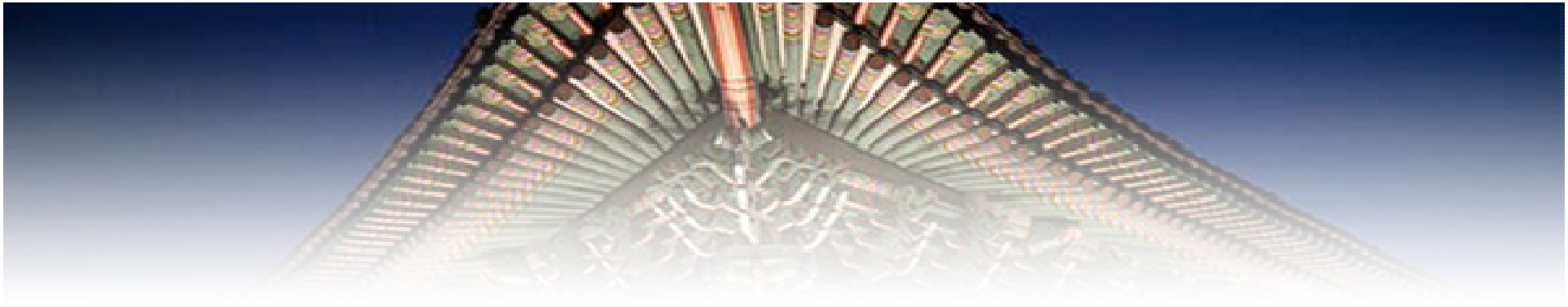

A creative convergence of the technology and business management using TRIZ method in display industry

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1. Motivation

Korean economy has shown remarkable developments especially in the areas of textile, shipbuilding, semi-conductor, display and IT industry. In most of the industries, it generally takes over 20 years for the late movers to overtake the early movers.
In recent years, many researchers have been investigating the factors that enable the late movers to surpass the early movers from a strategic management perspective. The factors was based on industrial organization theory, resource-based theory, and evolution theory.

However, in case of TFT-LCD industry, KOREAN companies take catch up with JAPANESE companies less than 10years and then take the lead for over 10years. I have a begin to question. What is the different factors between LCD business and others for a catch up?

In this study, centering on the case of Korea-Japan display industry, Strategies for catch up and overtake of late mover are investigated but precedence results. To do this, Viewpoint of TRIZ and intellectual property management is introduced for a case study of TFT-LCD industry. In the process, I plan to imbue my 25 years of experiences as an engineer, educator, and consultant in identifying the unique factors.

2.1 Theory_display industry

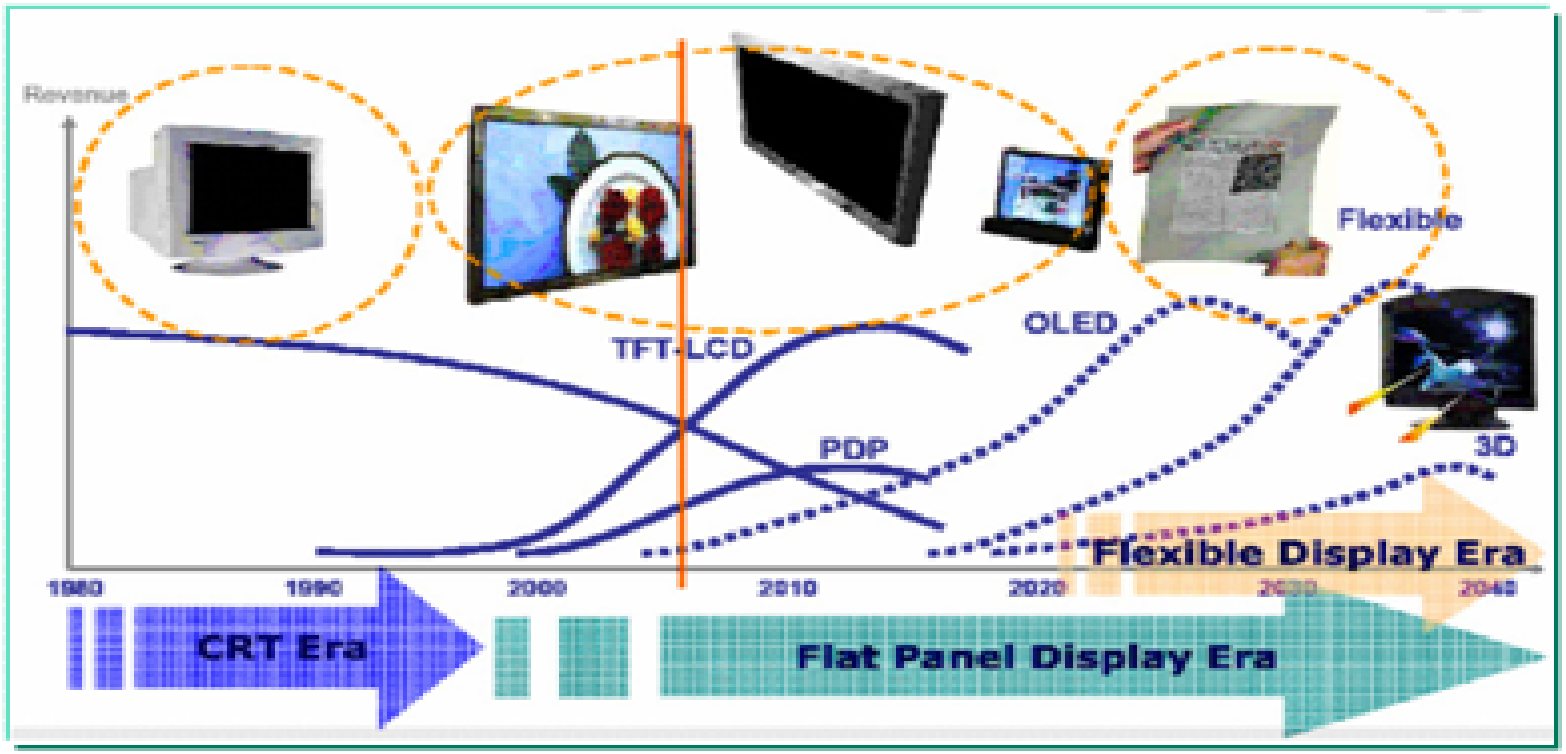


Figure 1. display technology

Evolution process in display
: CRT Era →Flat Panel Display Era; PDP, LCD, OLED →Flexible Display Era
Main stream at present: LCD (Liquid Crystal Display Device)

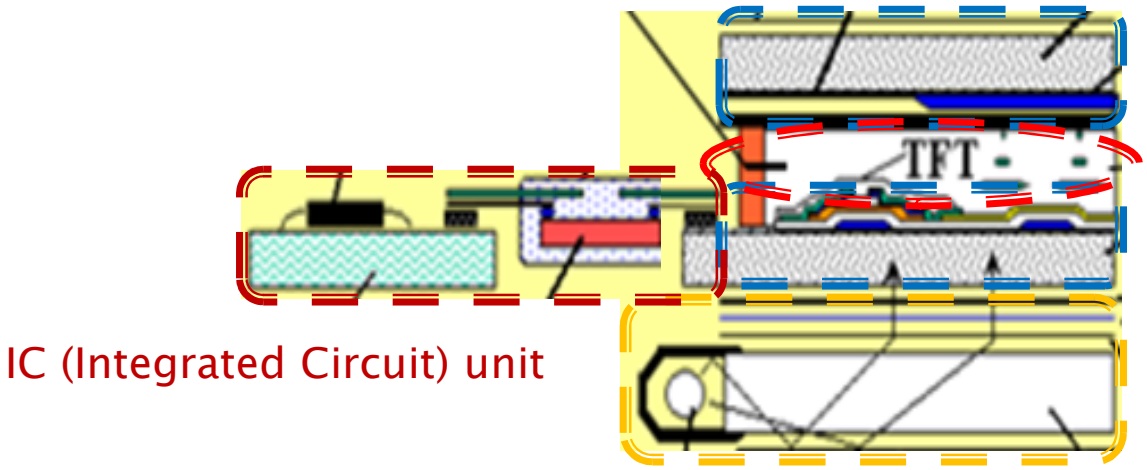


Figure 2. Structure of TFT-LCD

Structure of TFT-LCD is composed of CF, LC, TFT, BL, and IC unit.

Liquid Crystal Display Mode

PM(Passive Matrix)-LCD	TN
	STN
AM(Active Matrix)-LCD	TN
	IPS
	VA
	FFS

Liquid Crystal Phase

Smectic
Nematic
Cholesteric

Main stream at present: Nematic phase and AM-LCD

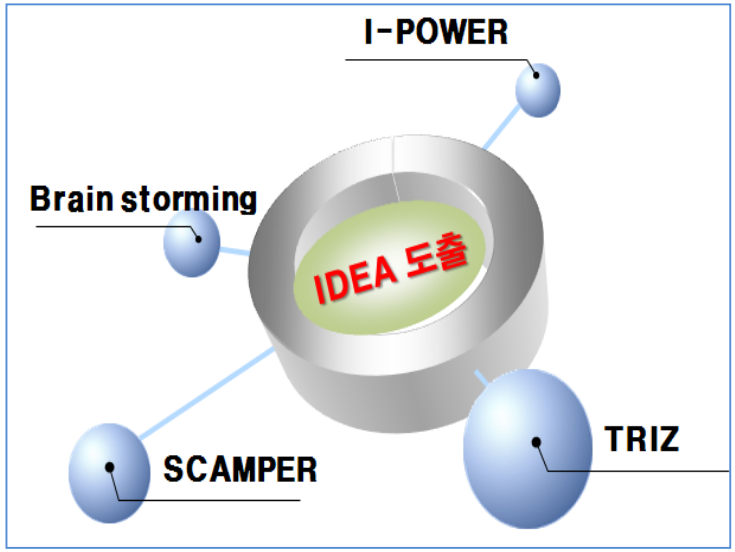
2.2 Theory_ Customer needs & Creative solution methods

Customers' needs

1. Multi-Screen Window in TRIZ
2. Production spec

Creative solution method

1. Brain storming:1941, Alex. F, Osborn
   [Applied Imagination, 1953]
2. TRIZ:1946, G. A. Altshuller
3. SCAMPER:1971, Bob. Eberle
4. POWER: [think better, 2007] T. Hurson



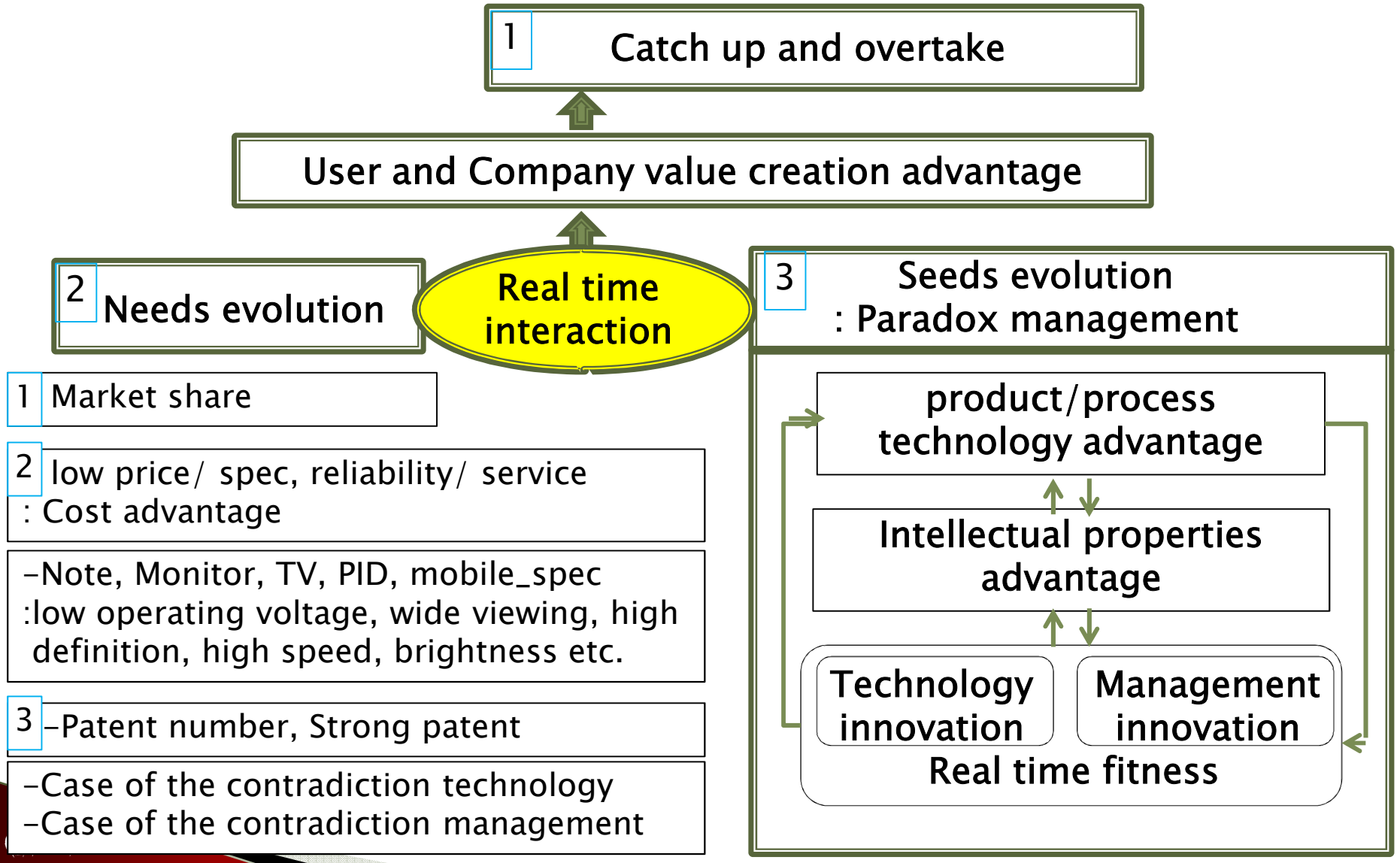
▪ Problem of the Mathematics & Chemistry

	Problem Model	Tool	Solution Model
Mathematics	Equation (X, Y)	*Mathematical formula*	Solution (a, b)
Chemistry	Reaction formula (HCl+NaOH)	*Chemistry Rule*	Product (H_20, NaCl)

▪ Problem of TRIZ

	Problem Model			Tool	Solution Model
TRIZ	Contra-diction	Technical	[2-Output p-], : Trade-off	Contradiction matrix (39*39)	Principles (40)
		Physical	(1-Input P-], : 有&無, 大&小	Separation [S,T,P,I]	Principles (4), Effects
	Ideality	Su-Field	-	Stand Solutions (76), Effect, Trend	
		Function	-	Effect guide (Knowledge Base)	Physical, Chemical, , Biological, Psychological, Geometrical, Social, etc
	Trend	-	-	-	Problem formulation, Directions for innovation, Multi-screen window

3. Study model for catch up and overtake of the late mover in display industry



4. Model verification

4.1 Each country market share in display field

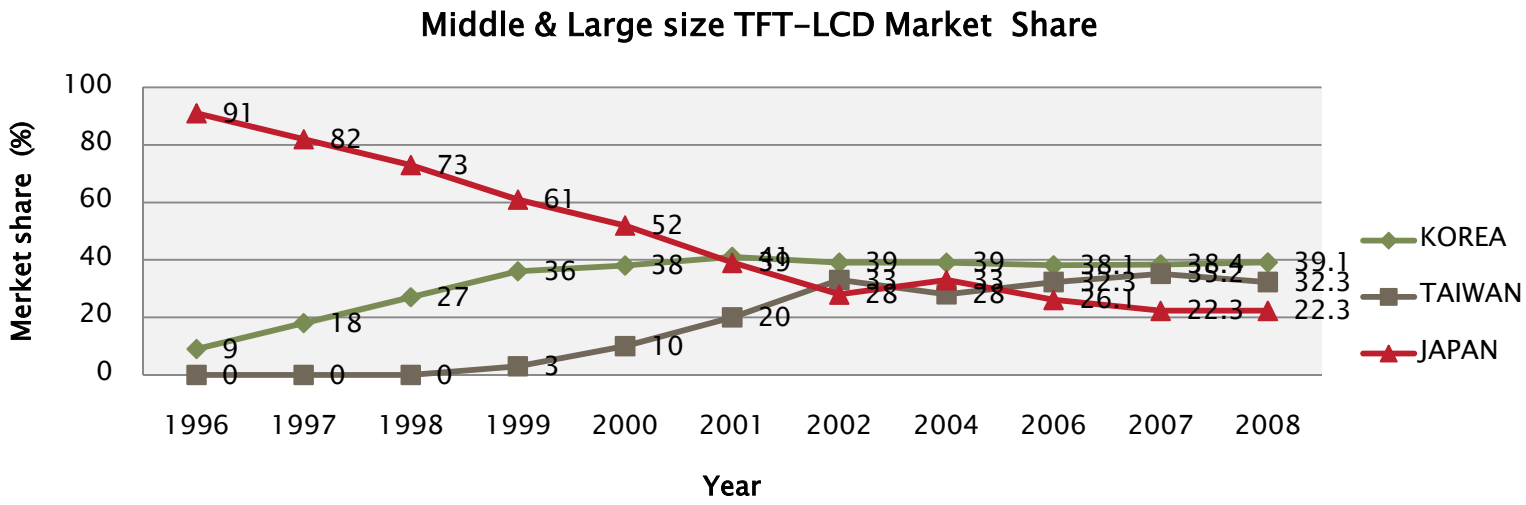


Figure 3 Market share of the TFT-LCD each country

Ref: KDIA, & MOTIE mix

JAPAN monopolize a market in LCD industry until 2000.
KOREA achieve 9% MS on 1996, and overtake with JAPAN after 2001.
TAIWAN achieve 3% MS on 1999, 35% on 2007.

→**Question:** In case of LCD industry, KOREA catch up with JAPAN less than 10years and take the lead from 2001 to 2008.
What is different factors from other business?

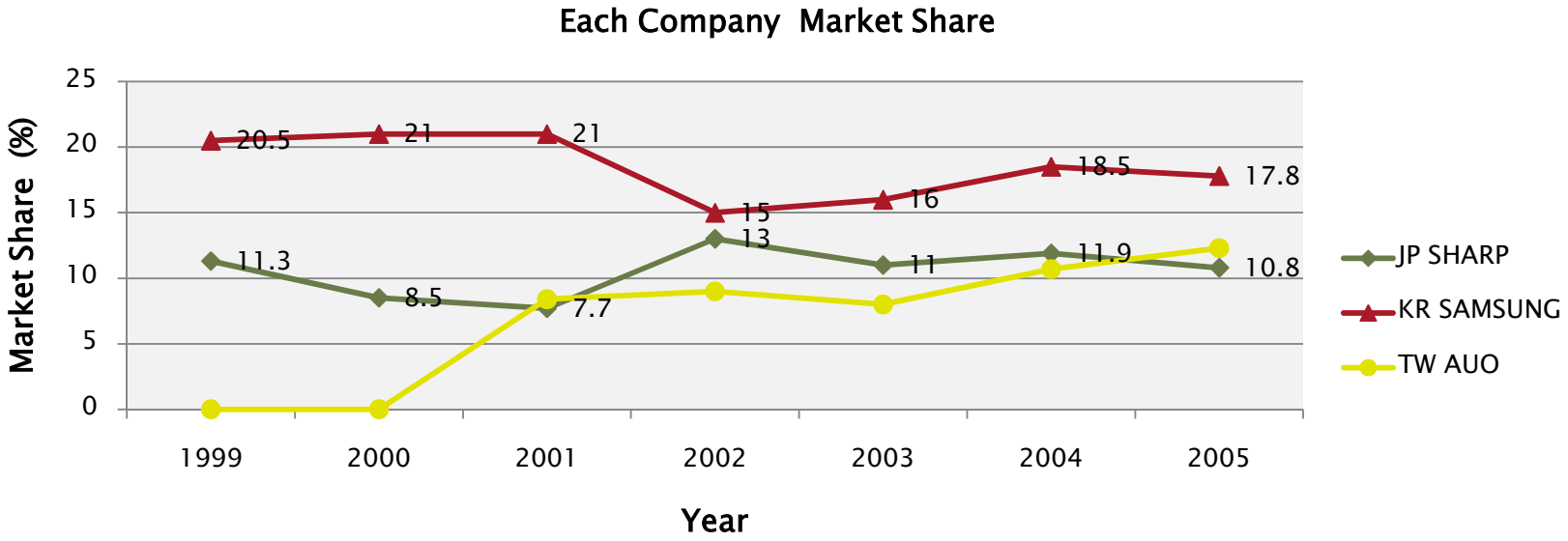


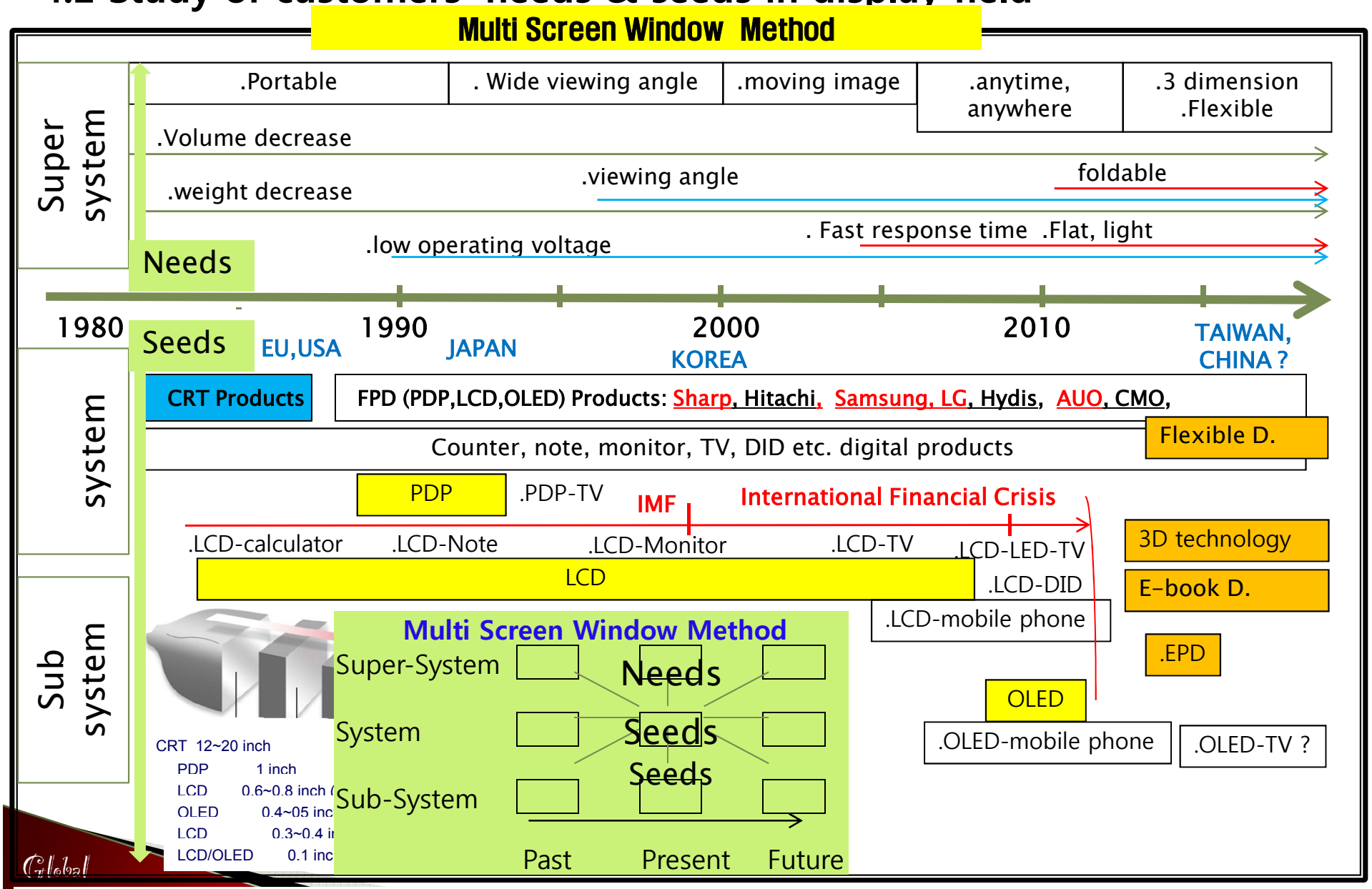
Figure 4. Market share of the TFT-LCD panel company

Ref: Display search, KDIA, & MOTIE mix

JAPAN : SHARP take the lead in LCD industry until about 1998.
KOREA : SAMSUNG D overtake with SHARP on 1999. She start on around 1990.
TAIWAN: AUO catch up with Sharp on 2005, however she didn't catch up with SAMSUNG D.

→ **Question:** Samsung D catch up with SHARP until 1998, and take the lead LCD industry from 1999 to 2005.
On the other hand, AUO catch up with first mover, however, she didn't catch up with SAMSUNG D.
What factors result in this situation?

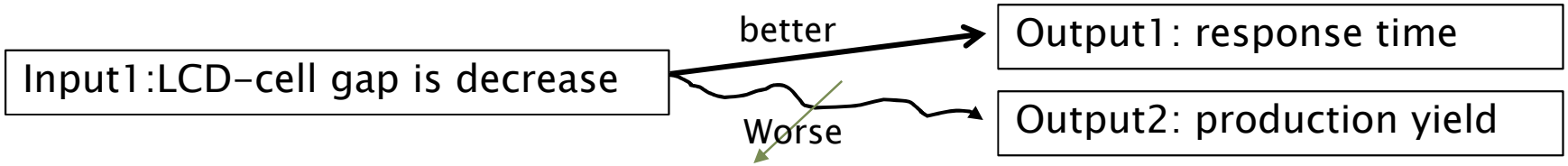
4.2 Study of customers' needs & seeds in display field



•**This data is based on experiences as an engineer, educator, and consultant in display field for more than 25years.**

4.3 Case study 1. Solution of a contradiction problem in display device → US Pat. No. 7,045,176

Problem Situation:
1. Operating Zone : LCD cell design for LCD note
2. Problem(OT): technical contradiction; response time & Production yield



3. What is improve the response time without damaging the production yield?

4. Technical contradiction matrix(9X32)→ Principles: 1, 8, 13, 35
→The change of parameter in production process and LC improve them

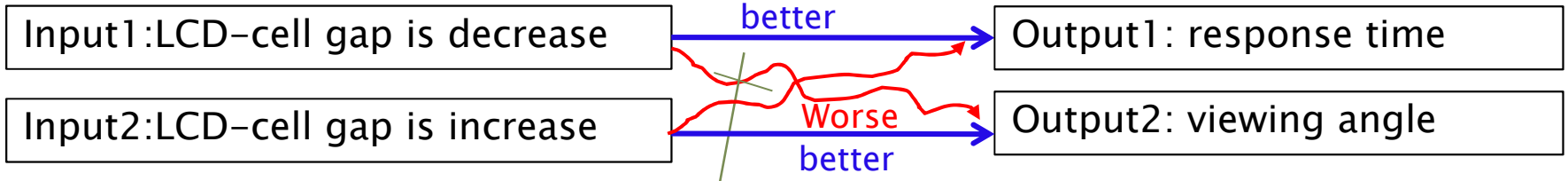
The TRIZ Matrix proposes the following Principles to solve this contradiction:

www.triz40.com →Improving 9: Speed without damaging 32: Ease of manufacture

35. Parameter changes
13. The other way round
8. Anti-weight
1. Segmentation

4.3 Case study 2. Solution of a contradiction problem in display device :contradiction +Stand solution→ US Pat. No. 7,220,368

Problem Situation:
1. Operating Zone : LCD cell design for wide viewing LCD monitor and TV
2. Problem(OT): Technical & Physical contradiction; response time & viewing angle



3. What is improve the response time without damaging the viewing angle?

4. Technical contradiction matrix(9X7)→ Principles: 7, 29, 34
→ High refractive index liquid crystal, and retardation film was able to used in LCD design without decreasing viewing angle.

The TRIZ Matrix proposes the following Principles to solve this contradiction:
www.triz40.com →**Improving 9: Speed without damaging 7: Volume of moving object**

7. Nested doll,

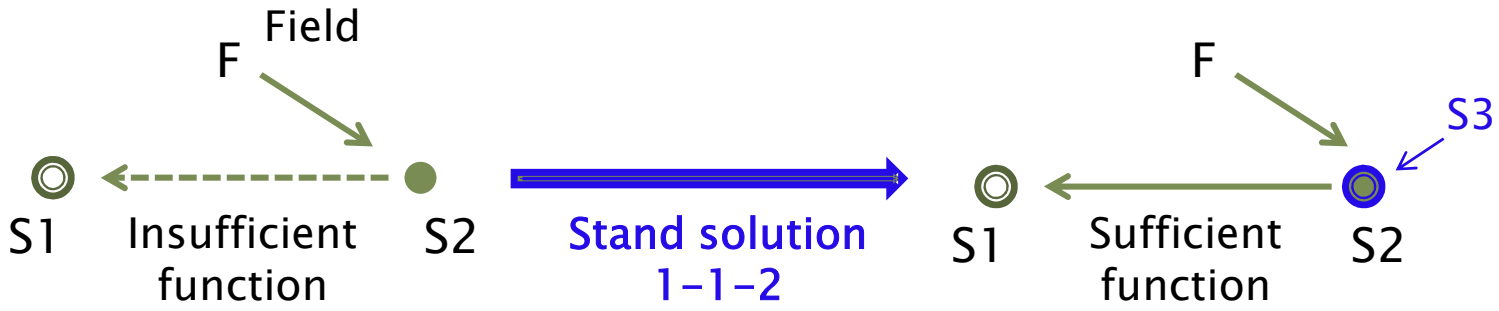
29. Pneumatics and hydraulics

34. Discarding and recovering

However, response time is necessary to improve.

Stand solution : Su-Field Analysis

Su-Field Analysis



F: Electric field

S2: High refractive index LC

S1: Response time

How to solve the insufficient function to sufficient function?

S3: high refractive index & low viscosity LC material

* LC in LCD cell is used mixture with more than 10 single materials.

→ US Pat. No. 7,220,368

4.4 Patent number analysis of SAMSUNG and SHARP

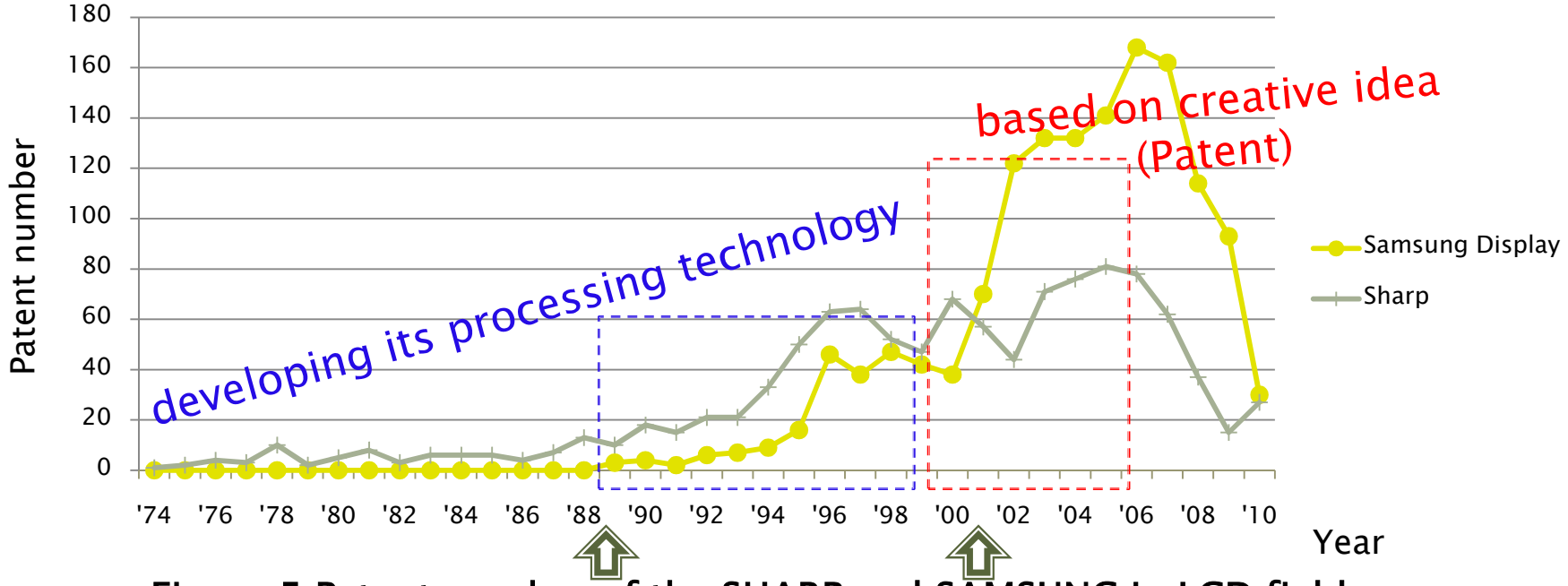


Figure 5 Patent number of the SHARP and SAMSUNG in LCD field

In Figure 5, SAMSUNG D start on around1990, catch up with SHARP on around 2000 and then overtake SHARP more than 10year

In Figure 4, SAMSUNG D catch up with SHARP until 1988, and take the lead LCD industry from 1999 to 2005.

Considering Figure 4 and 5, It is assume that SAMSUNG catch up with SHARP by developing its processing technology, and take the lead LCD industry based on creative idea, that is patent, swiftly responding to customers' demands.

Why contradictions happen in management?

-Human Factors

-Time Factors

-Space Factors

[Ref. GTC 2011, keynote speech by J. W. Han]

The case study for managing the contradiction of business management for late movers catching up with first mover will be carried out.

5. Conclusion and future research

1. I have suggested a model that investigates how late movers overtake the early movers from a fitness of real time interaction both customers' needs and seeds in LCD industry.

2. Pursuit and overtaking performances of the late mover are based on the market share in LCD field.

3. I have assumed that the pursuit and overtaking performances are the results of optimal real time interaction of customers' needs and seeds; The trend of them is *an in-depth studied* by using the multi-screen window method of TRIZ in LCD industry.

4. Some of the case study for solution of technical contradiction in LCD cell design are presented. It was applied to LCD note with high speed, monitor and TV products with high speed and wide viewing angle.

5. I conclude that Samsung as a late mover has overtaken the early movers and maintained its leadership status in the industry by swiftly responding to customers' demands, developing its processing technology, and establishing patents based on creative ideas.

6. *The case study for managing the contradiction of business management for late mover catching up with first mover is required additional research.*

6. Reference

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Thank you!

Q&A