ Cause and **Function** Analysis leads to the root cause
- ◆ **Functional Analysis**, TRIZ and TM solve the problem

Functional Chain in problem-solving process

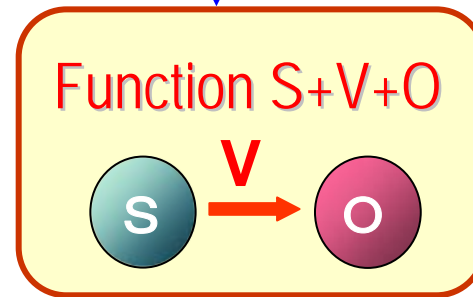
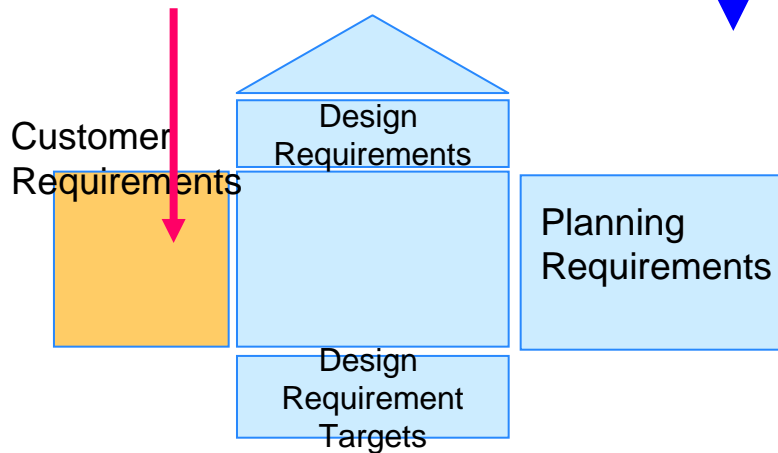
Cause-Effect Diagram (Fishbone Diagram)



Cause and Function Analysis in TRIZ



QFD: Requirement in Basic Function



TRIZ
Problem definition
Idea

TM
Basic Function
Functional Evaluation

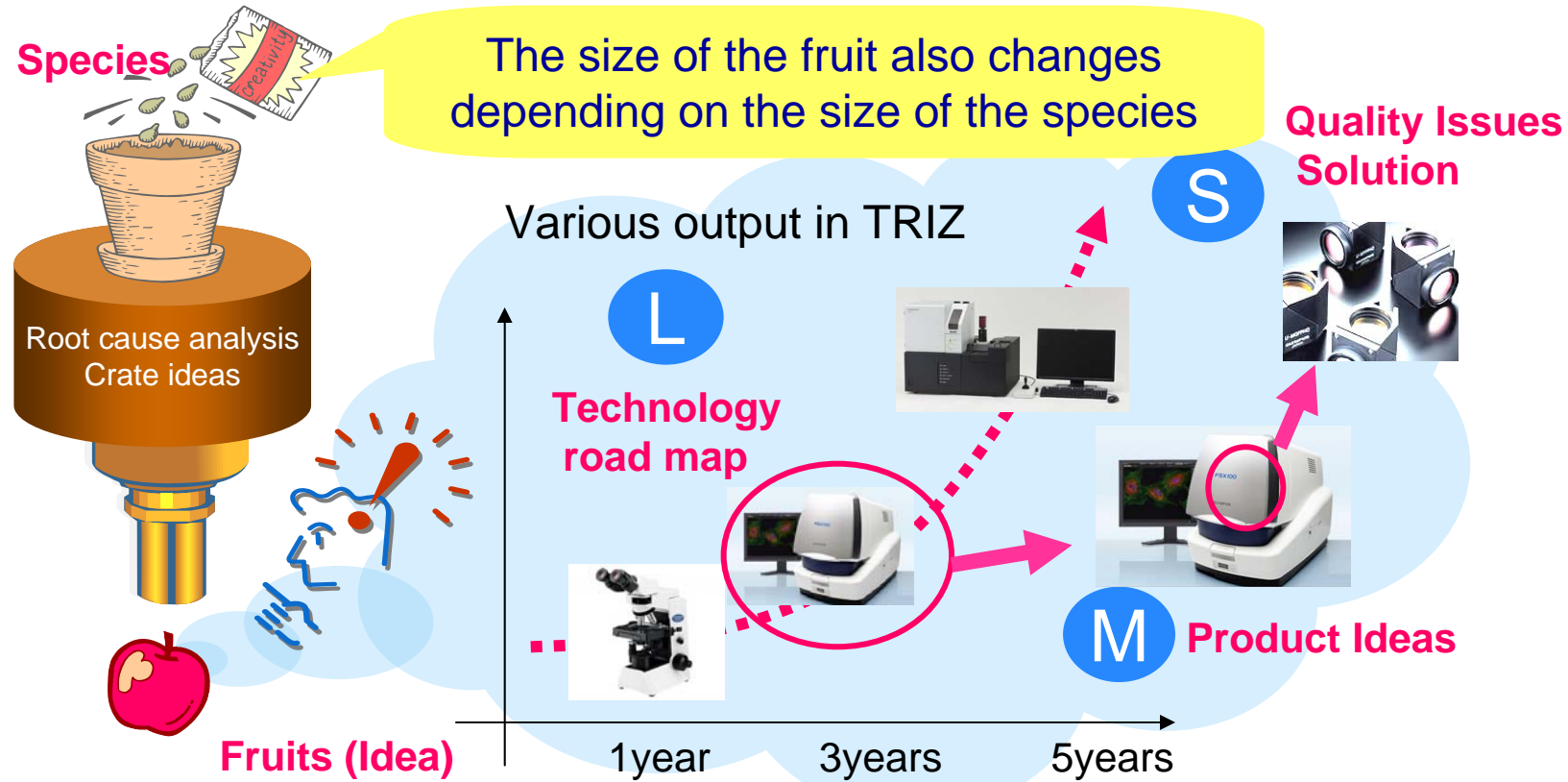
Solution based on
Functional Model

6. Visualization of the problem-solving process (3)

Determining the System Area

- ◆ Cause-Effect Diagram visualizes **Functional** Factors
- ◆ QFD visualizes the basic **Function** of Requirements
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- ◆ Functional Analysis ,TRIZ and TM solve the problem

Determining the size of the input species in setting the theme by using the **Cause –Effect Diagram** for scientific methods.

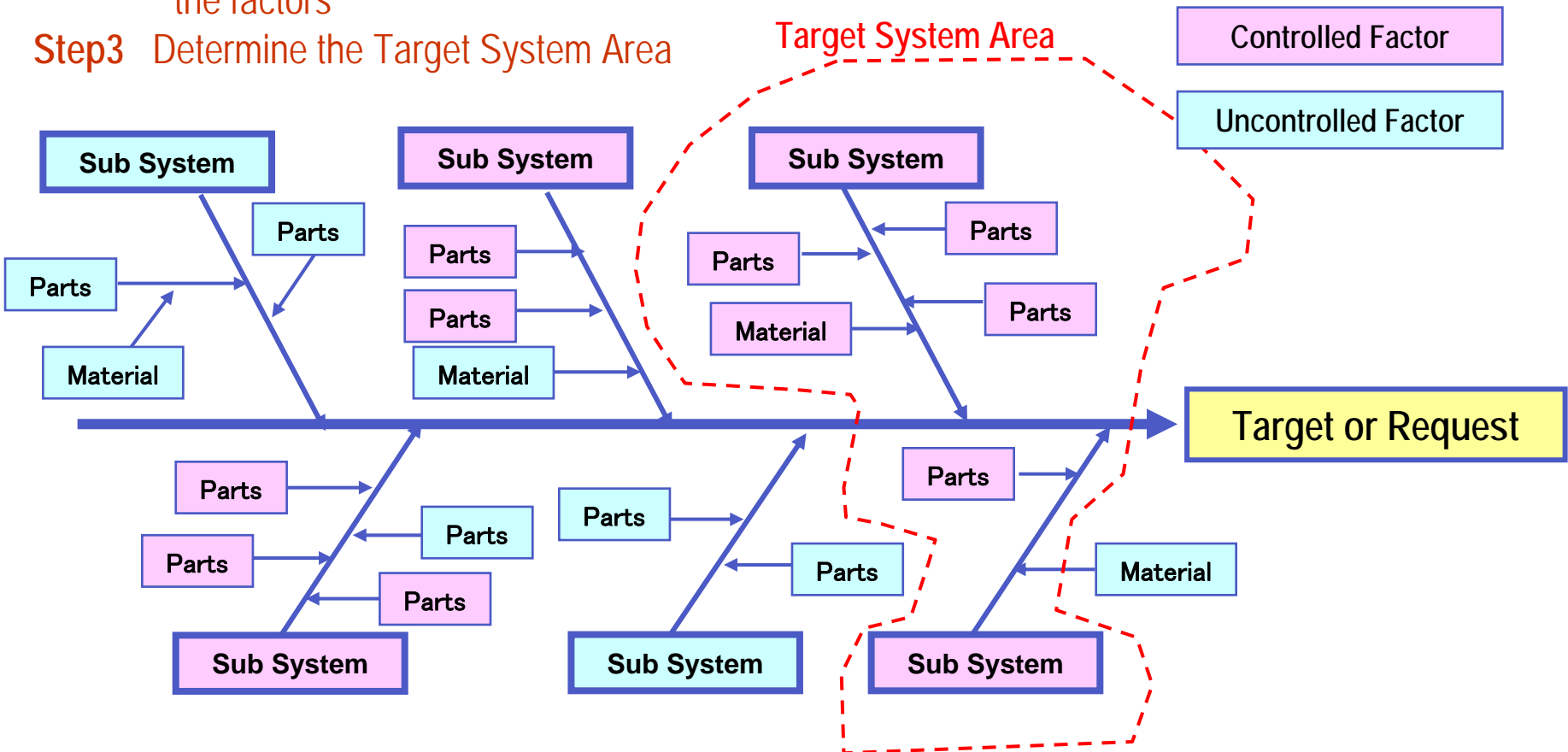


6. Visualization of the problem-solving process (4)

Cause -Effect Diagram for scientific methods (Fish bone Diagram)

- Step1 Extract the Functional Factor
- Step2 Identify by whether or not you can control the factors
- Step3 Determine the Target System Area

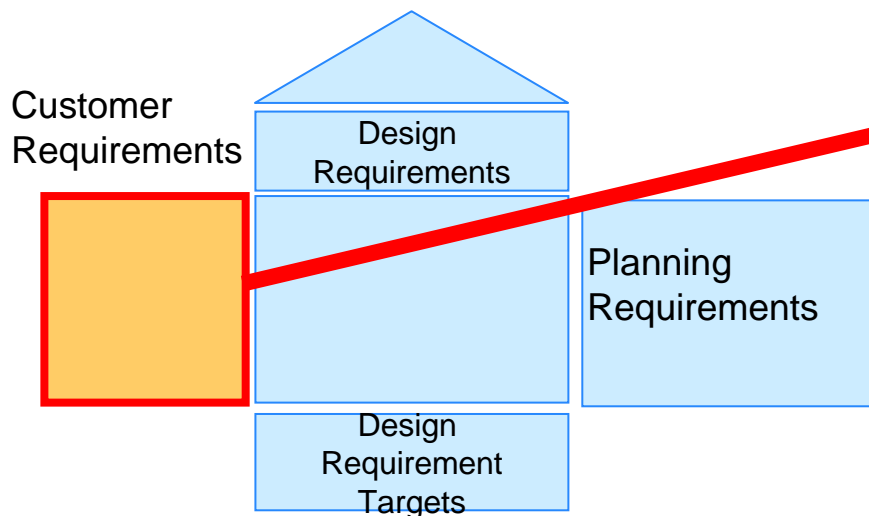
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6. Visualization of the problem-solving process (5)

QFD Customer Requirements

Clear and organize the requirements for basic function in QFD



- ◆ Cause-Effect Diagram visualizes Functional Factors
- ◆ QFD visualizes the basic **Function** of Requirements
- ◆ Cause and Function Analysis leads to the root cause
- ◆ Functional Analysis ,TRIZ and TM solve the problem

1次要求	2次要求	3次要求
Basic Function	照度	明るい部屋でも使いたい
		広い画面でも明るくして欲しい
		暗い色の画像でも見えるようにして欲しい
	解像度	細かな文字でも鮮明に映して欲しい
		細かな模様もリアルに写したい 1500画素のデジカメ写真もきれいに写したい
	画像補正機能	斜め20度方向から投影しても画像が歪まないのが良い
動画再生	ビデオ画像も再生したい	
通信機能	LANで離れた場所から画像を送りたい 無線LANで接続したい	
Usability	焦点合わせ	ピント合わせはレンズの周囲を回して行ないたい
	高さ調整機能	高さは1箇所の調整でできると便利
	コントロール機能	電源ON/OFFは一目でわかるようなボタンにして欲しい
Affectivity	静粛性	映画を見るときも静かな動作音が良い 静かな部屋でも騒音が気にならずに使いたい
	放熱性	放熱の風が会議の参加者にかから無い様にして欲しい
メンテナンス性	電球交換	電球交換はワンタッチでできると良い

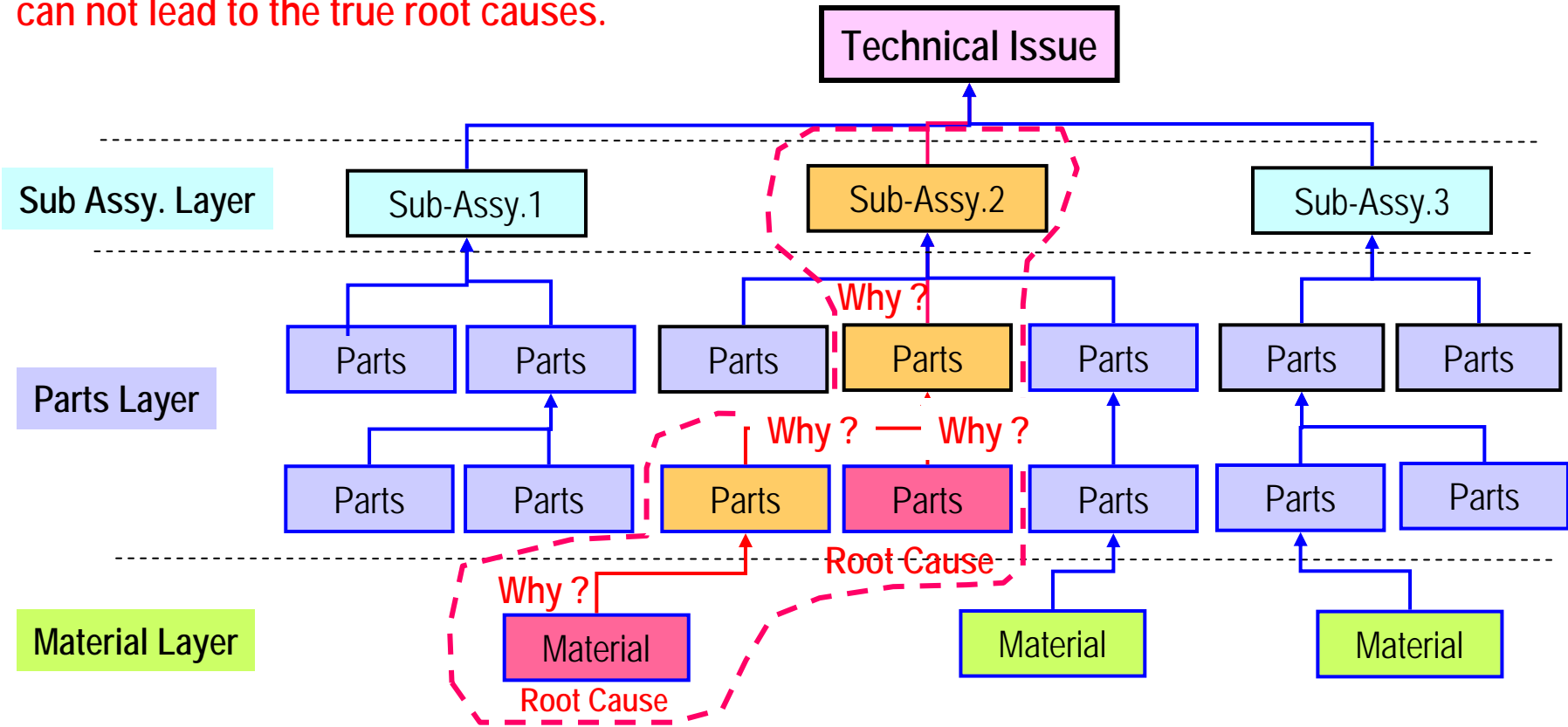
6. Visualization of the problem-solving process (6)

Cause and Function Analysis

Cause Analysis is more efficient than looking for the cause in the functional model.

However, oral simplistic " Why ? Why ? " can not lead to the true root causes.

- ◆ Cause-Effect Diagram visualizes Functional Factors
- ◆ QFD visualizes the basic Function of Requirements
- ◆ Cause and Function Analysis leads to the root cause
- ◆ Functional Analysis ,TRIZ and TM solve the problem

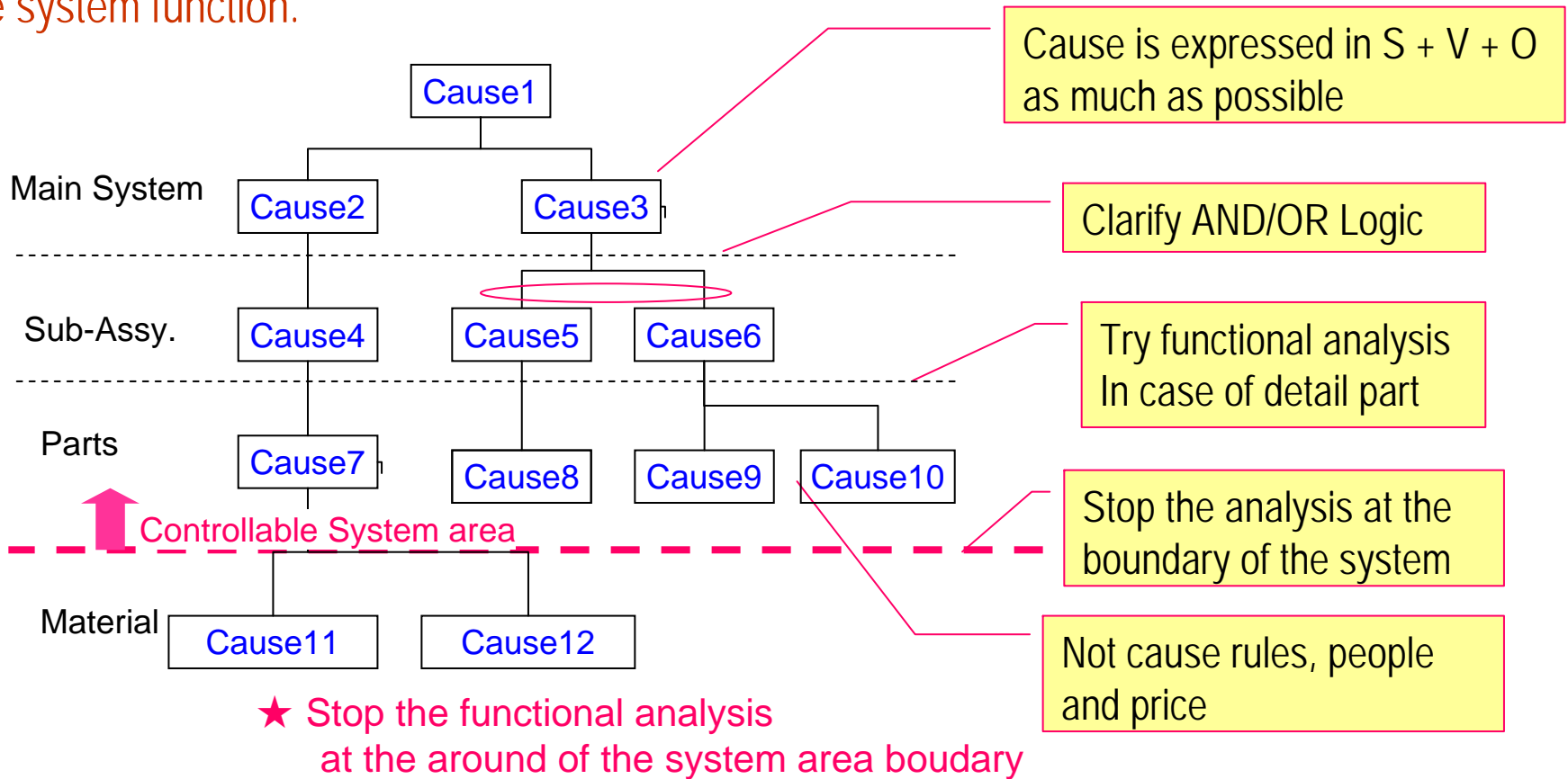


6. Visualization of the problem-solving process (7)

Rules of Cause and Function analysis

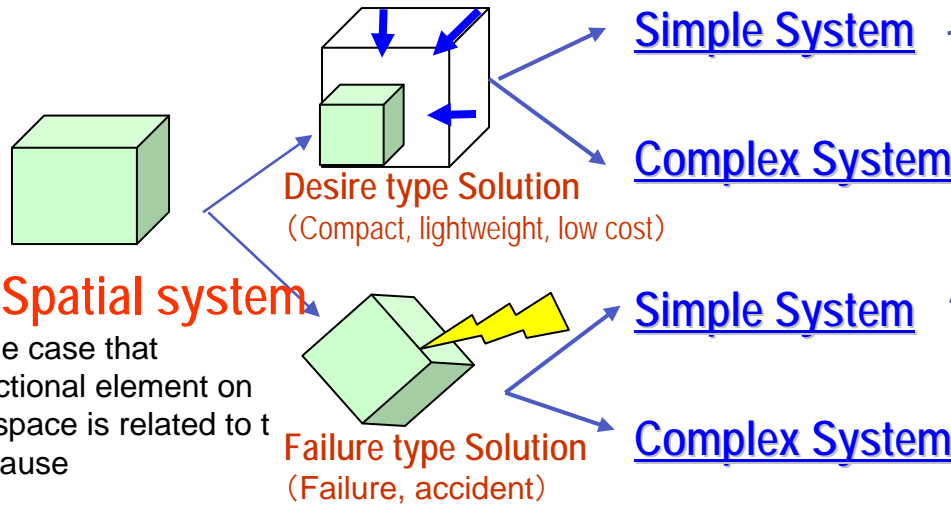
For eliminating the mistakes of Cause and Function Analysis, seek the true root causes of the system function.

- ◆ Cause-Effect Diagram visualizes Functional Factors
- ◆ QFD visualizes the basic Function of Requirements
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Fast Cause Analysis Solution

System for analysis



In the case that Functional element on the space is related to the cause

The system on the time axis is expressed in addition to the spatial system

- ◆ Cause-Effect Diagram visualizes Functional Factors
- ◆ QFD visualizes the basic Function of Requirements
- ◆ Cause and Function Analysis leads to the root cause
- ◆ **Functional Analysis** ,TRIZ and TM solve the problem

- Simple System → Cause -Effect Diagram of scientific methods
- Complex System → Cause -Effect Diagram of scientific methods + **TRIZ** Root cause analysis
- Simple System → Analysis of many measurement data
- Complex System → Analysis of many measurement data
- Simple System → TM MT method
- Complex System → Quality Control - 7 Tools, Analysis of Variance
- Simple System → Analysis of observed events
- Complex System → Analysis of observed events
- Simple System → **TRIZ** Root cause analysis
- Complex System → Systematic Approach For Error Reduction
- Simple System → KI method, KT method, FTA
- Complex System → Functional Model Analysis
- Simple System → **TRIZ** Root cause analysis
- Complex System → **TRIZ** functional analysis

Cause and Function analysis in TRIZ can also be used as a solution for the problem !

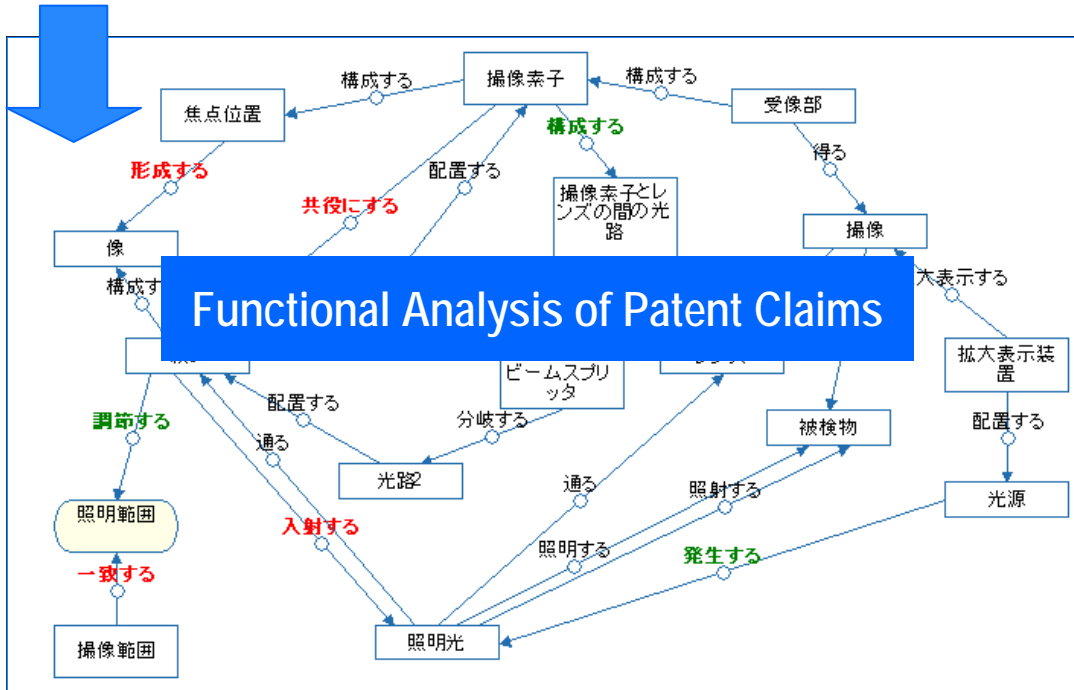
Strong Patent Solution

Avoid case by functional analysis of competitors' patent claims

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、撮像素子と受像部とを配して光路を分岐させ、撮像素子の撮像領域の光路に絞りを撮像素子の撮像領域よりも狭く形成するように光源を配して成り、照明光は絞り、レンズを通し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



- ◆ Cause-Effect Diagram visualizes Functional Factors
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Step1
Separate patent claims to **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**

* Invention Machine Corporation Innovation Support Software

Cost down Solution

Making Functional Model ,and evaluate the cost of each function by the concept of VE

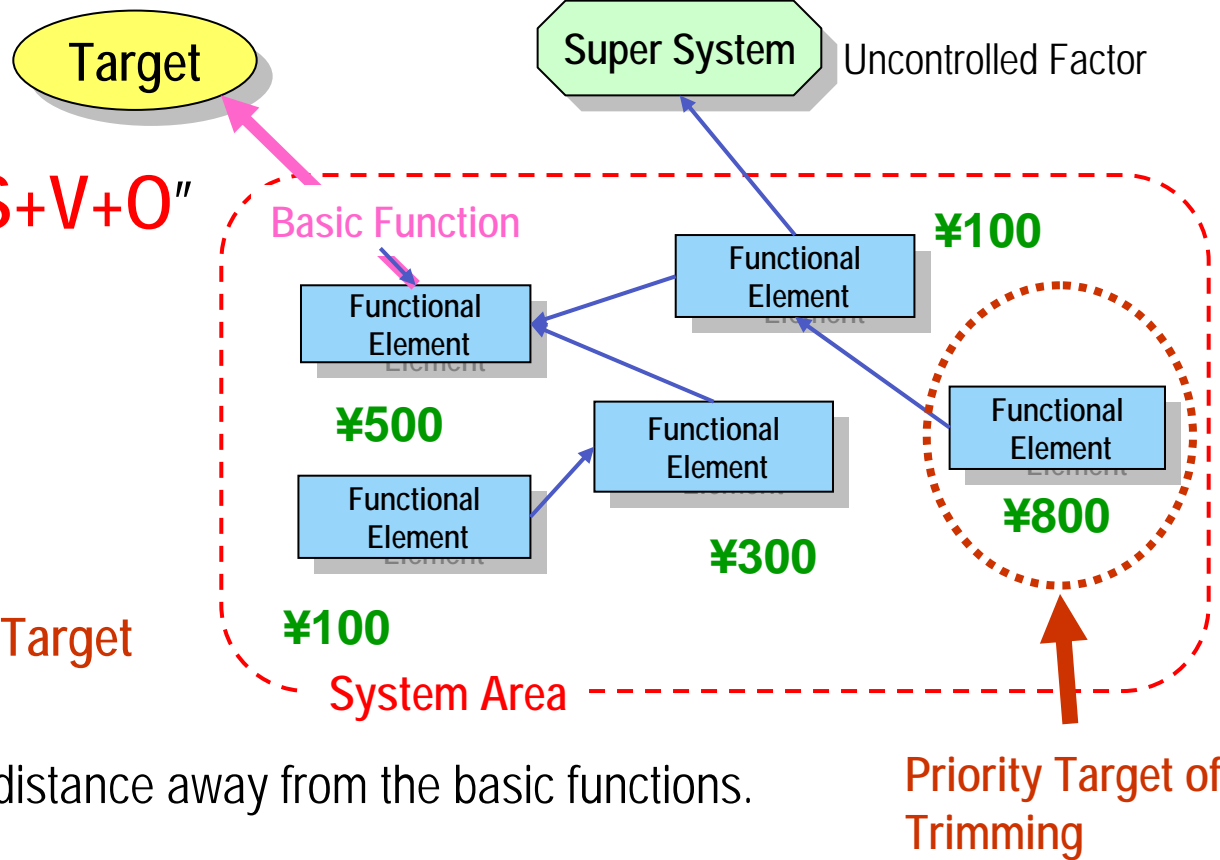
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Function F is V of " S+V+O "

$$\text{Value} = \frac{F}{C}$$

Low Value item Is Priority Target of Trimming

F is lower according to the distance away from the basic functions.



Promotion of solution for problems in OLYMPUS

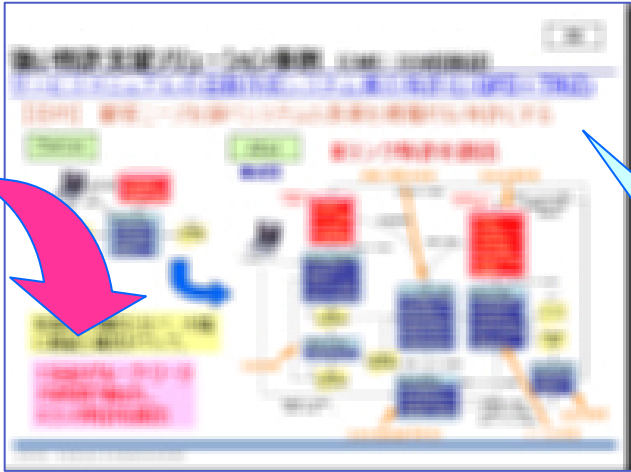
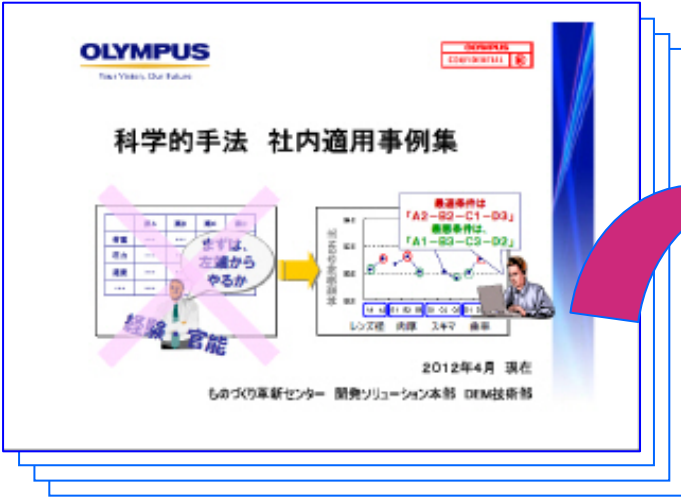
Textbook for Each Solution



Open the 90min Solution Course addition to the 90min traditional Basic Course

Case studies for Each Solution

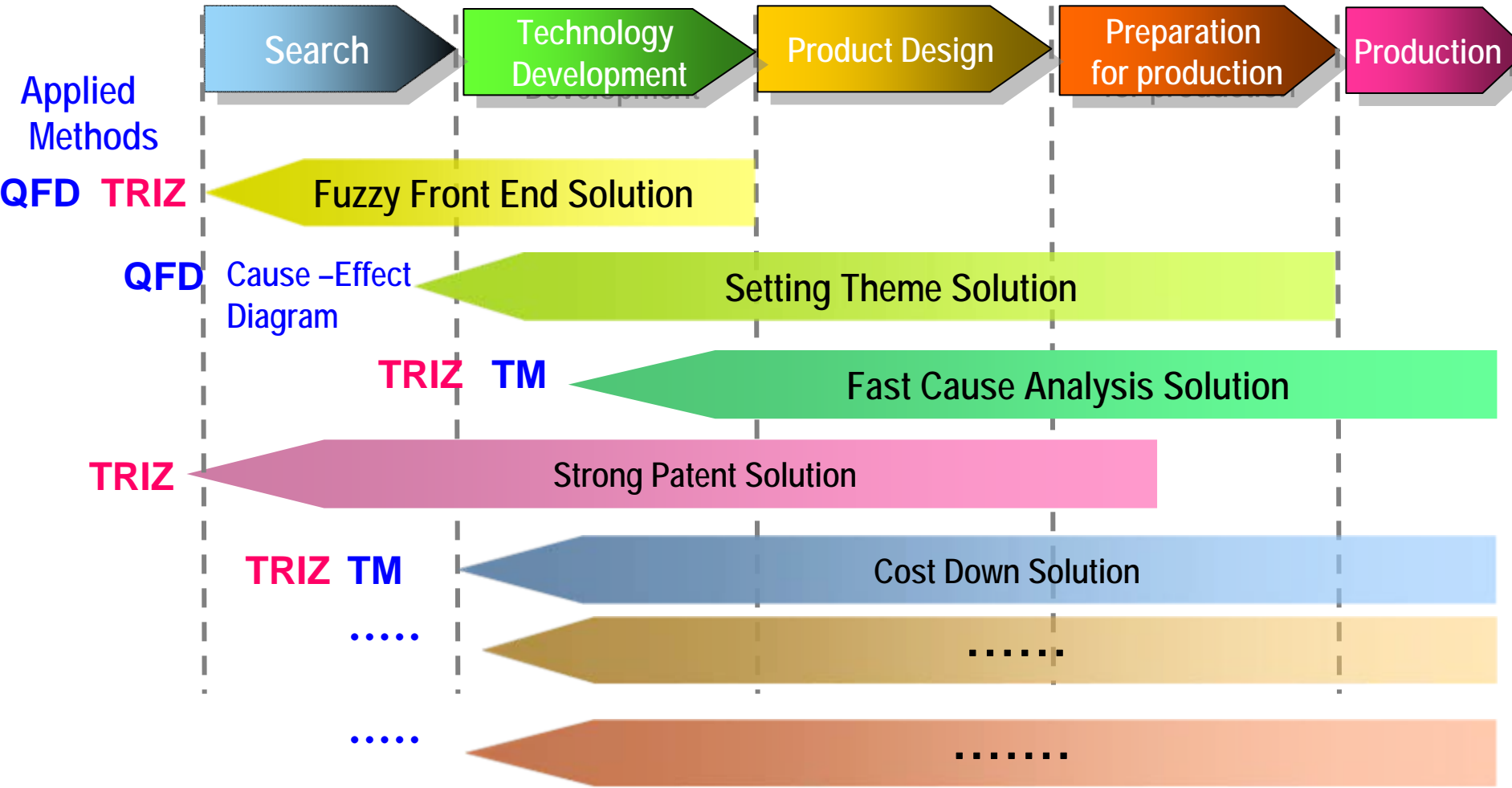
+ Sharing the Case Studies on the Company Data base



Power Point Sheet for Each Solution

8. Application of methods in the development process

Various applications of QFD, TRIZ and TM



Summary

- ① Visualization based on the functional Approach is effective for using the scientific methods including TRIZ in the technical problem-solving process .
- ② Providing the Solutions are acceptable for developers naturally without pushing to use scientific methods.

Next challenge

Our next challenge is to develop human resources who can provide a cross-method solution.

Thanks for Mr.Mamoru Zenko and Hjime Kasai in **IDEA,INC.**
They provide the chance of using scientific methods (QFD,TRIZ)
and support our activity in **OLYMPUS.**

Thank you for your attention.

OLYMPUS