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Analysis of the Future R&D Collaboration and Competition Strategies for ICT & FPD

Industries between Taiwan and South Korea

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Abstract

The economical developments **in** Taiwan and South Korea in the past decades **were** similar. Both of them depended **on** export trade for their economic growth. In recent years, Information and Communication Technology (ICT) and Flat Panel Display (FPD) industries are the main force and exportation industry for both countries. The clusters of these industries are gradually formed in Taiwan and Korea. This study explores the **strategy of** future international collaboration and competition between **these** two countries. Firstly, we use historical/comparative **analysis** and **analysis of** existing statistics **data** to analyze the **research and development** (R&D) activities, ICT and industries policies and imports/exports trading activities between Taiwan and South Korea. Then, we use regression analysis to forecast the total exports values of ICT and FPD of Taiwan and S. Korea. Finally, we use value chain to analyze ICT and FPD industries and game theory to analyze the probable **strategy of** collaboration and competition **strategy** between Taiwan and South Korea in the future. The results show that both of them are devoting to the high technology R&D activities. The differences between them are **that** South Korea **takes advantage of is** creativity-oriented approach **and nonetheless** Taiwan **is employs** stability-oriented approach. The total exports values of ICT and FPD products **of from** Taiwan and S. Korea **are were** US\$130 billion and US\$160 billion comparatively. If Taiwan and South Korea **would** choose cooperation and open the deadlock **to sharing share their** research resources for optimized efficiency, it **may might** be more beneficial for **both of** them in the future.

Key words: science and technology policy, competition and cooperation, game theory, value chain

Introduction

Taiwan and South Korea had similar economical developing processes in the past time. Both of them are experts in the field of engineering and manufacturing products for Information and Communication Technology (ICT) and Flat Panel Display (FPD) around the world [1]. Porter [12] indicated that technical innovation and the creation of knowledge are essential to raise national competitiveness in the knowledge-based era. Since R&D is the driving force of most new knowledge and innovation, most countries are taking more seriously about the need to invest in R&D, which means to boost economic performance and remain competitive.

In recent years, R&D collaboration and competition **is are** a popular topic in the world. South Korea devotes to become the “Northwest R&D Hub” **positive [UoAA1]**(MIC, 2004) [22], on the other hand, Taiwan wants to be the base for innovation and R&D in Asia for the plan of “International Innovation and R&D Base” Plan of “Challenge 2008” (CEPD, 2002) [19]. The two countries compete in ICT & FPD field and export in similar markets (United States, Japan, China, **and** EU). Therefore, **it is very important for Taiwan to analysis analyze and comparison compare with** South Korea’s **experiences in** economical growth **experiences**, R&D strategies, and industries policies. **are very important to Taiwan.**

This **thesis paper** has two objectives: (1) Identification of the R&D relationship between Taiwan and South Korea. (2) **Offering Suggestion on** the probable collaboration and competition strategies for ICT and FPD industries **strategies** between Taiwan and South Korea in the future. We **I.** will introduce relative literatures of the policy **for[UoAA2]** economical growth experiences between Taiwan and South Korea, and compares the industry**yies** policies between these two countries. The methodology of this **thesisstudy.** includes **The the** historical/comparative analysis, **analysis of** existing **statistics statistical analysis** and game theory are used. The **statistics statistical** analysis is utilized to survey the imports/exports

trading activities of these two countries, and uses regression analysis to forecast the export values of ICT and FPD industries. Then, we implement the value chain analysis and game theory to analyze the probable collaboration and competition strategies for ICT and FPD industries between Taiwan and South Korea in the future.

Literature Review

2.1 Comparison of The the policy for of economical growth experiences between Taiwan and South Korea

In recent decades, both Taiwan and South Korea have been lauded as **the** models **for of** the outstanding achievement of economic development. There are a lot of researchers who are interested in the study of comparison **of** R&D strategies and industries policies between these two countries. Related literatures indicated **d** that although the paths of economic development **in two countries** were similar, **but** there are still a lot of differences **for in** industries infrastructure, S&T policies between **Taiwan and South Koreathem**. Although **the technological capabilities of** Korean and Taiwanese **technological capability has have** been improved rapidly **both** during and after the 1980's, **but** these countries show different patterns, ; Korea highly concentrated technical field with dynamic growth **and nonetheless** Taiwan highly diversified technical fields with stable growth (Choung, 1998) [4]. After experiencing the finance-storm in 1997, South Korea industrial policy adopted the strategy of **the choice** and the centralism to establish the key territory of the development in industrial technology and to enhance the policy of **the** research and cultivation of talent person (Lee, 2006) [8].

From the view of business development in Taiwan and Korea, it easily reveals that Korea is pursuing creativity. Looking at the business structure of Taiwan and Korea, it can be found that Korea is developing enterprise as equal to industries, **and nonetheless** the industries in Taiwan are composed by mid-grade businesses. Advantages of monopolization come to Korea, and

competitions come to Taiwan (Yeh , 2005) [15].

Some scholars compared **with** the major competitive industries between Taiwan and S. Korea, such as ICT, TFT-LCD industries. Leu (2004) [9] indicated that Taiwan and S. Korea **both** have strong competitiveness in ICT and TFT-LCD industries, **but however Taiwan are is** weak in service industries. Nevertheless, major industries in South Korea are various **and havewith** high level, such as ship-building, automobile. In contrary, Taiwan is famous in information technology industries. Cheng (2005) [3] studied on the cluster of TFT-LCD industry and found **that** the main production bases for supplying worldwide TFT-LCD are Japan, South Korea, and Taiwan, **and** one of the possible causes is the industry cluster effect. Yu (2004) [16] also found that Taiwan's TFT-LCD companies emphasized cooperation **among on** partners of network, while the Korean companies **relyied** on the integration from down-stream to up-stream within their groups. Hence, the corporate in Taiwan should be toward technology upgrade and cost down to enhance their competitive advantages. In general, Taiwan, Japan and Korea's development in FPD **are is** estimated to continue **competitively competing** till 2010.

Kim (2005) [7] used the exports/imports trade to explore business collaboration opportunities between Taiwan and Korea, . **Hhe** found that Taiwan **is was** competitive in semiconductor, display and storage industries and **has had** strong competitiveness in electronic industry, high quality in component and well-established manufacturing infrastructure. On the other hand, South Korea **has had** wide popularity of Korean contents industry [UoAA5]in Asia, and strong competitiveness. Therefore, **these** two countries may have a strong possibility to cooperate in next- generation PC digital, multimedia broad-casting, and RF-ID.

But However until now, these studies almost focus on the comparative analysis of technology policies, industrial competitiveness and exports/imports trade between Taiwan and S. Korea; there are few studies to explore the R&D collaboration and competition relationship as well as the probable strategy between the two countries in the future; therefore, we take interest

in this topic.

2.2 Comparison of Industries Industrial Policies between Taiwan and South Korea

With a “Green Silicon Island” as its overall goal, in 2002, the Taiwan government began to implement the new six-year national development plan, “Challenge 2008.” This **is was** a strategic development plan that **reaches reached** such economic effectiveness as continuous economic growth, **upgrades upgraded** the quality of life, and **provides provided** more job opportunities; government **constitutes constituted** ten programs as the substantial methods (CEPD, 2002) [19].

The objective of “Industrial Value Heightening Plan” program **is was** to heighten industrial value-added and to form Taiwan into a global production and supply center for high-value-added products. The most important **subitems[UoAA6]** of “Industrial Value Heightening Plan” are “Two- Trillion and Twin-Star” industries (Table 2.1) and construction of industrial parks. The Ministry of Economics Affairs (MOEA) designates semiconductor industry and color-image display industry as the “Two-Trillion” industries; digital content industry and biotechnology industry as the “Twin-Star” industries. They are the new niche for Taiwan's industrial development.

It **is was** estimated that by 2006, Taiwan will become an important location for 12-inch wafer fabs plants and the biggest supplier of TFT-LCD panels in the world. At the same time, Taiwan **will would** be the pioneer of design and application of digital content and biotechnology in the Asia-Pacific region. Then, Taiwan **wants wanted** to promote the two-trillion and twin-star industries, with the goal of raising their total production value to NT\$3.58 trillion in 2006.

Besides, through the strategy of “mobile services, mobile life, and mobile learning”, the production value of broadband and wireless communication industry will exceed NT\$1 trillion in

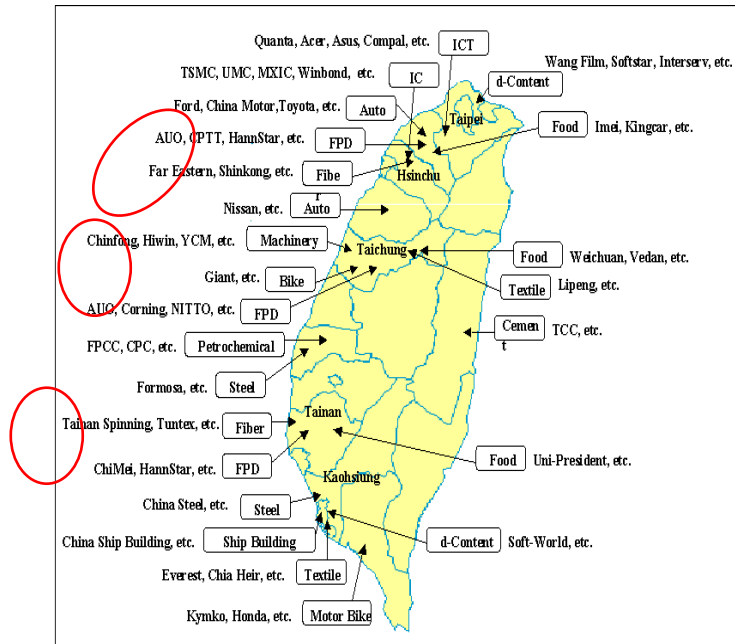
2008, enabling the communication industry to become the third "Trillion" industry. The contents are shown in Table 1.

Figure 2.1 shows the current cluster in various regions of Taiwan, as we know ICT industry and FPD (called "Two- Trillion" industries) share the most parts and take the most important roles of Taiwan's industry clusters.

Table 2.1 "Two- Trillion" and "Twin-Star" industries

Item	Target	Target
Two Trillion	Semiconductor Industry	Production value of NT\$1.59 trillion Global chip design and manufacturing center Three companies among the world's ten largest
	Image Display Industry	Production value of NT\$1.37 trillion Taiwan the world's biggest TFT-LCD supplier
Twin Star	Digital Content Industry	3,000 factories, with production value of NT\$370 million Asian digital content production center and main supplier of Chinese market
	Biotechnology Industry	Business volume of NT\$250 billion Induced investment of NT\$150 billion in 5 years and establishment of 500 firms in 10 years

Source: Hsieh, 2005 [5]



Source: Wang, 2005 [14]

Figure 2.1 Cluster in various regions of Taiwan (Source: Wang, 2005 [14])

In order to realize the goal of US\$20,000 GDP per capita within five to ten years, Korean President Roh Moo-hyun **hold held** a meeting about the next growth engines in 2003, and chose the “Ten next-generation growth engines” to promote the development of **economic economy** (see Table 2.2). The results showed **ed** that **the** sub items about Display, NG semiconductor, Digital content & software, Biomedical products **are were** the same with our “Two-Trillion & Twin-Star” industries, and we all want to be the No. 1. of the world in “Two-Trillion” industries, **, so Therefore** we can expect **that** these two countries would compete intensely in the future.

Figure 2.2 shows the major clusters in various regions of South Korea, including Pa-Ju LCD

Cluster, Tang-Jeong Crystal **Cluster**, O-Chang Hi-Tech **Cluster**, Gu-Mi Electronics **Cluster** and Gwang-Ju Photonics Clusters; as we know, **that** the major companies in each cluster are “chaebols”, such as Samsung, LG and KIA, **it which** is the most different from Taiwan’s that **almost most of** companies are SMEs.

Comparison Comparing of the major **industries industrial** policies between Taiwan and South Korea, we can find that **the** “Industrial Value Heightening Plan” project in Taiwan and **the** “Ten Next-Generation Growth Engines” in South Korea have the similar major industries, including semiconductor, image display, digital and biotechnology. **Therefore, we will both** **expense in these fields.**[UoAA7]

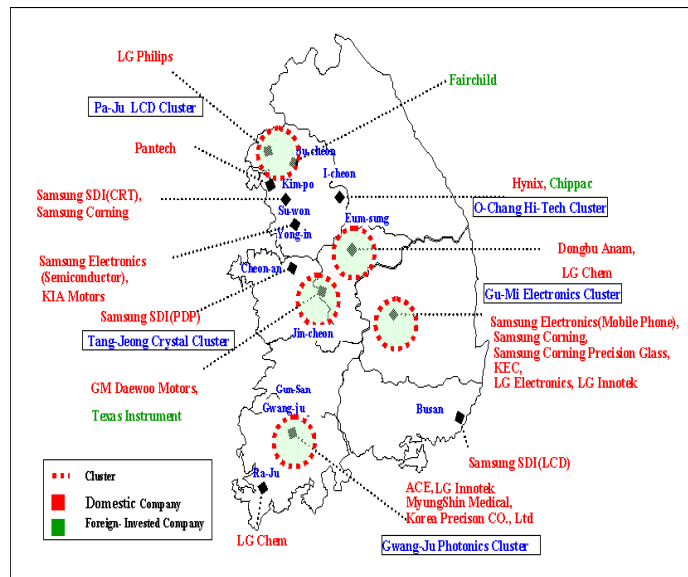
Although the **comparison** results show that Taiwan and S. Korea will **expense** [UoAA8]in the fields of semiconductor, image display, digital and biotechnology in the future, ICT and FPD industries **of them** are the focal **point areas** and **spent**[UoAA9] the most resources in **the these** two countries. Therefore, the industries of ICT and FPD are the main topics for this study. In the following **chaptersessions**, the detailed methodology of this **thesis paper** will be discussed.

Table 2.2 Korea ten next-generation growth engines

10 growth industries	Main Develops products (38 items)	Goal of 2012
DTV & broadcasting	Broadcasting, DTV, DMB, STB, DTV complex machine	To have a 20% market share by 2012
Display	LCD, LED, PDP, OLED, 3D, e-papers & related component	To be No.1 in display unit production by 2012
Intelligent robots	Home robots, IT industry robots, Limit environmental job robots, medical care robots	To be No.3 and have a 10% market share by 2012

Future automobile	Intelligent car, HEV, EV, Solar energy automobile, fuel cell automobile	To be No.4 in automobile production by 2012
NG semiconductor	NG memory, SoC, Nano-electric equipment and related component	Semiconductor Industry No.1, SoC industry No.3 by 2012
NG mobile communication	4G mobile phone, 4G telecomm system, Telematics	To be No.1 by 2012
Intelligent home network	Home serve, home gateway, home network, intelligent electric appliance, ubiquitous computing	To be No.2 by 2012
Digital content & software	Digital content make/use/logistic system, cultural issues, embedded software, intelligent comprehensive logistics system	To be No.5 in the world, the Northeast Asian e-business centre
NG batteries	Battery two times, fuel cell and relevant technology	To be No.1 and have a 15% market share by 2012
Biomedical products	New medication, biochemical organ, biochips	To be No.7 and have a 12% market share by 2012

Source: Huang, 2005 [6]



Source: Invest Korea, S. Korea, 2004 [20]

Figure 2.2 The major clusters in various regions of South Korea (Source: Invest Korea, S. Korea, 2004 [20])

Methodology

This **chapter section** will describe the relevant methodology of this **thesis study**, including historical/comparative analysis, existing **statistics statistical** analysis and game theory.

3.1 Historical/comparative analysis

Historical/comparative analysis is a qualitative method, and its observation and analysis are primarily from the historical records. Social scientists attempt to discover common patterns occurred in different time frame and placement. This method was applied to trace the development of social forms over periods of time and used to compare the developmental process between cultures (Babbie, 1998) [2]. This study utilizes this method to compare the same and the difference **industries industrial** policies between Taiwan and South Korea.

Analysis of existing statistics

Existing statistics research is best for topics that involve information that has been collected by large bureaucratic organizations. It is possible and necessary to undertake social scientific inquiry through the use of the official or quasi-official, international agencies and private source statistics. Such information is gathered for policy decisions or as a public service (Babbie, 1998) [2]. We collected the data mostly from official websites, the chief bureaus from Taiwan include Ministry of Finance (MOF), Ministry of Economic Affairs (MOEA) and Council for Economic Planning and Development Executive Yuan (CEPD) etc., and that from South Korea include Ministry of Science and Technology (MOST), Ministry of Commerce, Industry & Energy (MOCIE), Ministry of Information and Communication (MIC) etc.,. Quasi-official data were collected from the data base of a lot of **Research research Institutesinstitutes**, such as Taiwan Institute of Economic Research, Industrial Technology Research Institute (ITRI). International agencies's data were collected mainly from OECD, Business Week.

Subsequently, this study utilizes the analysis of existing statistics to compare the imports and outputs trade relationships **of between** Taiwan and South Korea. We investigate and account the statistical data of imports/outputs countries and commodities, **these analyses of statistics clarify us the source of this study.**[UoAA10]

3.3 Game theory

“Theory of Games and Economic Behavior” by von Neumann, J., and O. Morgenstern **was** published in 1944 [13]. **As well asTogether with the** expounding two-person zero sum theory, this book is the seminal work in areas of game theory, such as the notion of a cooperative game, with transferable utility (TU). Game theory concerns **the** situations in which multiple players make strategically interdependent decisions, that one person's behavior affects another person's well-being. Once the players reach the stable point, no one will leave alone. Game theory

provides a way to model and reason about multiple players decision making. Each player has only limited number of strategies. A game matrix may represent each different outcome for all combinations of strategies. Traditional game theory focuses on how to find a stable equilibrium point. The stable equilibrium is often known as Nash equilibrium (NE), if there is a set of strategies with the property that no player can benefit by changing her strategy while the other players keep their strategies unchanged.

In this **thesisstudy**, we use the game theory as a tool for the players to reason rational moves. Game matrix is used to model the decision situation. By analysis of the dominant relation, players could find the stable equilibrium points. The basic definitions and notations of Game theory relevant to **the thesis this study is as** following:

Normal form: A game involves a set of players; each player has a set of strategies to play.

Moreover, each agent has a utility function that maps every combination of strategies into payoff value. Here we discuss only 2-person game, which can be represented **in by** a 2 by 2 matrix. In this study we assume **that** the two players are Taiwan and South Korea, and each of them can choose cooperation (C or c) strategy or defect (D or d) strategy to maximize their payoff (Figure **3.13**).

Payoff value: The payoff value for each player in a combination of strategies is denoted as (T_i, K_i) , where T_i is the index of Taiwan, K_i **denoted denotes** South Korea.

The Nash equilibrium: A particular strategy combination (T_i^*, K_i^*) is a Nash equilibrium if and only if any player will get less **than** its payoffs when it deviates from this strategy combination alone. Mathematically: **it can be expressed as** $(T_i^*, K_i^*) > (T_i', K_i^*)$. Nash equilibrium is a stable point. **, Iif** two players reach the compromise on Nash equilibrium, they can be sure that each other will not defect.

		South Korea	
		C	D
Taiwan	c	T1 , K1	T3 , K3
	d	T2 , K2	T4 , K4

Figure 3.1 The game matrix that models decision making situation between Taiwan and South Korea

Empirical Analysis

In this **chaptersection**, empirical analysis is utilized to obtain the inference of the future strategies for Taiwan and South Korea. In **the sub-section 4.1A**, the existing statistics analysis is used to survey the imports/exports trading activities between Taiwan and South Korea. The results show that the major competitive high-tech industries between Taiwan and South Korea are ICT and FPD. In section **4.2B**, we use regression analysis to forecast the export values of ICT and FPD industries from 2006 to 2010. Then, in section **4.3C** and **4.4D**, we implement the value chain analysis and game theory to analyze the probable collaboration and competition strategies for ICT and FPD industries between Taiwan and South Korea in the future.

4.1A. The existing statistics statistical analysis for trading activities

Table **4.13** shows the **trade growth** rate and **the value of trade growth of in** Taiwan and South Korea. In recent years, the trade balance of South Korea increased rapidly. It reached US\$68 billion in 2005, almost 10 times of Taiwan.

Table 4.13 The statistics of trade growth the rate and value of trade growth of in Taiwan and

South Korea

S. Korea	2000	2001	2002	2003	2004	2005
GDP	511.8	482.0	546.9	605.3	681.5	
Exports	172.27	150.44	162.47	193.82	253.84	284.41
Imports	160.48	141.10	152.13	178.82	224.47	216.23
Total trade	332.75	291.54	314.60	372.64	478.31	500.64
Balance	11.79	9.34	10.34	15.00	29.37	68.18
Inc. Rate (%)	(50.75)	(20.76)	10.71	45.07	95.80	132.14
Taiwan	2000	2001	2002	2003	2004	2005
GDP	321.23	291.69	294.80	299.78	322.17	345.86
Exports	148.32	122.87	130.60	144.18	174.03	189.39
Imports	140.01	107.24	112.53	127.25	167.90	181.60
Total trade	288.33	230.11	243.13	271.43	341.93	371.00
Balance	8.31	15.63	18.07	16.93	6.13	7.79
Inc. Rate (%)	(23.78)	88.12	15.61	(6.30)	(63.77)	0.27

Source: MOF, Taiwan [25]; KITA, S. Korea, 2005 [21]

Note : 1. () means negative.

Korea's exports are expected to comprise 2.54% in 2002 to 3.26% in 2010 of in the global market. By 2010, Korea's exports forecast to rank the 8th after the UK and Canada (MOCIE, 2005) [23].

As the Table 4.2 shows, the average trade dependence of the world is 44.1%. **But** **However**, all the "Asian tigers", including Hong Kong, Singapore, South Korea, and Taiwan,

highly depend on export trade. This means that the export/import trades are the major economic activities of these areas.

Table 4.2 Trade dependence of the countries

of the world (Unit: %) [UoAA12]

Region / Year	2000	2001	2002	2003	2004
World	40.2	39.1	38.9	40.7	44.1
U.S.	20.3	18.4	17.6	17.9	19.4
JAPAN	16.9	16.7	17.6	18.5	20.3
GERMANY	55.0	56.1	48.1	55.6	59.0
CHINA	43.9	43.4	48.9	60.1	70.0
HONG KONG	250.8	240.2	254.9	291.1	322.2
SINGAPORE	287.6	270.0	267.5	288.1	314.0
S. KOREA	65.5	60.1	56.8	61.5	70.1
TAIWAN	93.7	82.3	86.1	94.8	111.7

Source: MOEA, Taiwan, 2005 [24]

Note : 1. Trade Dependence=Total trade / GDP*100%.

The major export trading partners of Taiwan are China, Hong Kong, U.S., Japan, Singapore, South Korea, and Germany. These seven countries share the 70% of total export value, in which China and Hong Kong almost share 40% and the rate is still increasing every year. South Korea is the 6th export trading area of Taiwan (see Table 4.35).

Table 4.35 Major export trading partners of Taiwan (Unit: US \$million) [UoAA13]

RANKING	COUNTRY NAME	2004	2005	%/Exports
	Global-Country	174,007	189,393	100
1	CHINA	34,012	40,879	21.5
2	HONG KONG	29,824	30,720	16.2
3	UNITED STATES	28,121	28,510	15.0
4	JAPAN	13,199	14,480	7.6
5	SINGAPORE	6,338	7,655	4.0
6	S. KOREA	5,349	5,574	2.9
7	GERMANY	4,507	4,351	2.3
1-7			132,169	70

Source: Bureau of Foreign Trade, Taiwan, 2005 [18]

As the Table 4.46 shows, South Korea and Taiwan have the same major export trading partners, . **these These** seven countries share 60% of total export value, **in which** China shares 21.7% and is still increasing every year. Taiwan is the 5th export trading area of South Korea, . **and** Taiwan trade deficit with Korea climbed to US\$7.6 billion in 2005. , **so,Therefore,** South Korea is the 2nd trade deficit (the 1st is Japan) of Taiwan.

Table 4.46 Major export trading partners of

South Korea (Unit:

US\$million)

RANKING	COUNTRY NAME	2004	2005	%/Exports
	Global-Country	253,845	284,419	100
1	CHINA	49,763	61,915	21.7
2	UNITED STATES	42,849	41,343	14.5
3	JAPAN	21,701	24,027	8.4
4	HONG KONG	18,127	15,531	5.4
5	TAIWAN	9,844	10,863	3.8
6	GERMANY	8,334	10,304	3.6
7	SINGAPORE	5,654	7,407	2.6
1-7			171,390	60

Source: KITA, S. Korea, 2005 [21]

Taiwan trade deficit with Korea is mainly caused by the shortage of domestic supply. This implies that **we are Taiwan is** not self-sufficient on key components and equipments. The trade deficit is centered on semiconductor industries, for instance, deficit with Korea on DRAM is US\$2.4 billions.

Then, we use “Harmonized System Codes” (HS Code) to classify the export commodity; we only use 2 digits to observe the whole industries. It can be found that the rank of the 1st to the 10th export products share the 82% of total exports value, the most important export products are electrical machinery and equipments (HS Code 85), which share the 33% of whole export, and we name it as ICT industry, **. another Another** high tech industry is optical, photographic,

etc. (HS Code 90),), and we name it as flat panel display (FPD) industry. In “Two-Trillion & Twin-Star” industries project, these two major industries (semiconductor industry and image display industry) include most of ICT and FPD industries separately (see Table 4.57).

Table 4.57 Major export products of Taiwan (Unit: US \$million) [UoAA14]

RANKING	HS CODE	COMMODITY	2004	2005	%/ Exports
		SUM	174,007	189,393	100
1	85	ELECTRICAL MACHINERY AND EQUIPMENT AND PARTS THERE	55,964	62,783	33
2	84	NUCLEAR REACTORS, BOILERS, MACHINERY ,AND MECHANIC	31,901	28,168	14.8
3	90	OPTICAL, PHTOGRAPHIC, CINEMATOGRAPHIC, CINEMATOGRAPHIC, MEASURING	11,181	13,303	7
4	39	PLASTICS AND ARTICLES THEREOF	10,981	12,761	6.7
5	27	MINERAL FUELS.MINERAL OILS, BITUMINOUS SUBSTANCES,	5,445	8,853	4.6
6	72	IRON AND STEEL	7,127	8,096	4.6
7	87	VEHICLES OTHER THAN RAILWAY OR TRAMWAY ROLLING-STO	5,882	6,302	3.3
8	29	ORGANIC CHEMICALS	4,102	5,606	2.9
9	73	ARTICLES OF IRON OR STEEL	4,849	5,083	2.6
10	54	MAN-MADE FILAMENTS	3,555	3,489	1.8
1-10				TOTAL	82

Source: Bureau of Foreign Trade, Taiwan, 2005 [18]

In Table 4.68, it can be found that the rank of 1st to 10th export products share the 85% of total exports value, . that ICT industries (HS Code 85) is the major export of South Korea, the same with as Taiwan, and it shares almost 30% of total export value. Hence, we know that the export trading of Taiwan and South Korea have the overlap items in ICT and FPD industries.

Table 4.68 Major export products of S. Korea Unit : US\$, million

RANKING	HS CODE	COMMODITY	2004	2005	%/ Exports
		SUM	253,845	284,419	100
1	85	ELECTRICAL MACHINERY AND EQUIPMENT AND PARTS THERE	73,170	80,488	28
2	84	NUCLEAR REACTORS, BOILERS, MACHINERY ,AND MECHANIC	39,403	38,563	13.5
3	87	VEHICLES OTHER THAN RAILWAY OR TRAMWAY ROLLING-STO	32,106	37,491	13.2
4	89	SHIPS, BOATS AND FLOATING STRUCTURES	15,321	17,231	6
5	27	MINERAL FUELS.MINERAL OILS, BITUMINOUS SUBSTANCES,	10,532	15,709	5.5
6	39	PLASTICS AND ARTICLES THEREOF	11,900	14,262	5
7	72	IRON AND STEEL	10,578	12,805	4.5
8	90	OPTICAL, PHTOGRAPHIC, CINEMATOGRAPHIC, CINEMATOGRAPHIC, MEASURING	5,767	11,911	4.1
9	29	ORGANIC CHEMICALS	8,749	10,539	3.7
10	73	ARTICLES OF IRON OR STEEL	3,320	4,426	1.5
1-10				TOTAL	85

Source: KITA, S. Korea , 2005 [21]

Therefore, we can find that the major export products between Taiwan and South Korea are very similar, except for the ship-building and textiles. We probably are the rival with each other especially in ICT and FPD high tech. industries in the future.

4.2 B. Forecast of the export value of ICT and FPD industries

ICT and FPD industries are listed in “Two-Trillion & Twin-Star” program in Taiwan and “ten next-generation growth engines” in South Korea, so it catch our attention to explore the probable collaboration and competition strategy for ICT and FPD industries between Taiwan and South Korea. In At the beginning, we survey the export trading value of Taiwan and South Korea within the last five years (from 2001 to 2005) and then use regression analysis to forecast the export value of the next five years (from 2006 to 2010). Therefore, we can draw the charts of Figure 4.1 to 4.47 and compile the Table 4.79 and Table 4.810.

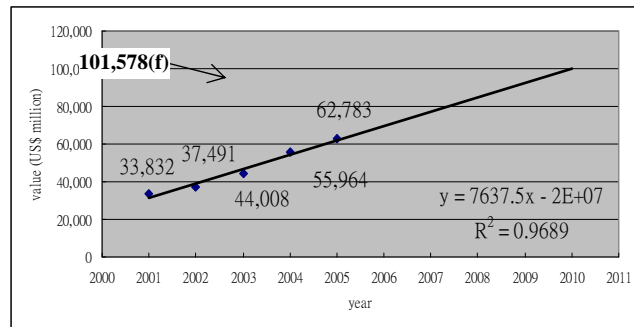


Figure 4.14 Forecasting Taiwan’s ICT industry export trading value

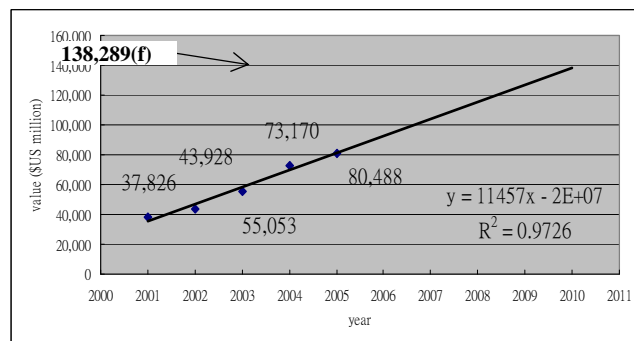


Figure 4.25 Forecasting South Korea’s ICT industry

export trading value

Table 4.79 Forecasting the ICT industry export trading value of Taiwan and S. Korea (Unit: US\$million)

[UoAA15]

ICT (HS Code 85)	2005	2006 (f)	2007 (f)	2008 (f)	2009 (f)	2010 (f)
Taiwan	62,783	69,924	78,174	85,003	92,640	101,578
S. Korea	80,488	87,731	98,895	115,376	126,832	138,289

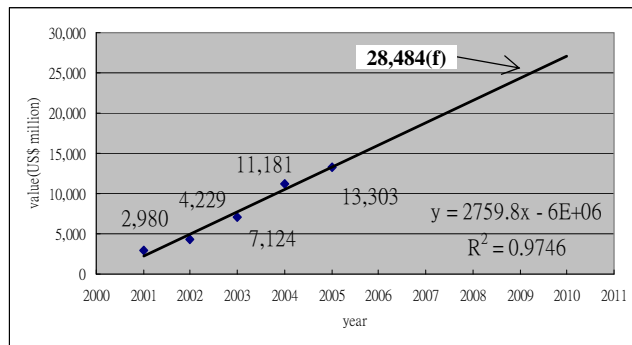


Figure 4.36 Forecasting Taiwan's FPD industry export trading value

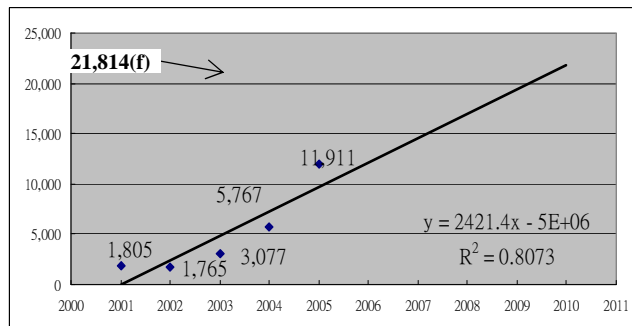


Figure 4.47 Forecasting South Korea's FPD industry export trading value

Table 4.810 Forecasting the FPD industry export trading value of Taiwan and S. Korea (Unit : US\$, million)

FPD (HS Code 90)	2005	2006 (f)	2007 (f)	2008 (f)	2009 (f)	2010 (f)
Taiwan	13,303	1,6569	18,802	21,562	24,322	28,484
S. Korea	11,911	12,129	14,550	16,972	19,393	21,814

Subsequently, we add up the export value of ICT and FDP industries of Taiwan and S. Korea in 2010(f) and get the total expected export value of US\$130,062 million and US\$160,103 million , **respectivelyrelatively**. Then, we simplify the payoffs and set the scales for 13 and 16 for the further game theory analysis.

Table 4.911 The total export value of ICT and FDP industries between Taiwan and S. Korea in 2010(f) (Unit: US\$, million)

	ICT (2010f)	FPD (2010f)	Total (2010f)	Scale
Taiwan	101,578	28,484	130,062	13
S. Korea	138,289	21,814	160,103	16

4.3C. Value chain analysis

The value chain developed by Michael Porter (1985) [11] is a model to analyze specific activities of the business process. A **firm company** utilizing value chain analysis can develop

competitive advantages and create shareholder value. Value chain analysis is useful to separate the business system into a series of value-generating activities.

The goal of these activities is to offer **the a** customer a level of value that exceeds the cost of the activities, thereby resulting in a profit margin (operating profit rate). The **margin or profit of the firm's company margin or profit** then depends on the chain's effectiveness **through in** performing these activities **in the chain efficiently**, so that the value that the customer is willing to pay for the products exceeds the total cost of the activities in the chain.

Value chain activities are not isolated **from one from another; . O**one value chain activity often affects the cost or performance of other ones. Linkage, overlap, and coupling may exist between these activities. Consider the case in which the design of a product is changed in order to reduce manufacturing costs. **Supposinge** that inadvertently the new product design results in the increase of service cost; , the cost reduction could be less than anticipated and even worse, **and then** there could be a net cost increase. Therefore, in this **thesisstudy**, we only use **the** average method to calculate the average operating rate for each activity in value chain. The main contains for this analysis are listed as follows:

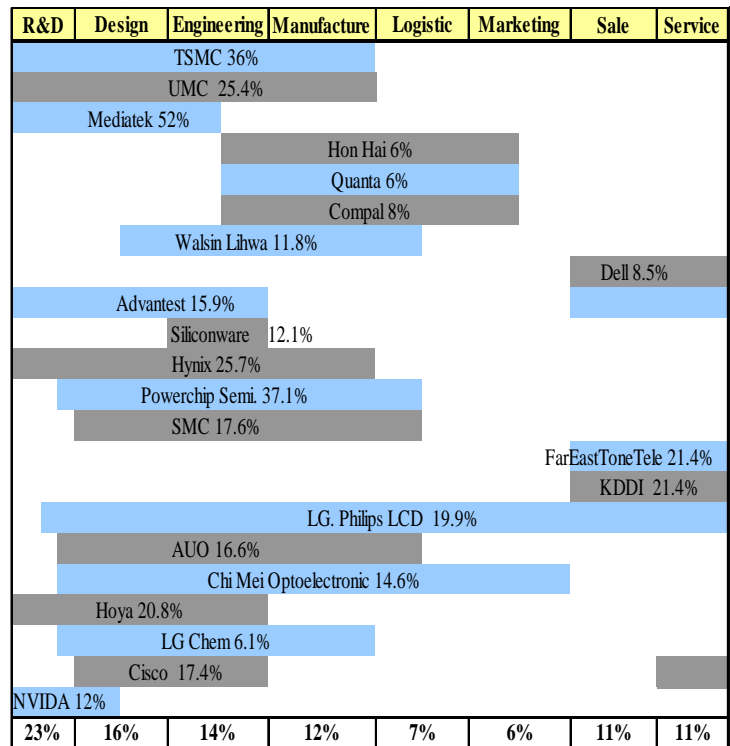
In order to find the scales of game matrix to analyze the probable collaboration and competition strategy between **these** two countries in 2010, we **developed** a model of value chain. At first, we **choose** the typical companies in ICT and FPD fields of the world, such as TSMC, Quanta, Hynix (Dram film), AUO, LG. Philips LCD, etc., and **illustrated** the ranges of their business models as Table **4.1012**. Then, the average method **is was** used to calculate the average operating rate for each activity in value chain. Thus, we **can** see if the company focuses on R&D activity, it can gain almost 23% operating profit **rate**. Because samples are insufficient; we obtain 22 representative corporations in global ICT and FPD business.

Operating profit rate is calculated by the amount of average for each activity in value chain. Due to that the operating profit rate **is was** calculated by averaging each activity in value chain,

and in order to avoid the low average on certain activities of the value chains, the businesses own the entire value chain are neglected from chosen samples.

Table 4.1012 The business model and operating profit rate of major ICT and FPD firms in the

World (%: Operating profit rate)



Source: Original research results from this thesis
 Note: 1)The operating profit rate was got from BusinessWeek, 2005 [17]
 2) Partial business model refer from MOEA, 2005 [10]

4.4D. Collaboration and competition strategies

The goal in this section is to explore the probable cooperation and competition strategies for ICT and FPD industries between Taiwan and South Korea. According to the methodology in the chapter three previous section, we assume that the players are Taiwan and South Korea, and each of them have two choices in this game, cooperation (C or c) or defection (D or d), finally, they can get probable payoffs by themselves (See Figure 4.58).

		South Korea	
		C	D
Taiwan	c	T1 , K1	T3 , K3
	d	T2 , K2	T4 , K4

Figure 4.58 The decision-making situations between Taiwan and South Korea

According the value chain analysis, the average operating profit rate is 12% ($= (23\% + 16\% + \dots + 11\%) / 8$), so we can transfer the scales of Table 4.911 to Figure 4.69. When Taiwan and S. Korea compete with each other in ICT and FPD fields, the payoffs of this game are (1.625 , 2). The formulas are listed after Figure 4.69.

		South Korea	
		C	D
Taiwan	c	T1 , K1	T3 , K3
	d	T2 , K2	1.625 , 2

Figure 4.69 Game matrix of a game with the strategy of d , D between Taiwan and South Korea

The formula:where

$$T4 : 13 \text{ (scale)} \times 12.5\% \text{ (average operating profit rate)} = 1.625$$

$$K4 : 16 \text{ (scale)} \times 12.5\% \text{ (average operating profit rate)} = 2.0$$

If Taiwan and South Korea are willing to cooperate in R&D activities with each other, each of them could increase **of** extra profit **of** 23% additionally; **.in In** other wards, Taiwan will choose strategy “c” and South Korea choose strategy “C”, then, the final payoffs of this game are (2 , 2.46), therefore, we can get Figure 4.710 as follows:

		South Korea	
		C	D
Taiwan	c	2 , 2.46	T3 , K3
	d	T2 , K2	1.625 , 2

↙ 23%

Figure 4.710 Game matrix of a game with the strategy of c, C between Taiwan and South Korea

The formula:where

$$T1 : 1.625 (\text{scale}) \times (1+23\%) (\text{cooperation in R\&D activities}) = 2$$

$$K1 : 2 (\text{scale}) \times (1+23\%) (\text{cooperation in R\&D activities}) = 2.46$$

If South Korean has more competitiveness than Taiwanese **in the real world**, they will choose defection and erode the market owned by Taiwanese. Therefore, if they increase some activities X%, **we Taiwan** will decrease these activities proportional.

Assumed that South Korea will erode the activities for half of R&D and design when Taiwan losses its competitiveness in ICT and FDP industries, thus, the final payoffs of this game are (1.3 , 2.4) as shown in Figure 4.811.

		South Korea	
		C	D
Taiwan	c	2 , 2.46	1.3 , 2.4
	d	T2 , K2	1.625 , 2

↑ 19.5%

Figure 4.811 Game matrix of a game with the strategy of c, D between Taiwan and South Korea

The formula:where

$$T3 : 1.625 (\text{scale}) \times \left[1 - \frac{23\%}{2} + \frac{16\%}{2} \right] (\text{increase on half of R\&D \& design activities}) = 1.3$$

$$K3 : 2 (\text{scale}) \times \left[1 + \frac{23\%}{2} + \frac{16\%}{2} \right] (\text{decrease on half of R\&D \& design activities}) = 2.4$$

In contrary, if Taiwanese has more competitiveness than South Korean **in the real world**, we will choose defection and erode the market owned by South Korean. Therefore, if **we Taiwan** increases some activities X%, **they S. Kprean** will decrease these activities proportionally.

Assumed that Taiwan will erode the activities for half of R&D and design when South Korea losses its competitiveness in ICT and FDP industries, thus, the final payoffs of this game are (1.94 , 1.6) as shown in Figure 4.912.

		South Korea	
		C	D
Taiwan	c	2 , 2.46	1.3 , 2.4
	d	1.94 , 1.6	1.625 , 2



19.5%

Figure 4.912 Game matrix of a game with the strategy of d, C between Taiwan and South Korea

The formula:where

$$T2 : 1.625 (\text{scale}) \times \left[1 + \frac{23\%}{2} + \frac{16\%}{2} \right] (\text{increase on half of R\&D \& design activities}) = 1.94$$

$$K2 : 2 (\text{scale}) \times \left[1 - \frac{23\%}{2} + \frac{16\%}{2} \right] (\text{decrease on half of R\&D \& design activities}) = 1.6$$

When we get all the payoffs for these strategies(c,C or d,C or c,D or d,D), we can fill the game matrix as shown in Figure 4.1013. This figure presents that, the Nash equilibrium solution of this game is (2,2.46). It means that if any of Taiwan and S. Korea expresses a good intention, the other will accept the goodwill, otherwise, they will choose competition. As we know, the payoffs (2,2.46) are bigger than (1.625,2), if we choose cooperation, we may get more payoffs in the future (FY2010).

		South Korea	
		C	D
Taiwan	c	2 , 2.46	1.3 , 2.4
	d	1.94 , 1.6	1.625 , 2

Figure 4.1013 The results of cooperation or competition strategy between Taiwan and South Korea

Conclusions and Suggestions

Based on the results of analysis, Taiwan and South Korea may choose the possible relationship of cooperation or competition for the R&D activities in the future. Both countries could choose cooperation strategy and gain win-win results, or choose competition strategy to make loss-loss results. If both countries want to obtain more benefits, they may select the cooperation for the R&D activities.

When the globalization trend comes to international competition, countries are not only competing on the market share, but also on techniques, human talents, finance, knowledge and resources. How to prove to be a leader in the global competition is exactly what we should face. , thus

The main stream of international R&D business is cooperation, thus it is more beneficial for both Taiwan and Korea to work with each other than continually competitions. There are so many similarities between Taiwan and S. Korea in R&D, ICT, industrial policies and export business. It is very important for both countries to open the deadlock, sharing research resources for optimized efficiency. **We Taiwan** can start to communicate with Korea on the matters of Free Trade Agreement. The trade deficit **of Taiwan** with Korea has climbed only second to Japan. The free trade agreement with Korea would ease the situation. Taiwan may need to enhance the execution of the governmental policies. The brilliant performance by Korean government is mainly because of the determination and strength of execution on national policies. It is revealed on the initialization of the technology industrial policies and the improvement on market-leading businesses. What Taiwan needs in the future is the firmer execution to make the deficiency in recent years. Industrial policies may need to focus on the trend of newly developing business, instead of Two Trillion and Twin Stars.

Taiwan government is over-emphasized **on** the revenue of production and large enterprises at current stage, **and** resulted in over-dependency on electronics industries. Under the pressure from the “world factory”, China, our revenue **way may** be compressed even more seriously in manufacturing areas. We need to re-evaluate the global trend and lead the way into high value added industries.

Taiwan and Korea have **a** similar background for the past development of science and technology. If two countries could be integrated together as an industrial union or an R&D hub to leverage the resources, perhaps the capability of R&D for these two countries may catch up the other advanced countries, such as US and Japan in the world. There would be worldwide-known new brands merged from LG Philip LCD, BenQ-Simens, and Samsung SDI within the area of Taiwan and Korea.

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