Korean Industrialization: From Imitation to Innovation Cluster

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Contents

Overview of Korean Industrial Development

I.1. An Overview of the Korean Economy

- Korea was one of the least developed countries in terms of industrial development in the early '60s → It has been transformed into one of the leading industrial countries in the world during the last 50 years.
- Now, major Korean industries are ranked at the top 5 level.
- They take, in general, approximately 5% of the shares in the world market.

Korea's Industries in 1960 and in 2010

	1960	2010
GDP per capita (in US$)	82	29,101
Population	25 mil.	48.9 mil.
Share of Manufacturing (in GDP(%))	14.4	27.6
Major Industries	Wigs Eyelashes Clothes Plywood	Shipbuilding(world # 2) Semiconductor(world # 3) Flat Display(world # 1) Automobile(world # 5) Steel(world # 6) Mobile Phone(world # 2) Petrochemical products(world # 5)

I.1. An Overview of the Korean Economy

- Diversifying Exporting Industries, especially for ICT industries
- Major Korean industries are ranked at the top 5 level in the world market.

Top 10 export items (%)

1960			2010		
	Item	%		Item	%
1	Iron Ore	13.0	1	Semiconductor	10.9
2	Tungsten Ore	12.6	2	Ships	10.5
3	Raw Silk	6.7	3	Automobile	7.6
4	Anthracite	5.8	4	Flat Panel Display	7.0
5	Cuttlefish	5.5	5	Petrochemical Products	6.8
6	Live Fish	4.5	6	Wireless Telecommunication Equip.	5.9
7	Natural Graphite	4.2	7	Automobile Parts	4.1
8	Plywood	3.3	8	Plastics	3.7
9	Rice	3.3	9	Iron & Steel Products	3.6
10	Bristles	3.0	10	Computers	2.0

Source: KOTIS

I.2. What are the Major Factors of Korean Industrialization?

- **How have Korea and Korean firms managed to achieve such rapid growth in industrialization in only five decades? (compared to 100 years for Japan, 200 years for the US)**
  - In industrialized economies, many studies have shown that more than 50 percent of long-term economic growth stems from technological changes that improve productivity and lead to new products, processes, or industries (Kim, 1997).

Establishment of Industrial Clusters

- **Korean cluster development used one of the key strategies of industrial location policy in Korea.**

[Status of Contribution of Industrial Complexes to the National Economy]

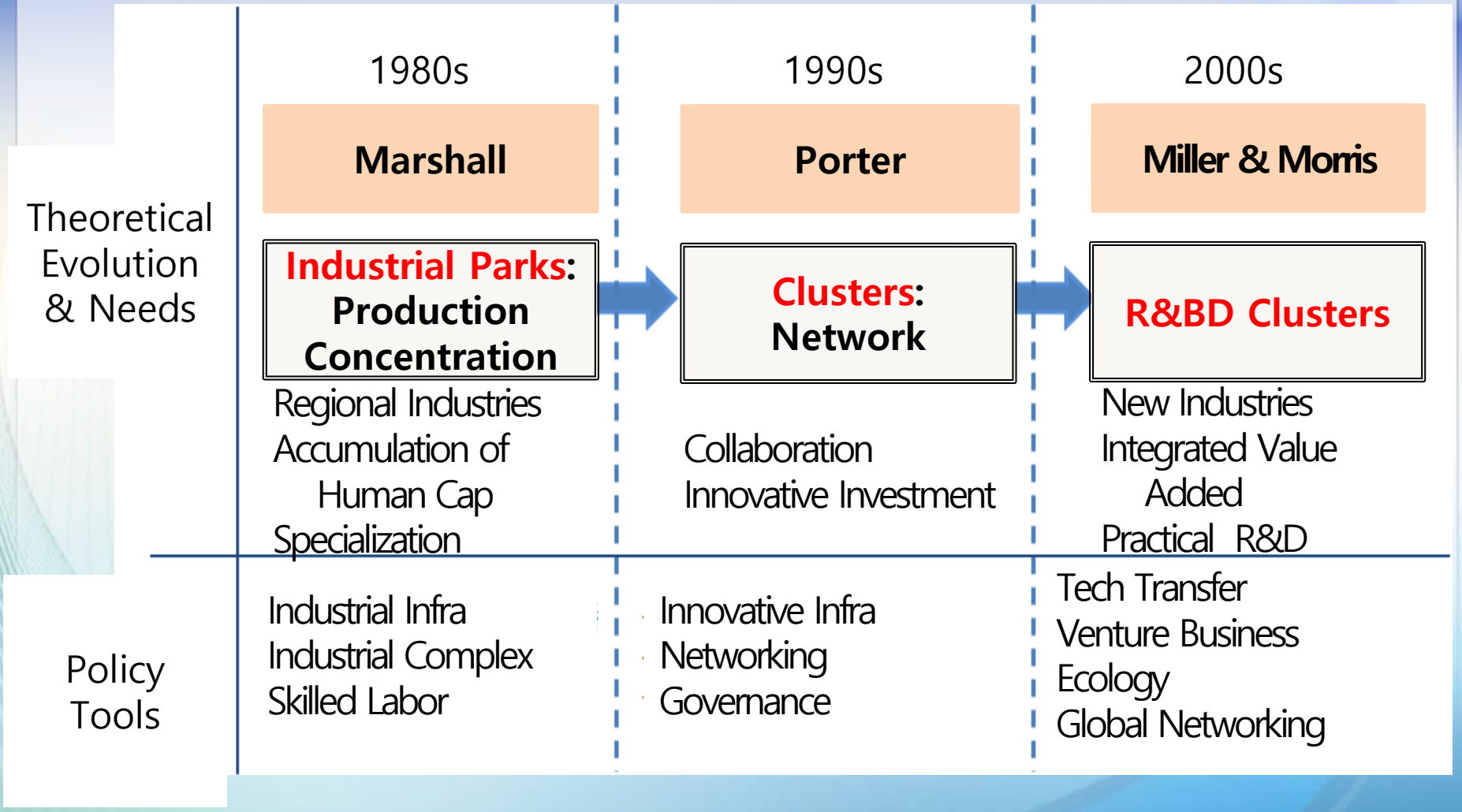
unit: %, %p

Share of	2000	2003	2006	2010	Growth Rate (2000 ~ 2010)
Number of Firms	7.9	10.0	13.1	16.3	8.4
Production (Output)	51.1	52.2	59.9	62.3	11.2
Export	59.4	68.6	80.4	79.1	19.7
Employment	28.9	30.8	37.1	42.1	13.2

Source: KICOX, 2012

I.3. What are Industrial Clusters?

Theory of Industrial Clusters



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Industrial Complexes(Capacity Building): Imitation Phase (1962~1979)

II. 1. Export Promotion Policy

1. Export Promotion

- **From Import Substitution to Export Promotion**
  - From the 1960s, the Korean government was deeply involved in the country's economic development through intervention in industrial, labor, and credit markets.
- **Export promotion became the first priority in economic policy with various measures to achieve this end.**

2. Major Policies

- **Major tools for export promotion policy in Korea**
  - Exporting firms were allowed to retain exchange earnings for the purchase of imports.
  - Tax concessions were granted to exporters.
  - Monthly meeting for export promotion
    - presided by the president
    - convening of related ministers and business leaders
    - discussion on how to promote exports

II. 1. Export Promotion Policy

3. The Change of Export Structure

Dramatic Change of Export Structure

- From a traditional agriculture-based economy to a manufacture-led economy

	1961	1966	1971
Agricultural products	28.6	9.6	4.3
Fishery products	19.2	10.4	4.6
Mining products	24.5	22.5	2.2
Manufacturing products	27.7	67.5	88.9
Total	100.0	100.0	100.0

Source: Song, B. (2009)

From 1961 to 1973, Korea's exports boosted its share of world exports from zero to about 0.5%.

- Exports increased from 0.2 billion dollars in 1965 to 0.8 in 1970 and 17.5 billion dollars in 1980: 34.7% annual growth rate between 1965 and 1980.
- The growth of trade fuelled output growth at an average annual rate of 9%. The contribution of exports to GDP growth was 59 percent in 1975.

II. 1. Export Promotion Policy

▷ 1960s : Export-Driven Industrial Development Policy

Stage of Development	Policy Guideline	Key Industry
The formative stage of the foundation for industrial development	▪ Government-led export policy with a focus on light industries ▪ Expansion of SOC	▪ Textiles ▪ Wigs, Plywood ▪ Shoes ▪ Cements, steel, machinery

Location Policy	Applicable Laws	Remarks
▪ Planned location development program ▪ Locations for export-centered light industries	▪ Comprehensive national land development plan ▪ **The Act on Development of Export Industrial Parks** ▪ **The Textile/Machinery/ Shipbuilding Industry Promotion Act(1967)** ▪ **The Electronics Industry Promotion Act(1969)**	**Development of Export Industrial Parks** Development of Ulsan Industrial Complex

Source: Korea Industrial Park Corp., 2009. Revised by Kim (2014)

II. 2. Targeted Heavy and Chemical Industries (HCI)

1. Industrial Targeting Policy

Importance of "Sequencing" in the Process of Industrialization

- Labor intensive industries, which had fully developed during the first stage of industrialization, started to demand materials produced by heavy and chemical industries.
- Apparel and textile for petrochemicals, electronic appliances for steel and nonferrous metals, and all light industries for industrial machinery, etc.

2. Selective Interventions Favoring HCI

Government policy targeted heavy and chemical industries (HCI): iron and steel, metal product, machinery, electronics, ship-building, and chemicals.

- Special laws to promote the targeted industries provided them with extensive benefits.
- The key element of the program was to provide credit to the favored industries.
- In addition, targeted industries were granted preferential tax treatment through investment tax credits and accelerated depreciation.
- State-owned enterprises were also established in steel and petro-chemicals.
- Increased import protection was granted to heavy and chemical industries.

3. Mobilization of Investment Funds

Policy loans and the government's role for investments

- Credit allocation by the government through the banking system was the most powerful means of supporting selected industries.
- Banks, practically owned by the government, were directed to allocate loans to targeted industries on a preferential basis.
- During the latter half of the 1970s, the share of policy loans in domestic credit rose steadily from 40 percent to over 50 percent.

Regulated and Market Interest Rates(%)

Year \ Rates	General bank loan rate	Curb rate	Average borrowing cost(manufacturing)	Consumer price inflation
1970	24.0	49.8	14.7	15.4
1975	15.5	41.3	11.3	25.4
1980	23.4	44.9	18.7	28.7
1985	11.5	24.0	13.4	2.5
1990	11.5	18.7	NA	8.6

(source: Bank of Korea)

II. 2. Targeted Heavy and Chemical Industries (HCI)

1970s : Fostering of Heavy and Chemical Industries

Stage of Development	Policy Guideline	Key Industry
The stage of expansion of the foundation for heavy and chemical industries	▪ Government-led heavy and chemical promotion policy	▪ Petrochemical, steel, motors and machinery industries

Location Policy	Applicable Laws	Remarks
▪ **Development of large-scale industrial parks as heavy and chemical industrial parks** ▪ Controlled development of the Seoul Metropolitan Area	▪ The Local Industry Development Act ▪ **The Industrial Complex Development Promotion Act** ▪ The Distribution of Industry Act	Local Industrial Development Promotion Zones Southeastern Large-Scale Industrial Complex **Development of Free Export Zone**

Source: Korea Industrial Park Corp., 2009. Revised by Kim (2014)

II. 3. Strategies for Technology Development

1. General Trading Companies (GTC)

- **Contribution made by GTCs to export promotion and industrial development**
  - **Played a leading role in exports and especially contributed to the exports of heavy and chemical industries.**
  - **Developed new markets through completing requirements in the number of overseas branches and target countries for exports.**
  - **Contributed in improving the information and technologies of domestic companies and training professional manpower .**

2. Technological Development

- **Strategies for technological development related to industrial development**
  - **In 1960s, there were industrial bases for absorbing "imported technologies"**
  - **In 1970s, strategies for developing heavy & chemical industries demanded new technologies**
  - **Many public research centers such as KIST were established for developing newly demanded industrial technologies**

II. 4. SME Development

Growth of SMEs

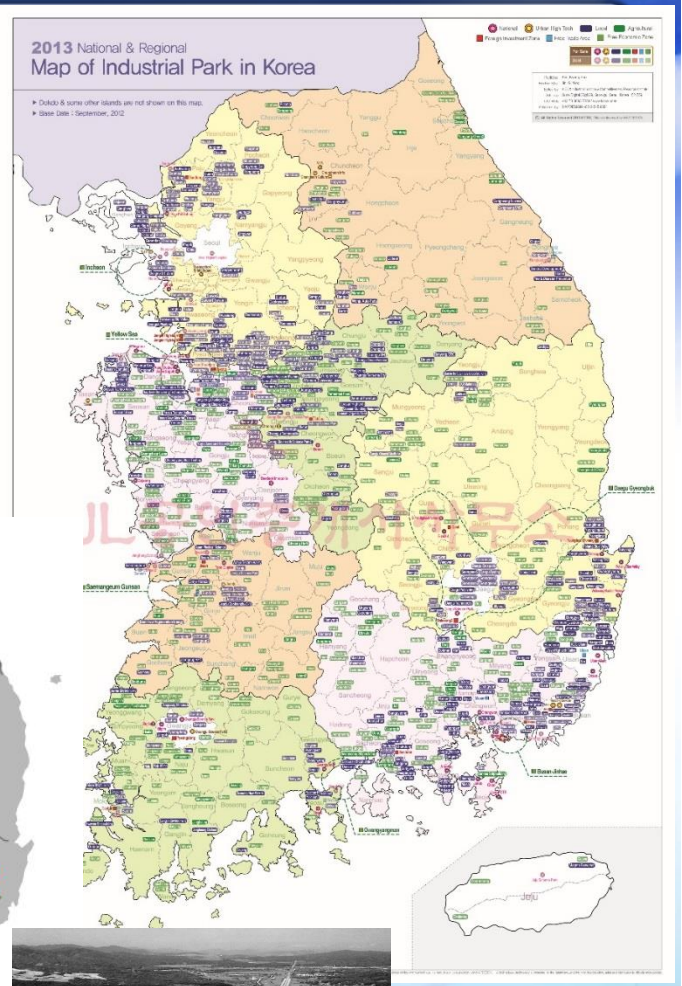
- **The government was pursuing large enterprise-oriented industrial development to achieve rapid economic growth in the 1960s.**
  - **Subsequently, a major mistake made by the government was neglecting to encourage balanced growth between large firms and small firms.**
- **The total number of businesses in the manufacturing sector increased by 1.36 times from 1963 to 1973.**
  - **The number of large companies rose by 4.34 times, while that of SMEs grew by just 1.32 times.**

Policies for Korean SMEs

- **The government established an "SME Department" inside the Ministry of Commerce in 1968 to go ahead with SME policies more efficiently.**
  - **The "Industrial Bank of Korea (IB)" established in 1961 as a bank for SMEs.**
  - **The Korea Trade Investment Promotion Agency (KOTRA) in 1962, which dedicated to exploring overseas markets and supporting the exports activities of SMEs.**

II. 4. Korean Industrial Complexes

- **1st Generation Industrial Clusters in Korea : Industrial Complexes**
  - Korea Industrial Complex Corp. (KICOX) is an industrial complex management and supervision agency which was established in 1964 after integrating five regional industrial complex management corporations.



- **The 426-Kilometer Gyeonbu Expressway from Seoul to Busan to Seoul paved the way for the industrialization of Korea.**
  - Gyeonbu Expressway, constructed in 1970, was working as the corridor of the industrial complexes or industrial clusters, networking the industrial complexes.

Source : KICOX (www.kicox.or.kr)

II. 4. Korean Industrial Complexes (KIC)

1. Definition of KIC

- An industrial complex refers to a parcel of land, developed and managed to be used by industries according to a comprehensive plan established for an industrial location (KICOX, 2011).
- The applicable law defines an industrial complex as any plot of land to be designated and developed under a comprehensive plan to collectively install factories

2. Establishment of Industrial Complexes

- **What has been provided in industrial complexes?**
  - Land provided by the Ministry of Construction and Transportation(MOCT) or public utility corporations (LH Corporation).
  - Access roads, industrial water supply, electricity, communication system, pollution control, land scraping and other facilities(e.g. schools, housing, recreation, medical centers) provided by MOCT and/or public utility corporations such as Korea Land Development Corporation, Water Resource Development Corporation, and Agriculture Promotion Corporation
  - Financial support by central (MOTIE) or local governments and managed by Korea Industrial Complex Corporation (KICOX)

II. 4. Korean Industrial Complexes (KIC)

3. Types of KIC

- **Korea is mainly classifying its industrial complexes into National Industrial Complexes, Local Industrial Complexes, Urban High-Tech Industrial Complexes and Agricultural Industrial Complexes based on the Industrial Sites and Development Act.**
  - **In addition, as industrial complexes for attracting foreign investment, there are functionally the Free Trade Zone intended to induce free customs clearance of commodities and goods, supplementing the logistic function of a foreign investment district for industrial complexes; and the Free Economic Zone.**

Type	Designation Authority Holder	Purpose of Designation	Target Region
Free Trade Zone	Minister of Trade, Industry and Energy (MOTIE)	Attract foreign investment, promote trade and promote local development	A region surrounding a harbor, an airport and an existing industrial park
Foreign Investment Zone	Mayors and governors of provinces	Promote attraction of foreign investment	An industrial park and a region where foreign investors wish to invest
Free Economic Zone	Minister of Trade, Industry and Energy (MOTIE)	Improve business and living conditions for foreign investors	A region having a high possibility of foreign investment and settlement of foreigners
Industrial Technology Park	Minister of Trade, Industry and Energy (MOTIE)	Joint technology development and activation of local economies through clustering industry, academy and institute	A region having a high possibility of clustering and connection of industry, university and institute

Source: KICOX (2011)

II. 4. Korean Industrial Complexes (KIC)

Government Subsidization for KIC

- Construction expenses for main roads and green facilities in an industrial complex;
- Construction expenses for water supply facilities, sewerage, and waste water terminal treatment facilities;
- Expenses for relocation projects;
- Land purchase expenses for an industrial complex developed for the purpose of leasing land, facilities, etc. and construction expenses for parks and common ditches;
- Land purchase expenses for construction of apartment-type factories (urban factories) ;
- Site development expenses for creation of agricultural and industrial complexes, infrastructure facilities expenses and land purchase expenses for access roads, electric power, communications facilities, etc. ;
- Expenses for research on cultural properties.;
- Areas deemed especially necessary for development of a backward area; and
- Instances when a project operator wishes to lease land within an industrial complex which is neither exploited nor parceled out

II. 4. Korean Industrial Complexes (KIC)

Industrial Complex Development Process

Development: "Industrial Site and Development Act"

- This act defines the general procedures related to designation and development of industrial parks.
- Central administrative agency : Ministry of Land, Infrastructure and Transport(MOLIT) , Korea Land and Housing Corporation(LH)

Procedures of KIC Development

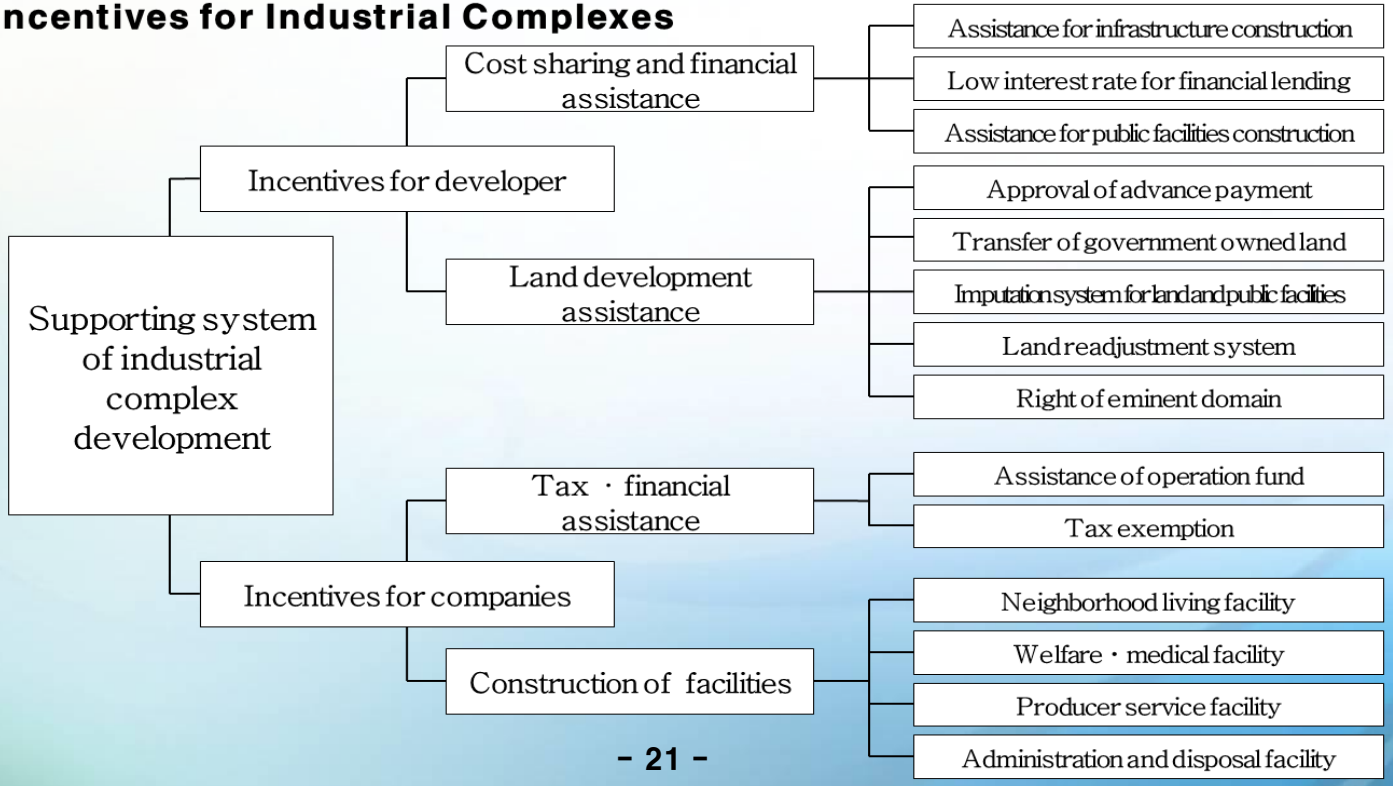
- Land development : To arrange lands for enterprises and those for supporting facilities to enhance efficiency and functions of the industrial complex.
- Construction of infrastructure : To supply of the infrastructure required for an industrial park, which includes water supply, electricity, energy, transportation, sewage and waste treatment, prevention of environment pollution

Procedures of Industrial Complex Development

II. 4. Korean Industrial Complexes (KIC)

- When an industrial complex is developed, various benefits are provided by the government as development of an industrial complex creates significant ripple effects in regional economy.
  - The support system for developers is intended to partially support development cost of IC and to apply relevant laws and systems to enable easy acquisition of land for development of IC.
  - The support system for resident enterprises includes tax benefits at the time of land acquisition and low-interest loan arrangement for land purchase.

Incentives for Industrial Complexes



II. 4. Korean Industrial Complexes (KIC)

Management of KIC

- Management: "Industrial Cluster Development and Factory Establishment Act"
  - The purpose of this act is to contribute to sustained industrial development and balanced regional development by developing industrial clusters, supporting establishment of factories and systematical managing industrial complexes, promoting export .
  - Central administrative agency : Ministry of Industry, Trade and Energy(MOTIE), Korea Industrial Complex Corporation(KICOX)

Points of the industrial complex management

- Efficiency of land use(Zoning): The industrial complex needs to be managed where its uses of land must be Characteristics of public goods: separated from that of residential and commercial areas.
- To enhance competitiveness of tenant firms, the government needs investment on industrial infrastructure so that industrial complexes can lower its rents in relative to market price.
- Regulation of permitted industries(targeting industries): Select permitted industries(targeting industries) and only permitted industries to reside in the industrial complexes
  - A tenant firm needs to sell the land to another firm that is also specialized in permitted industries.

II. 4. Korean Industrial Complexes (KIC)

Management of Industrial Complex

- **The supporting services, which is a new paradigm of management, include not only diverse supporting services for businesses but also facilitation of industry-academia cooperation to lead the tech innovation of the complex.**

Incentives for Resident Enterprises

- **Reduction or Exemption of Taxes**
  - 100% exemption of registration tax and acquisition tax, and 50% reduction of property tax
- **Financial Assistance**
  - Agricultural Industrial Parks : Subsidization of the capital expenditure and the operating expenses of resident enterprise
  - Urban high-tech industrial parks : Low-interest financing for the projects of resident enterprises
- **Support of Welfare Facilities**
  - A management agency may operate support services such as improvement of energy efficiency, promotion of labor relations and vocational training.
  - A lot of welfare facilities are installed and managed by the agency

II. 4. Korean Industrial Complexes(KIC)

- **Industrial complexes were established to locate targeted industries, which were the foundation of Korean Industrialization.**
  - **The first industrial complex was established in Ulsan city in 1962, famous for a heavy and chemical industry(HCI) complex.**
  - **There were 915 industrial complexes established in 2010 as Korean industrial clusters.**

Industrial Complexes in Korea, 1960-2010

Types of Industrial Complex	Level of government responsible	1960s	1970s	1980s	1990s	2000	2010
National industrial Complex	Central Government	2	17	10	7	4	40
General industrial Complex	Local Government	9	18	13	111	296	447
Urban high-tech Complex	Central Government	-	-	-	-	6	6
Agricultural and Industrial Complex	Central Government	-	-	168	126	128	422
Total		11	35	191	244	434	915

Source: Outlook of Industrial complexes in Korea, KICOX (December, 2010)

II. 5. Case Study: Ulsan Industrial Complex 1

Ulsan National Industrial Complex in the 1960s and 1970s

[Ulsan National Industrial Park in the 1970s]

- At the early stage of industrial complex construction in 1962, Ulsan City was just a small fishing village where the number of primary industry workers was 23,482, 71.4% of the total employees (KICOX, 2011).
- Ulsan Industrial Complex was developed with the area of 46.1km^2 in accordance with the First Five-year Economic Development Plan for Economic Growth initiated by the government in 1962, for development of the nation's key industries including fertilizers, oil refining and chemical industries, as well as the strategy to foster export industries.
  - In 1964, development of relevant industries was started or completed at point of the completion of the Ulsan Refinery Factory.
  - After refinery and fertilizer factories were settled in the center first, relevant petrochemical factories were clustered and completed in 1969 in accordance with the Petrochemical Industry Development Plan adopted in 1966.

II. 5. Case Study: Ulsan Industrial Complex 1

Characteristics of Ulsan Industrial Complex

- Ulsan had the ideal conditions for industrial location in terms of transportation and logistics.
  - Ulsan was located not only at the center of Southeast, the largest domestic market, but also at a transportation point equipped with both marine and inland transportations.
- Ulsan emerged as the nation's largest heavy and chemical industrial complex and is still considered as "the Industrial Capital of Korea. “
  - Thanks to the success of the relevant petrochemical industries, the motor, shipbuilding, aluminum and machinery industries and relevant parts factories gathered at the complex.
  - When Hyundai Motor Company started operation of its factory at the Complex in November, 1968 and Hyundai Ulsan Shipyard was completed in March, 1972.
- Since 1970s, production capacity of Ulsan Industrial Complex has shown a rapid growth

Items	1963	1980
Number of Resident Enterprises	23	154
Production (KRW 100 million)	7.3	43,298
Export (USD 1 million)	0.3	1,699
Number of Employees	1,236	67,587

Source: KICOX, 2012

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Industrial Clusters:
Creative Imitation Phase (1980~1997)

III.1. Evolution of Korean Industry Policy

- **Adjustment of Intervention Failure: 1980-85**
- **From Sectoral Measures to More Functional Policies**
  - During 1985-1992, the Korean government shifted its industrial policy direction to horizontal policies such as support of R&D.
- **Contributions Made by GTCs(General Trading Companies) to Export Promotion and Industrial Development**
- **Liberalizing the financial sector and privatizing commercial banks**
  - Entry barriers to non-bank financial institutions were also liberalized
  - Preferential credit and tax concessions were reduced, and price control regulations were replaced in 1981 by the Fair Trade Act to promote competition.
- **Progress in reducing government intervention in the economy continued**
  - The number of industries where foreign direct investment was prohibited declined significantly.
  - The average tariff rate fell from 21% in 1984 to 6% in 1996.
- **In 1993, the practice of the five year economic planning was abolished, which had been introduced in 1962**

III.1. Evolution of Korean Industry Policy

- **Foreign Investment Policy changed in Korea: In the first stage, industrial development and export support policy were not open to foreign investors, and investment attractiveness was relatively low until 1980**
  - **Upon entering the 1990s, at the second stage, the global flow opening took place gradually in the investment sector.**

Stages Years	First Stage (1962~1983)	Second Stage (1984~1989)	Third Stage (1990~1997)	Fourth Stage (after 1998)
Policy Goal	Foreign Investment Restriction	Foreign Investment Foundation	Foreign Investment Liberalization	Foreign Investment Promotion
Policy Measures	- Priority to attract foreign investment by foreign loans	- Switch from the negative to positive - Abolish the restriction of holding 50% of rest ricted sector	- Foreign Investment Report (1991) - Permit exception of foreign investment sector (1992) - Foreign Investment five year plan(1993) - Combined civil complain investigation system(1995) - Favorable M&A allowed (1997)	- Foreign Investment Restrictions sector further opening(1998) - Allowing Foreign Investors' M&A of Domestic Companies (1998) - Foreign exchange liberalization(1998) - Foreigner Land Acquisition allowed (1998) - Foreign Investment Promotion Act (1998) - Regulatory and 4 sector reform

Source : Choo et.al (2012)

III.1. Evolution of Korean Industry Policy

1980s : Balanced National Development

Stage of Development	Policy Guideline	Key Industry
The stage of adjustment of industrial structure	▪ **Industrial rationalization of heavy and chemical industries** ▪ Development of tech-intensive industries into export industries	▪ Semiconductors, electronics and motors

Location Policy	Applicable Laws	Remarks
▪ Improvement of internal stability of industrial parks ▪ **Development of industrial parks in the under-developed regions** ▪ **Development of Agricultural & Industrial Parks**	▪ The Seoul Metropolitan Area Planning Act ▪ The Small and Medium-Sized Enterprises Promotion Act ▪ The Agricultural and Fishery Income Development Promotion Act ▪ **The Industry Development Act(1986)**	**Southwestern Large-Scale Industrial Complex** Development of Agricultural & Industrial Parks

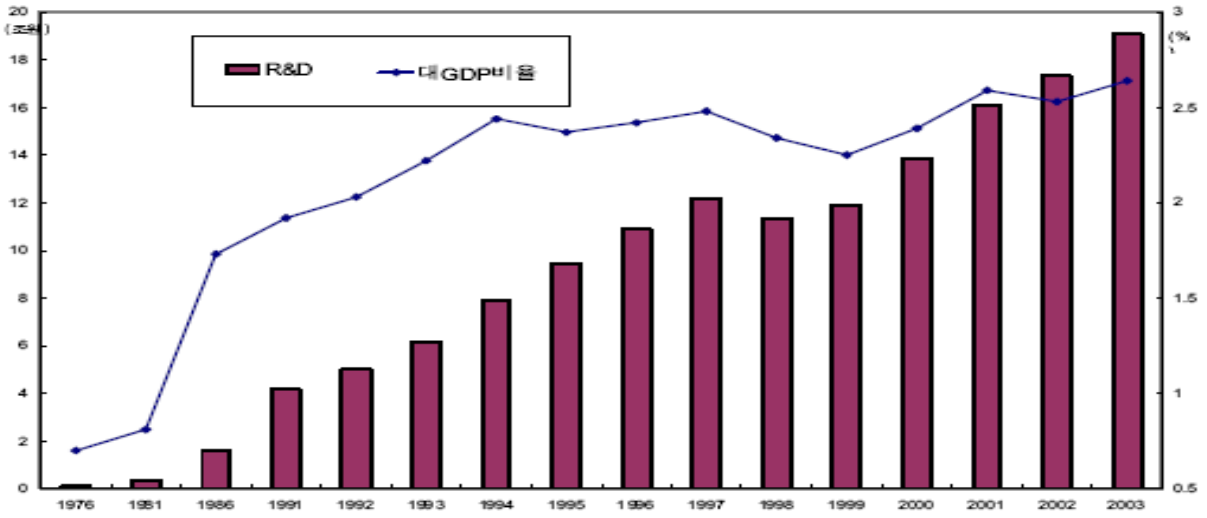
Source: Korea Industrial Park Corp., 2009. Revised by Kim (2014)

III. 2. Shift from Export Promotion to R&D

Technology Development

- **In 1980s, aimed at technology catch-up**
  - Support to R&D activities by private-sector started
  - Project for developing basic industrial technologies launched (1987)
- **Private-sector investment for R&D increased substantially**
  - private vs. public, 36:64 in 1980 → 81:19 in 1990
  - private R&D centers: 53 in 1980 → 824 in 1989

Soaring R&D Expenditures and GDP Ratio



Source: Song, B. (2009)

III. 2. Shift from Export Promotion to R&D

Technology-driven Policy

- **Changes in Targeted Industries**
  - to capital- intensive and to technology-intensive (automobile, semiconductor).
- **Changes in Trade Environments**
  - IPR protection emerged as a major issue under WTO (joining in 1995)
- **Extraordinary meetings for R&D promotion (1982-87)**
  - Regularly convened and presided by the president
  - Participated by ministers, businessmen, and scientists

Korean R&D Process

- **Usual Process of Technology Development (or R&D) in Advanced Countries**
  - Universities → Private enterprises by establishing research centers based on their own industrial needs → Public research centers
- **Korean Style**
  - Initially led by public research centers up to the 1970s
  - R&D efforts by private enterprises promoted by government assistance since the 1980s
  - R&D efforts in universities have been emphasized and assisted by the government since the 1990s

III. 2. Shift from Export Promotion to R&D

1990s : Advancement of Industrial Structure

Stage of Development	Policy Guideline	Key Industry
The stage of acceleration of industrial development	▪ Opening and the private-led economic operation(the first half) ▪ Industrial restructuring under IMF guideline(the second half)	▪ Promotion of the software industry with a focus on services ▪ Development of semiconductors, precision chemistry and automation program

Location Policy	Applicable Laws	Remarks
▪ **Diversification of types of locations** ▪ **Eased regulations on locations** ▪ Renaming of industrial parks ▪ Streamlining of development procedures	▪ **The Industrial Location Act** ▪ The Distribution of Industry Act ▪ The revised National Land Utilization Control Act ▪ The Act on Special Cases of Industrial and Technical Complex Support	Increase of location of individual businesses **Development of Techno Parks** **Construction of Apartment-type factory buildings**

Source: Korea Industrial Park Corp., 2009. Revised by Kim (2014)

III. 3. SME Development

Growth of SMEs

- **SMEs played their role in providing parts and materials consumed in the heavy and chemical industries, replacing imported parts and materials.**
  - SMEs were able to grow rapidly through active start-ups, facility investment, and improved structures because the Korean government started actively promoting policies to nurture SMEs.
- **The total number of businesses in the manufacturing sector increased by 2.89 times from 1977 to 1991(47,256 firms)**
  - The number of SMEs rose by 2.97 times, while that of large companies grew by just 1.08 times (79 firms).
  - The number of employees in SMEs rose by 2.45 times, while that of large firms grew by just 1.11 times from 1977 to 1991, contributing to job creation.
- **The government established the "Fund for SME Multi-aid Projects" in 1982 to prevent bankruptcy and promote mutual SME businesses.**
- **The government raised the mandatory ratio of loans extended to SMEs in 1992, from 35% to 40% for commercial banks .**
  - The government opened the KOSDAQ, a stock market dedicated to SMEs and venture companies in 1996 to mobilized funds directly.

III. 4. Industrial Clusters

- **2nd Generation Industrial Clusters in Korea : R&D Special Zones**
  - Established as science park in 1974, turned into R&D special zones in 2005 and expanded in 2011 and 2012
  - Innovation clusters with research institutes, universities & enterprises
  - Establishing trilateral collaboration networks and Enhancing technology transfer
  - Bridging National Innovation System(NIS) and Regional Innovation System(RIS) by hub and spoke

<Statistics of R&D Special Zone of 2012>

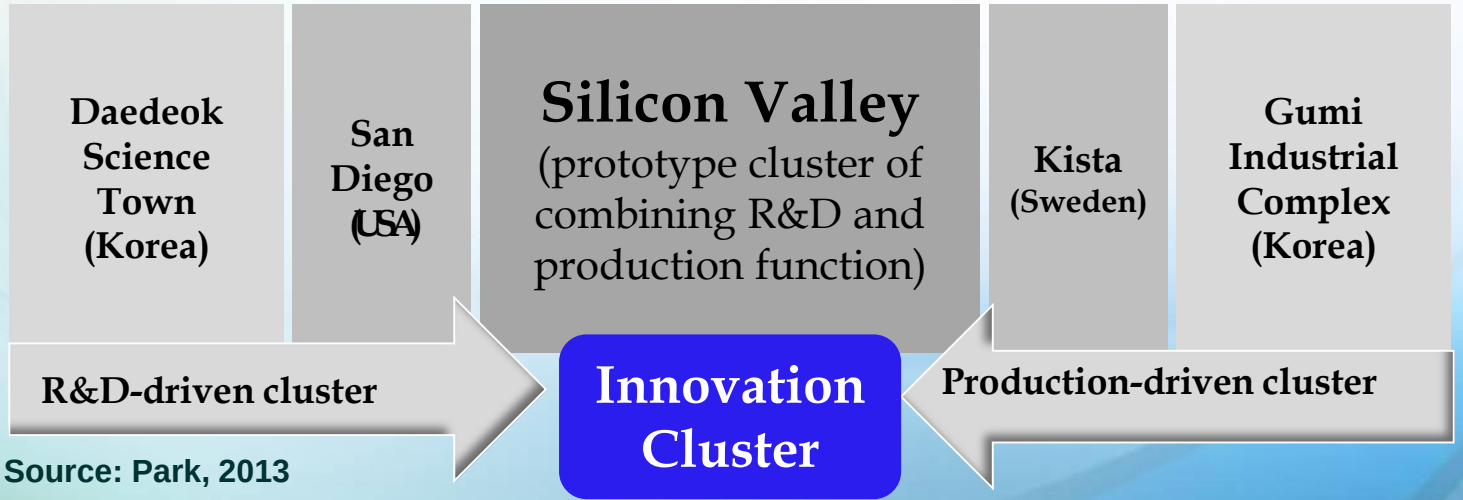
R&D Special Zone	Institutes & Universities	Industry	Products (million $)	R&D exp (million $)	Employees	Area (km^2)
Daedeok	89	IT, Biomedical	16,698	6,652	64,321	66.8
Gwangju	46	Photonics, Bio	8,208	473	19,748	18.7
Daegu	29	Green energy	4,320	566	28,817	22.3
Busan	16	Ocean plant	3,898	388	21,316	14.1
Total	180		33,124	8,079	134,202	121.9

Source : Innopolis (www.innopolis.kr)

III. 4. Industrial Clusters

Cluster Policies in Korea

- **Most of Korean industrial clusters are a production-driven cluster type in the 1980s and 1990s.**
  - The Korea government intended to attract research institutes, supporting facilities and universities to the industrial complexes, build an organic network and improve the growth potentials(KICOX, 2011).
  - **In the 90s most of the support to industrial complexes shifted to R&D and innovation activities**, and investments were made to transform industrial complexes into knowledge-based centers, as in the case of the Seoul Digital Industrial Complex(OECD, 2012).
  - **2nd Generation Industrial Clusters in Korea : R&D Special Zones**

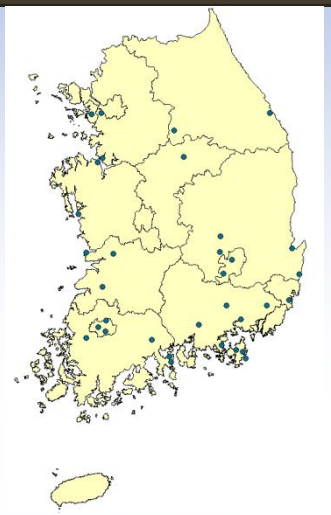


Source: Park, 2013

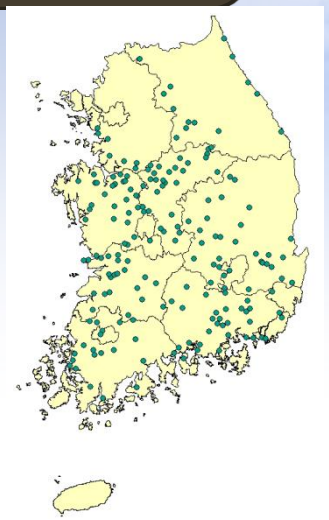
III. 4. Industrial Clusters

Korean Industrial Complexes from 1960s to 2010s

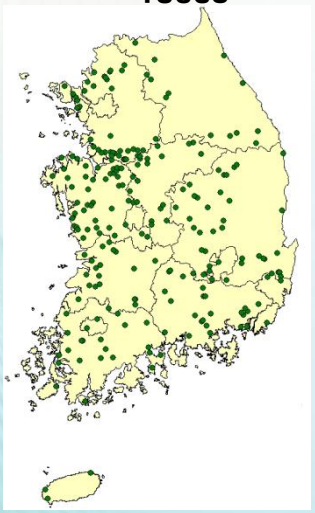
1960s



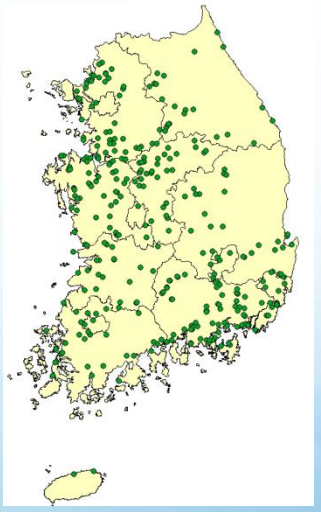
1970s



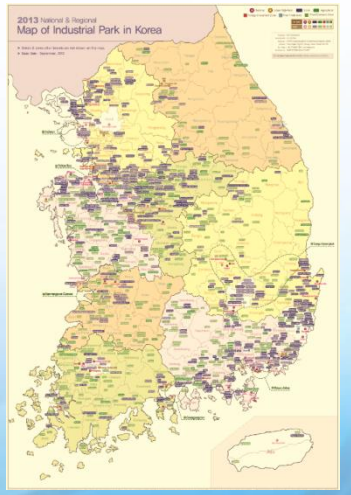
1980s



1990s



2000s

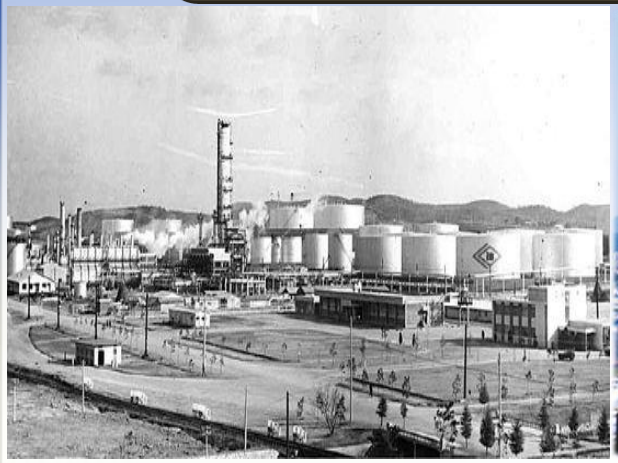


2010s

Source: MOTIE and KIAT, 2013

III. 5. Case Study: Ulsan Industrial Complex 2

Ulsan Industrial Complex in 1980s and 1990s



- At Ulsan Industrial Complex was developed into a cluster of petrochemical industries, and the Complex was further expanded to accommodate motor-related factories and parts factories.
- Later, the shipbuilding industry was developed and large enterprises operated related engine, steel, lumber and heavy electric equipment businesses at the Complex.
- In addition, Onsan Industrial Complex was developed adjacent to Ulsan Industrial Complex, accommodating oil refinery and non-ferrous metal processing factories.

<Operation Status of Ulsan National Industrial Complex>

Items	1980	2000	2009
Number of Resident Enterprises	154	488	806
Production (KRW 100 million)	43,298	458,270	976,562
Export (USD 1 million)	1,699	19,328	44,651
Number of Employees	67,587	87,529	88,278

Source: KICOX, 2011

III. 5. Case Study: Ulsan Industrial Complex 2

- As related industries created an industrial belt and the industries dramatically grew, the production volume of Ulsan Industrial Complex rapidly increased from KRW 0.73 billion of 1963 to KRW 98 trillion in 2009
  - Its exports also grew from USD 0.3 million of 1963 to USD 44.7 billion in 2009, recording the largest production and export volumes among Korea's industrial complexes.

Imports and exports

(unit : million $)

year	export			import		
	national	ulsan	%	national	ulsan	%
1992	76,632	9,137	11.92	81,775	11,893	14.54
1993	82,236	9,987	12.14	83,800	10,861	12.96
1994	96,013	11,417	11.89	102,348	13,205	12.90
1995	125,058	14,905	11.92	135,119	17,695	13.10
1996	129,715	16,079	12.40	150,339	20,001	13.30
1997	136,164	18,624	13.68	144,616	19,930	13.78
1998	132,313	17,289	13.07	93,282	13,336	14.30
1999	143,685	19,103	13.30	119,752	15,593	13.02
2000	172,268	19,972	11.59	160,481	14,268	8.89
2001	150,439	19,951	13.26	141,098	18,272	12.95
2002	162,471	24,177	14.88	152,126	18,943	12.45
2003	193,817	27,485	14.18	178,827	22,651	12.67

Source: KICOX, 2011

Ⅳ Innovation Clusters (Capability Building): Innovation Phase (1998~)

Ⅳ.1. Knowledge Based Economy

From Crisis to Recovery: 1998-present

- Due to the economic crisis, the Korean economy experienced a negative 5.8 percent growth in 1998.

- **Restructuring Initiated by Government**
  - In mid-1998, the government strongly persuaded the conglomerates ("*Chaebols*") into propelling business restructuring.

Knowledge Based Economy

- **Accelerated globalization and upgrading of industry**
  - Fortunately corporate restructuring has strengthened Korea's export competitiveness, with priority given to high value-added and capital goods industries.
  - To attract foreign investment and adopt a one-stop service for foreign investors
- In regards to long-term structural adjustments, the Korean government has planned to develop a knowledge-based economy.
  - The plan also emphasizes institution building for knowledge-intensive industries, such as standardization, intellectual property right protection.

Ⅳ.1. Knowledge Based Economy

Diversifying Exporting Industries, especially for ICT industries

Top 10 export items (%)

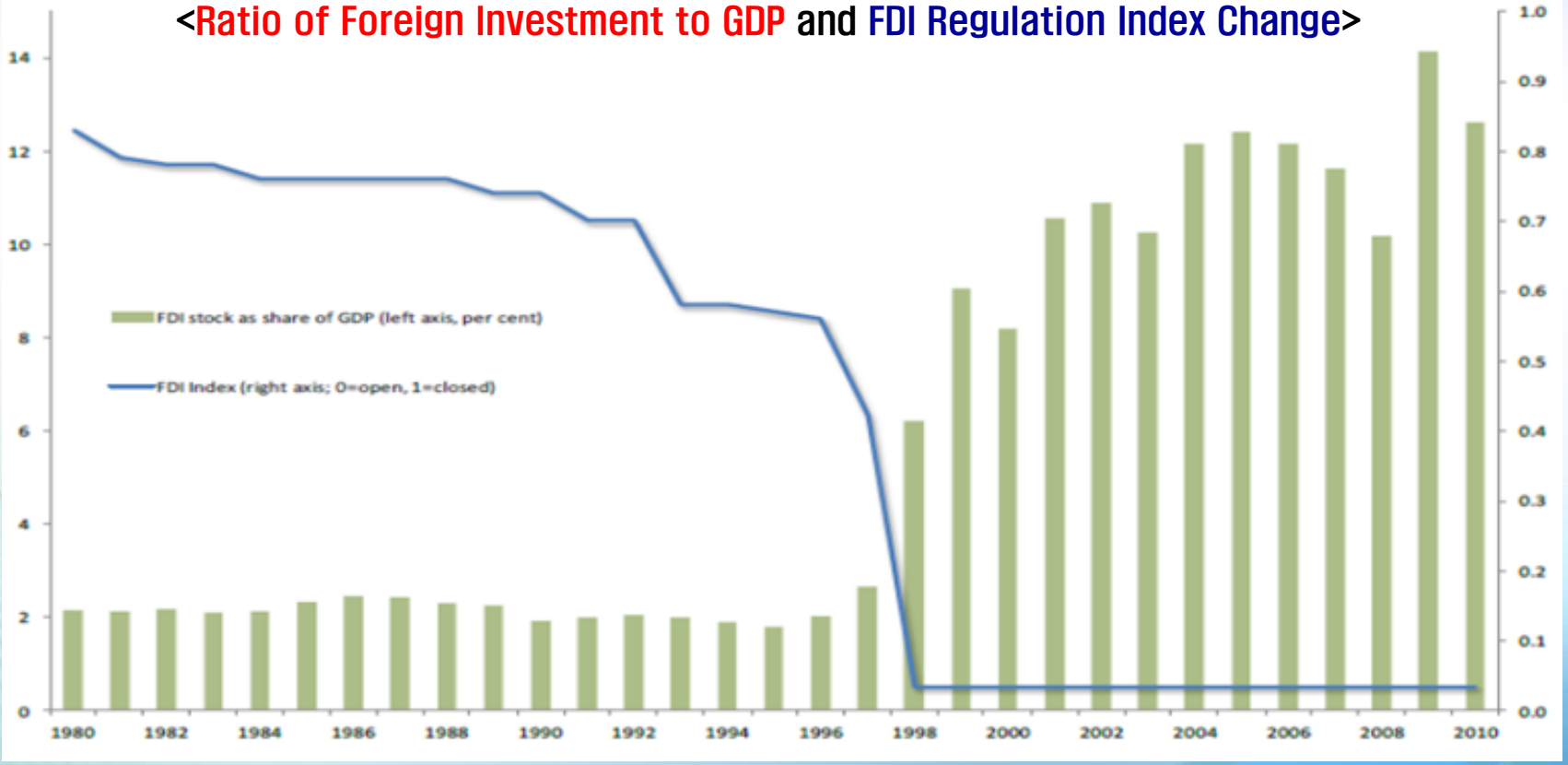
Rank	1970		1980		1990		2000		2010	
	Item	Share	Item	Share	Item	Share	Item	Share	Item	Share
1	Textiles	40.8	Garments	16.0	Garments	11.7	Semiconductor	15.1	Semiconductor	10.9
2	Plywood	11.0	Steel Plate-rolled Products	5.4	Semiconductor	7.0	Computer	8.5	Vessel	10.5
3	Wigs	10.8	Footwear	5.2	Footwear	6.6	Automobile	7.7	Automobile	7.6
4	Iron ores	5.9	Vessel	3.6	Video Apparatus	5.6	Petrochemical products	5.3	Flat Panel Display	7.0
5	Electronic goods	3.5	Audio Apparatus	3.4	Vessel	4.4	Vessel	4.9	Petrochemical products	6.8
6	Confectionery	2.3	Man made filament fabrics	3.2	Computer	3.9	Wireless telecom	4.6	Wireless telecom	5.9
7	Footwear	2.1	Rubber Products	2.9	Audio Apparatus	3.8	Synthetic Resin	2.9	Parts of Automobile	4.1
8	Tobaccos	1.6	Woods & Wood items	2.8	Steel Plate-rolled Products	3.8	Steel Plate-rolled Products	2.8	Plastics	3.7
9	Iron products	1.5	Video Apparatus	2.6	Man made filament fabrics	3.6	Garments	2.7	Iron & Steel Products	3.6
10	Metal products	1.5	Semiconductor	2.5	Automobile	3.0	Video Apparatus	2.1	Computer	2.0
Total		81.1		47.6		53.4		56.6		62.1

Source: KOTIS

Ⅳ.1. Knowledge Based Economy

- From its rapid liberalization since 1998, Korea's investment openness has been significantly increased and the amount of investment has also rapidly increased, resulting in an increased ratio of foreign investment to GDP from 6% in 1998 to 12% in 2010.

<Ratio of Foreign Investment to GDP and FDI Regulation Index Change>



Source: Nicolas, F., S. Thomsen and M. Bang (2013), OECD.

Ⅳ.1. Knowledge Based Economy

▷2000s : Diversification of Industrial Locations

Stage of Development	Policy Guideline	Key Industry
The stage of growth and expansion of industrial development	▪ Fostering of the knowledge-based industry and future industries ▪ Transformation into the innovation-led economy and the balanced development of various sectors	▪ ICT, ▪ Game industry ▪ Bio industries

Location Policy	Applicable Laws	Remarks
▪ **Specialized clusters** ▪ Support for the knowledge-based economy and clustering ▪ Improvement of competitiveness of exiting parks	▪ The revised Distribution of Industry Act ▪ The Cultural Industry Promotion Act ▪ The National Land Planning and Utilization Act(2002)	**Urban High-Tech Industrial Parks** Cultural Industrial Parks **Foreign Investment Zones** **High-Tech & Bio Park**

Source: Korea Industrial Park Corp., 2009. Revised by Kim (2014)

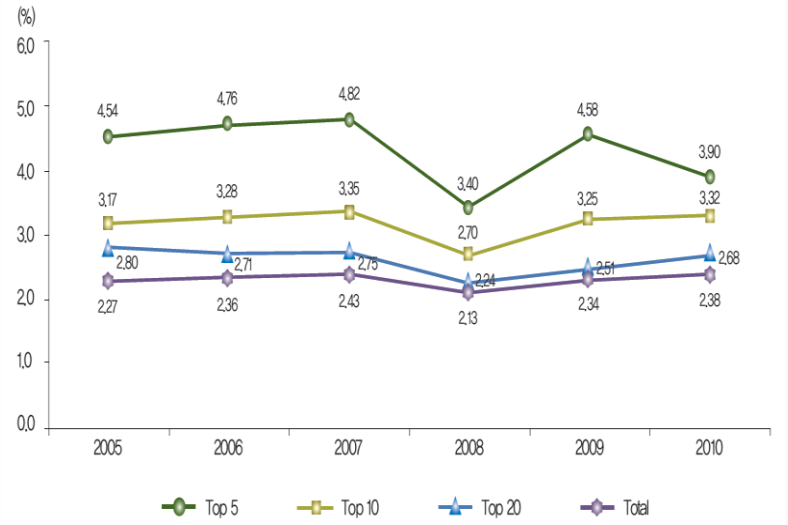
Ⅳ.2. Technology and Innovation Policy

- **Contribution of the government's innovation policy in the structural advancement of industry and the enhancement of technological innovation capacity**
  - Imitation, assimilation, absorption, improvement of advanced technology until the 1980s.
  - Strengthening of efforts to secure proprietary technology with focus on semiconductors, mobile phones, displays, etc. from the 1990s to the mid-2000s
  - Efforts to secure new growth engines in green industry, industry convergence, service R&D, etc. since 2008-current.
- **Technological innovation led by business enterprises and manufacturing industries**
  - In the early stages of industrialization, with government-funded support came the initiative for technological innovation as the private sector almost completely lacked the base for technological innovation.
  - Through the government's financial and tax support policies, innovation of infrastructure and buildings, etc. companies built up innovative capability and assumed responsibility in the cost and usage of R&D
  - However, the technological innovation activities of universities are relatively weak in comparison to government-funded or corporate activities.

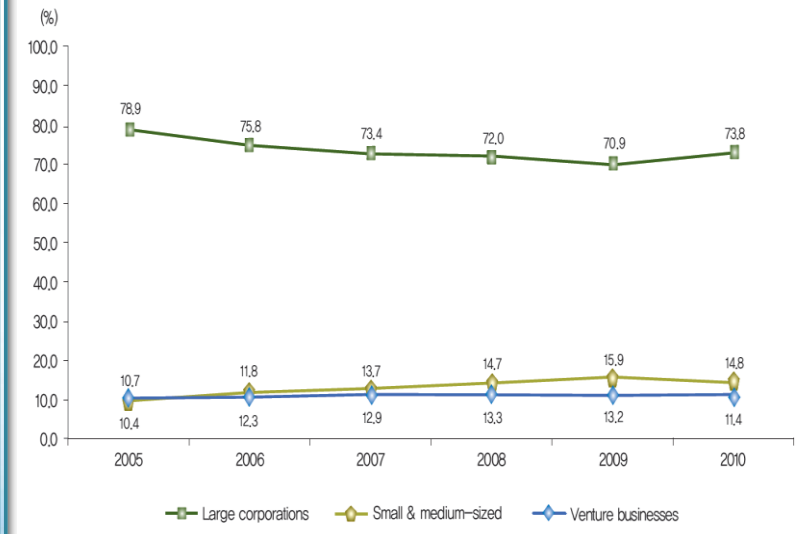
The R&D expenditure of companies focused on large companies

- Large corporations, especially top-sales companies are focused on the R&D expenditure rate due to industry imbalances that re-emerged in technological innovation activities that had previously appeared during the growth process of Korean industries

R&D expenditure rate to sales of the top sales companies(Korea)



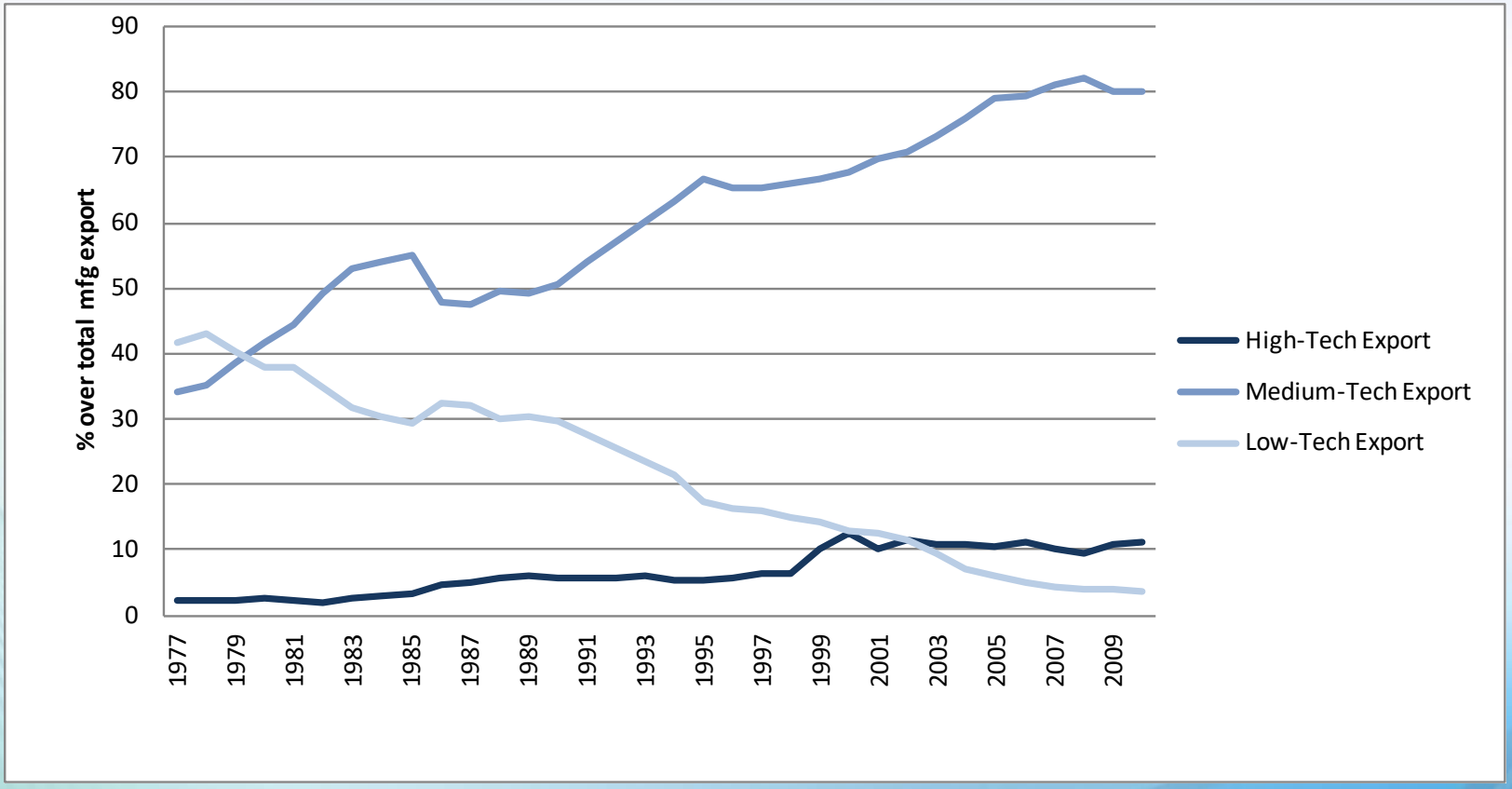
R&D expenditure rate by company type(Korea)



Source: National Science & Technology Commission

Exports by Technological Intensity (1970-2010)

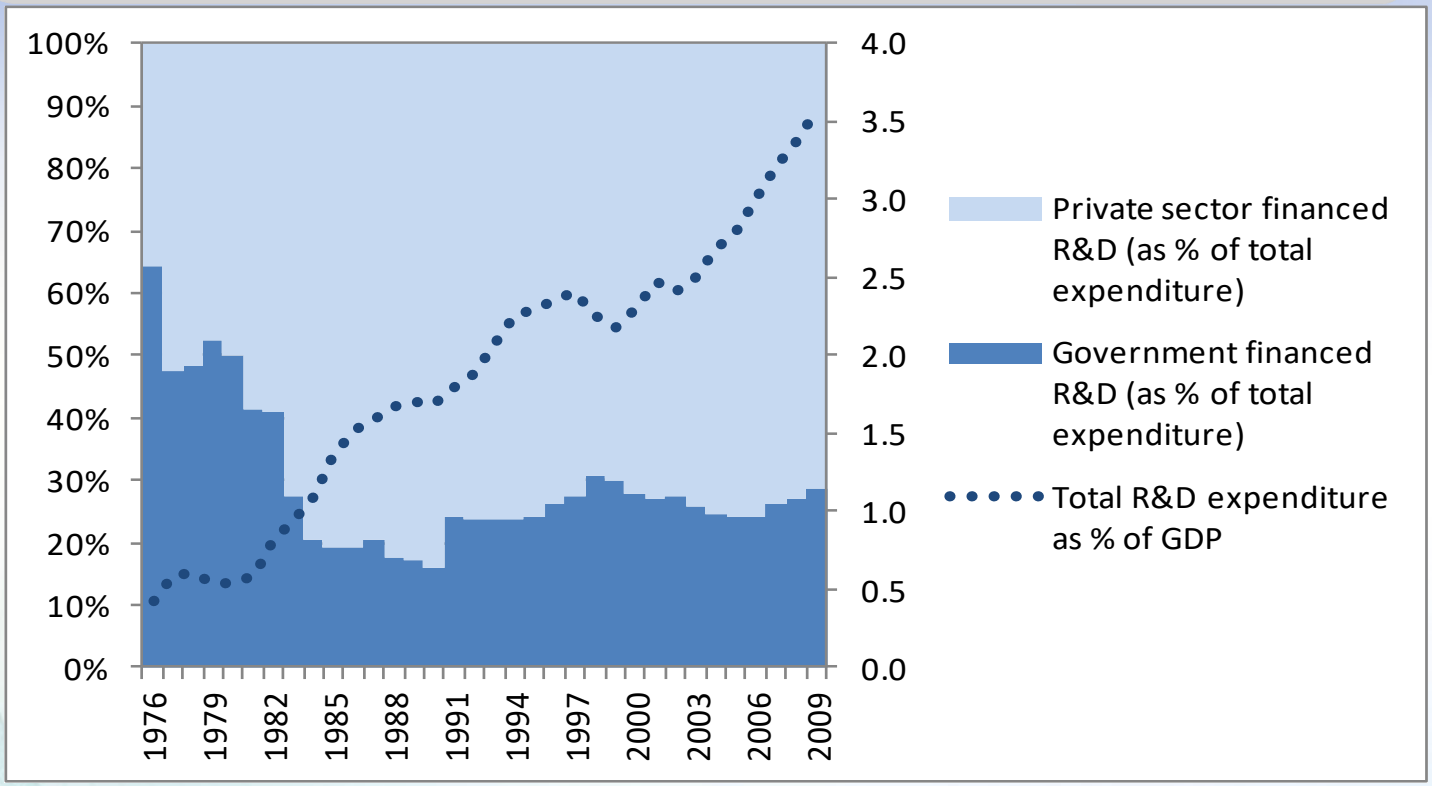
- The trend of Korean exports by degree of technological intensity shows the gradual exit of Korea from the low-technology export market and its entry into the medium and high-tech global export market.



Source: OECD (2012)

Ⅳ.2. Technology and Innovation Policy

Rising Commitment of R&D to GDP, Korea



source: OECD, 2011

IMD Statistics(2015)	Korea	China	Russia	Japan
R&D expenditure/GDP, Comparing to USA, %	147.7	74.0	40.2	123.5
Enterprise R&D expenditure/GDP, Comparing to USA, %	166.3	81.6	35.2	134.7

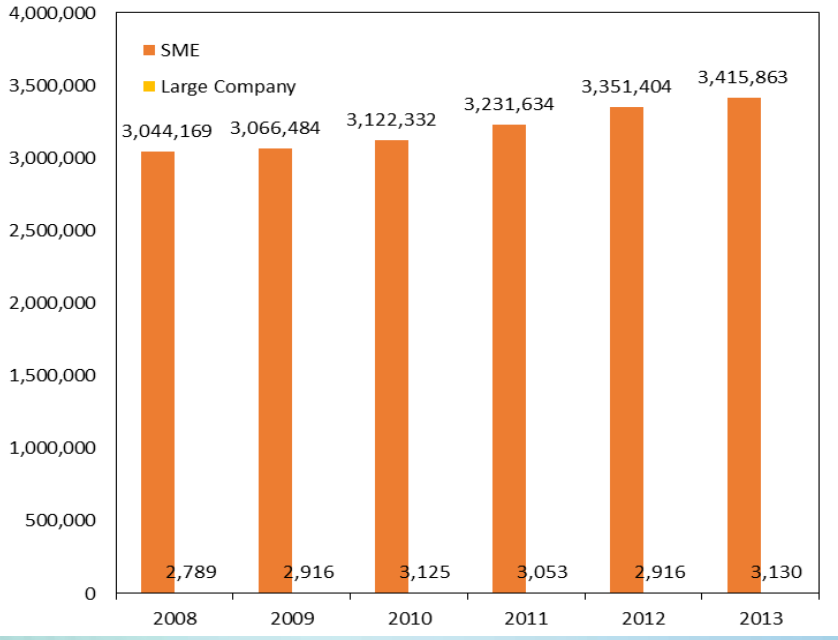
source: IMD, 2015

Ⅳ.3. SME Development

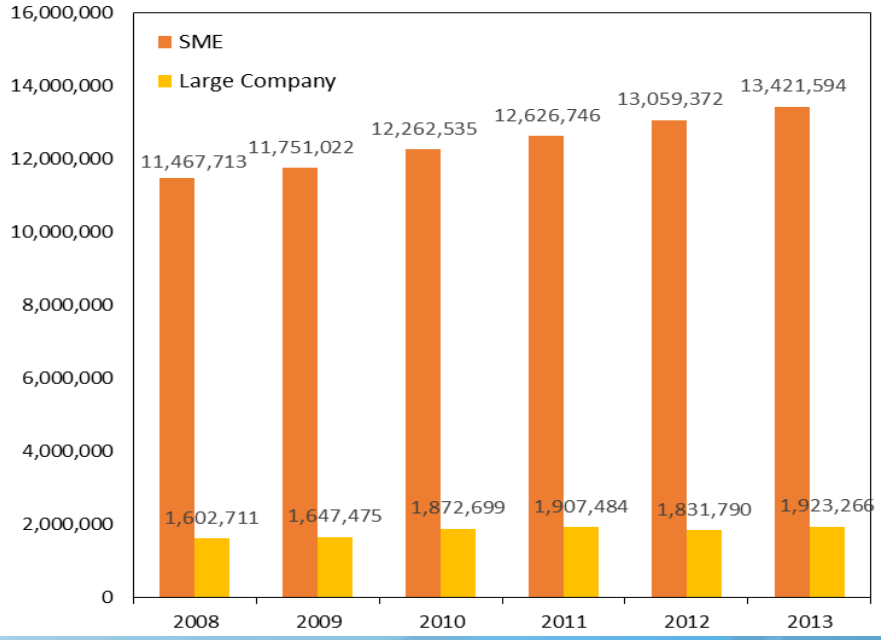
SMEs in Korea

- **As of 2013, there were 3,415,863 SMEs, and the number of employees numbered 13,421,594.**
  - **SMEs make up 99.9% of enterprises and 87.4% of total employment.**
- **Innovative SMEs and venture businesses emerged, and SMEs faced a transitional period with acceleration in the market opening.**
  - **The number of SMEs rose by 1.67 times.**

No. of Enterprises by the Entire Industries



No. of Employees by the Entire Industries

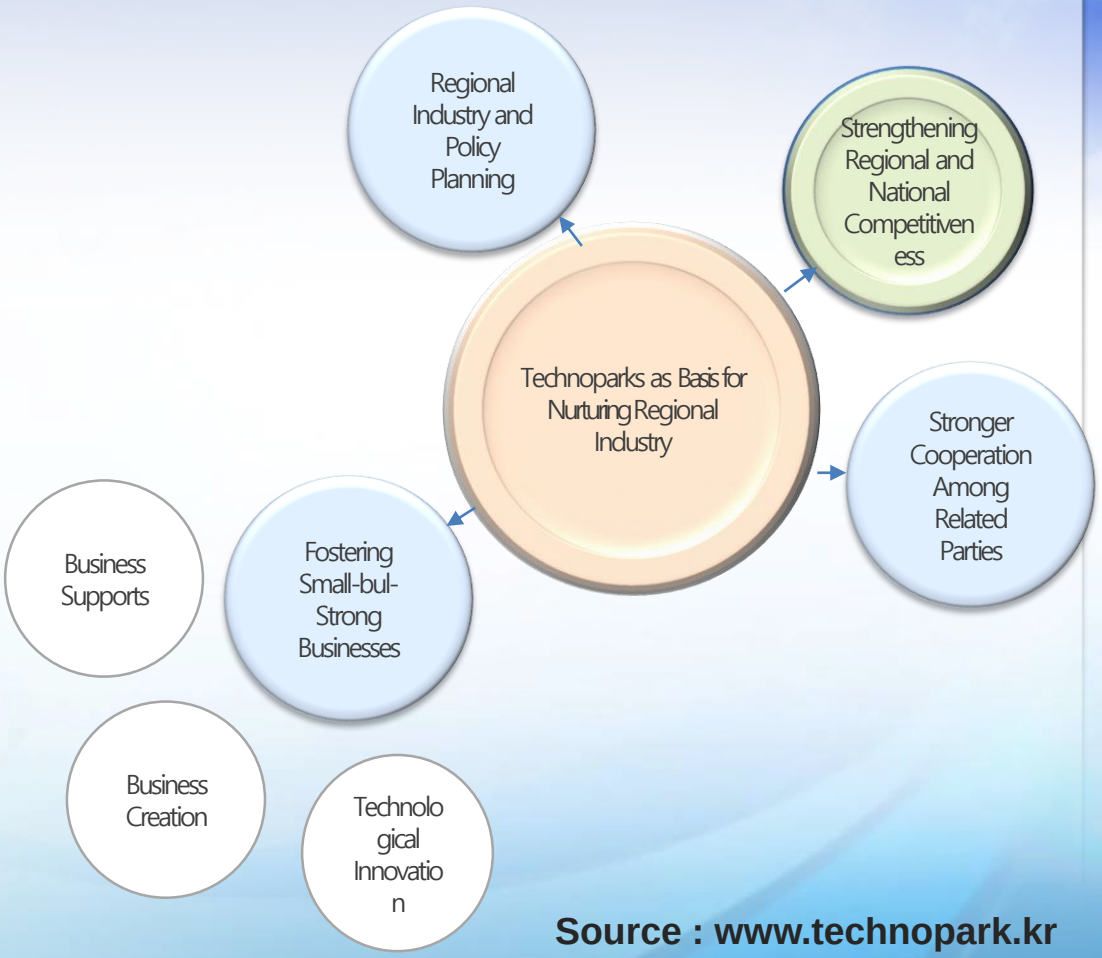


Source: SMBA Korea Web site (2015)

Ⅳ.4. Innovation Clusters

3rd Generation Industrial Clusters in Korea : Technoparks

- Has been established since 1999 to nurture local industries by forming an organic cooperative networks
- Creating strategies and plans that fit the regions circumstances and characteristics and by discovering knowledge-based and small-but-technologically-capable businesses
- Operated by both central government and local governments



Source : www.technopark.kr

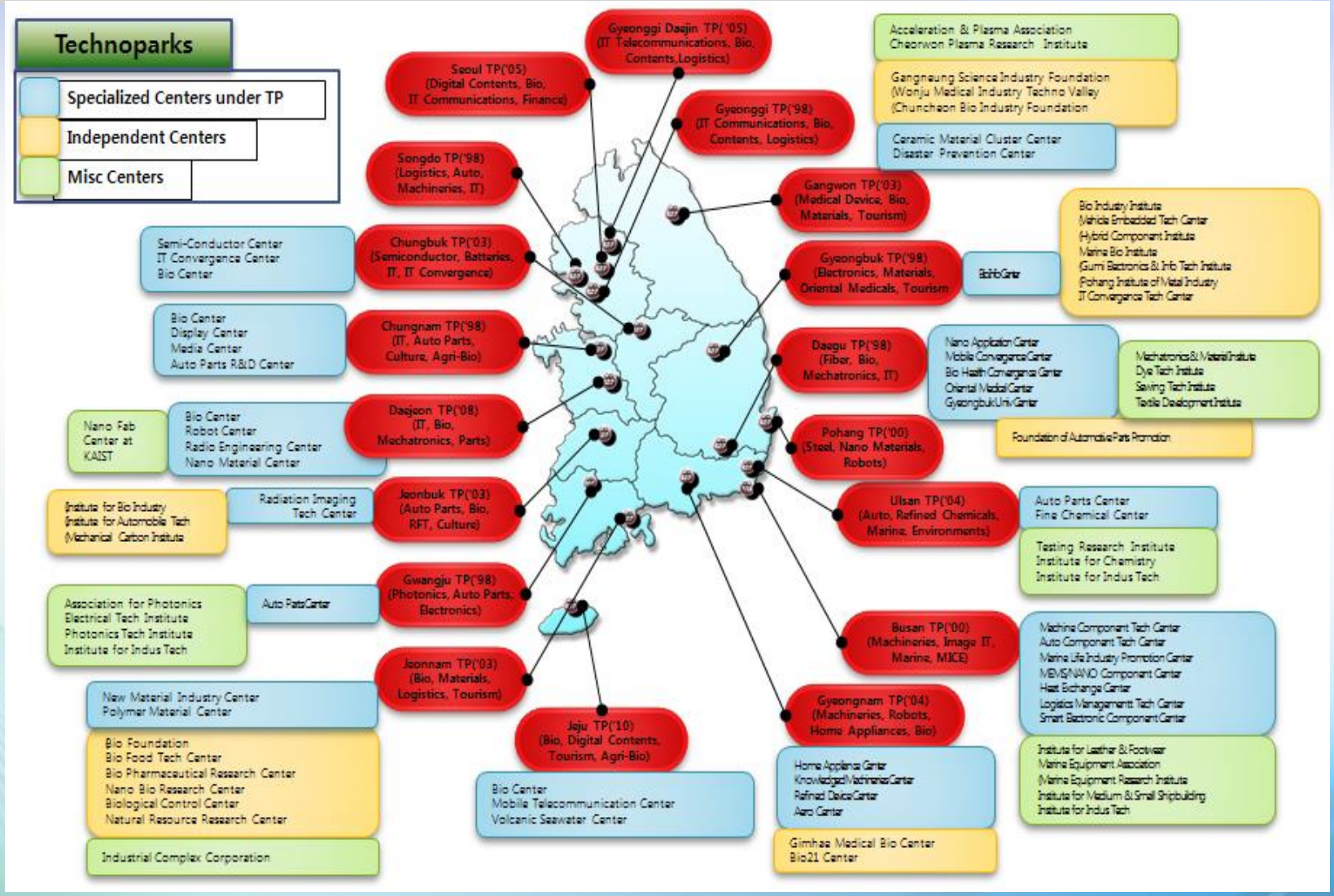
Ⅳ.4. Innovation Clusters

Techno Park as the Key Agency in RIS

- **A techno park is the concept of the planned development that includes technology, R&D and the space in which universities, research institutes and enterprises gather and closely cooperate with one another.**
  - **Korean government and local governments have pursued the development of techno parks as pivotal facilities for creating academic-industrial networks to establish self-sustaining system of regional innovations.**
  - **The governments have pushed forward with the techno park project as key entities for innovation clusters, which organically connect industrial policy centering on the expansion of industrial complexes and policy for corporate-oriented technology development since 1998.**
- **The 18 techno parks are currently in operation, and they have grown as the backbone of the innovation clusters in Korea.**
  - **The government has initiated reform on the promotion of RIS, designing to select and integrate regional specialization centers into techno parks.**
  - **As of 2010, the techno-parks supported a total of 4,142 technology-based SMEs throughout a variety of systematic support activities; as a consequence, these enterprises achieved sales of 28.7 trillion KRW and created new jobs for 126,000 people.**

Ⅳ.4. Innovation Clusters

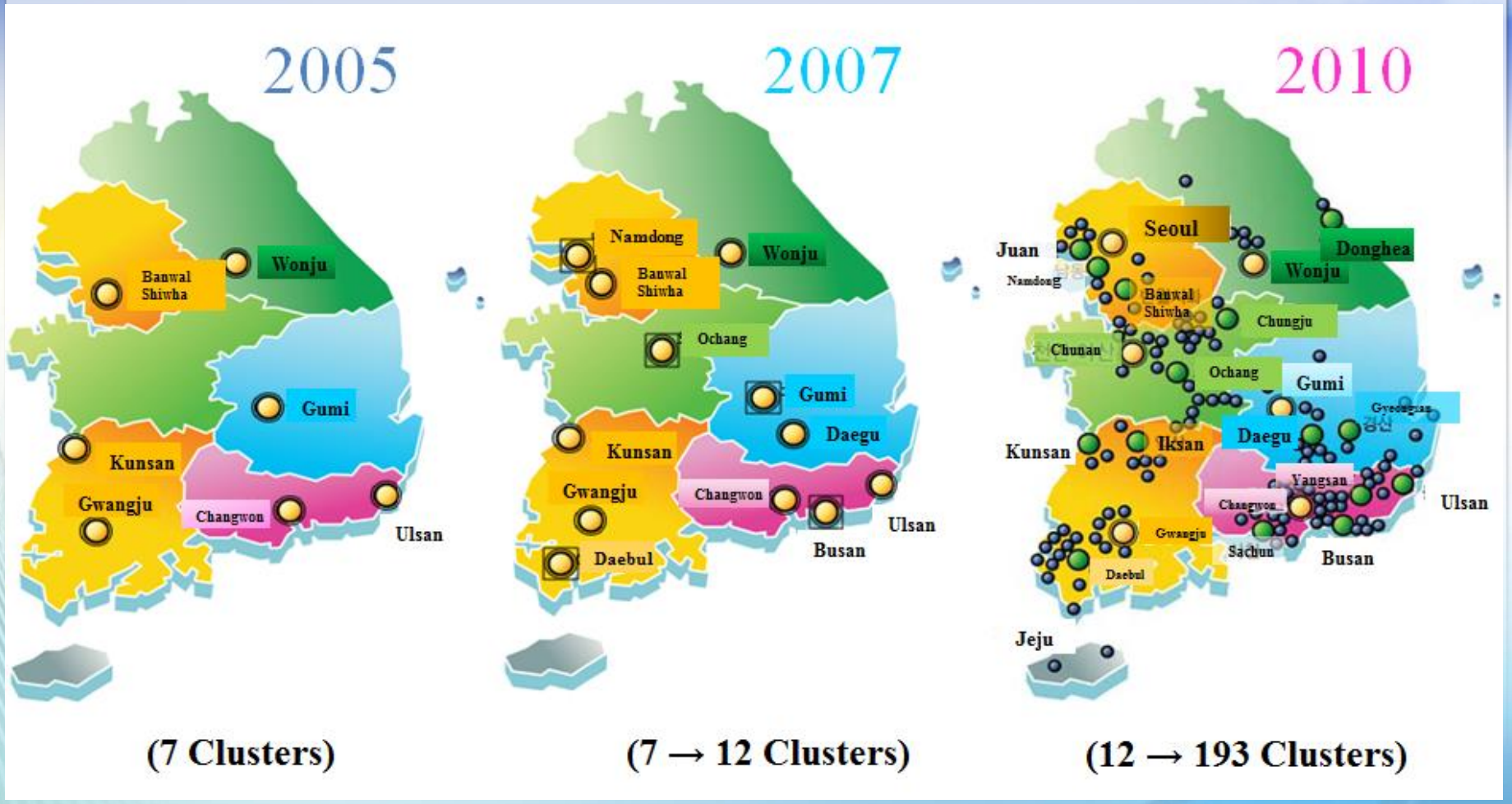
Locations of Techno Parks and Specialized Centers



Source: Kim, D., 2012

Ⅳ.4. Innovation Clusters

Innovation Clusters (RIS) in Korea, 2005-2010



Source: KICOX, 2012

Ⅳ.4. Innovation Clusters

Establishment of Industrial Complexes

- **Industrial complexes were established to locate targeted industries, which were the foundation of Korean Industrialization.**
  - **There were 1,074 industrial complexes established in 2014 as Korean industrial clusters.**
  - **The share of the KIC's export to total export in Korea is 80.7% in 2012.**

Industrial Complexes in Korea, 2014

	Complexes	Area (km^2)	Companies	Activated Companies (%)	Employees (thousands)	Products (million USD)	Exports (million USD)
National	41	770	48,313	92.6	1,187	665,686	282,511
Local	560	508	25,346	89.1	743	339,813	152,151
Hi-tech	14	3	235	80.0	2	188	1
Small	459	74	6,626	88.6	148	50,762	12,777
Total	1,074	1,355	80,520	91.1	2,080	1,056,449	446,439

Source: Korea Industrial Complex Corporation(KICOX), 2014

Ⅳ.5. Case Study: Ulsan Industrial Complex 3

- Since 1970s, production capacity of Ulsan Industrial Complex has shown a rapid growth from KRW 4.3 trillion in 1980 to KRW 98 trillion in 2009, prompted by the rapid growth of petrochemical, motor and shipbuilding industries.
- Currently, the Complex is being evolved into an advanced high-tech industrial complex producing industrial robots, precision and electronic products and chemical products.
- Ulsan is in the top world' s top 5 automobile cities, shipbuilding, which is one of the largest cities.

<Operation Status of Ulsan National Industrial Complex>

Items	1963	1980	2000	2009
Number of Resident Enterprises	23	154	488	806
Production (KRW 100 million)	7.3	43,298	458,270	976,562
Export (USD 1 million)	0.3	1,699	19,328	44,651
Number of Employees	1,236	67,587	87,529	88,278

Source: KICOX, 2011

Ⅳ.5. Case Study: Ulsan Industrial Complex 3

Ulsan Industrial Complex in the 2000s



Category	Ulsan	Onsan	Total
Food Products	9	–	9
Textile Products	5	1	6
Wood Papers	13	3	16
Petrochemical	105	52	157
Nonmetallic	24	9	33
Steel	8	13	21
Machinery	149	43	192
Electric, Electronic	45	4	49
Transport Equipment	97	28	125
Others	13	2	15
Services	54	23	77
Total	522	178	700

(data : 2004)

Source: KICOX, 2011

V

Implications of Korean Industrialization

V.1. Driving Forces of Industrialization

1. Strong Government Leadership

- **One of the most conspicuous characteristics of the industrialization of Korea is the strong government and its orchestrating role(Kim, 1997).**
  - The government held the wheel and supplied the fuel, while private firms, particularly large conglomerates - *chaebols*, functioned as the engines.

2. Large Conglomerates, *Chaebols*

- **Behind the remarkable industrial growth are big businesses, which have emerged as powerful engines in the past decades.**

3. Crisis Construction

- **The government and *Chaebols* used crises as major means of technological transformation.**
  - The government deliberately imposed a series of crises on firms by demanding that they achieve overly ambitious goals.
  - **The Top management also constructed a series of crises as a strategic means to expedite technology learning (the recently Samsung CEO still uses the strategy).**

V.1. Driving Forces of Industrialization

History of the Government-Business Relationship in Korea

period	Firms' Strategy	Government Policy	Major Industries
60s~ mid 70s	• take advantage of cheap labor • search for economies of scale • export	• export-promotion • pick-the-winner	textile, footwear, clothing, electronics
mid 70s ~ 70s	• diversify • export	• incentives on HCI	steel, automobile, shipbuilding, chemical
80s	• diversify • more attention to domestic demand	• adjust HCI • rationalize "sunset industries"	machinery, hi-tech parts And intermediate products
90s	• reclaim deregulation • independent from government	• specialize • reduce chaebols' economic power	hi-tech, R&D, software
2000s	• streamline their own businesses	• implement a harsh plan of corporate restructuring	ICT industries, software and Services

Source: Kim, D. (2004)

V.1. Driving Forces of Industrialization

4. Export-oriented Industrialization Strategy

- **Korea pursued an export-oriented industrialization strategy from the very beginning, when import substitution was still in its early stage.**
  - The Korean government made exports a life-or-death struggle in order to achieve economic growth goals.
  - The government pushed and pulled firms with threats and promises.
  - During the 1960s and 1970s, the period of Korea's development of major industries, export growth outpaced GDP growth.
  - Korea rapidly stepped up the ranks of exporting countries worldwide, from the 87th place in 1961 to the 26th in 1980, and finally to the seventh in 2013.

Rapid increase of export share of GDP(%)

1960	1965	1970	1975	1980	1985	1990	1995	2000	2005	2010
3.2	8.3	13.6	26.8	32.0	31.9	27.9	28.8	38.5	39.2	52.3

Source: IMF (2012)

V.1. Driving Forces of Industrialization

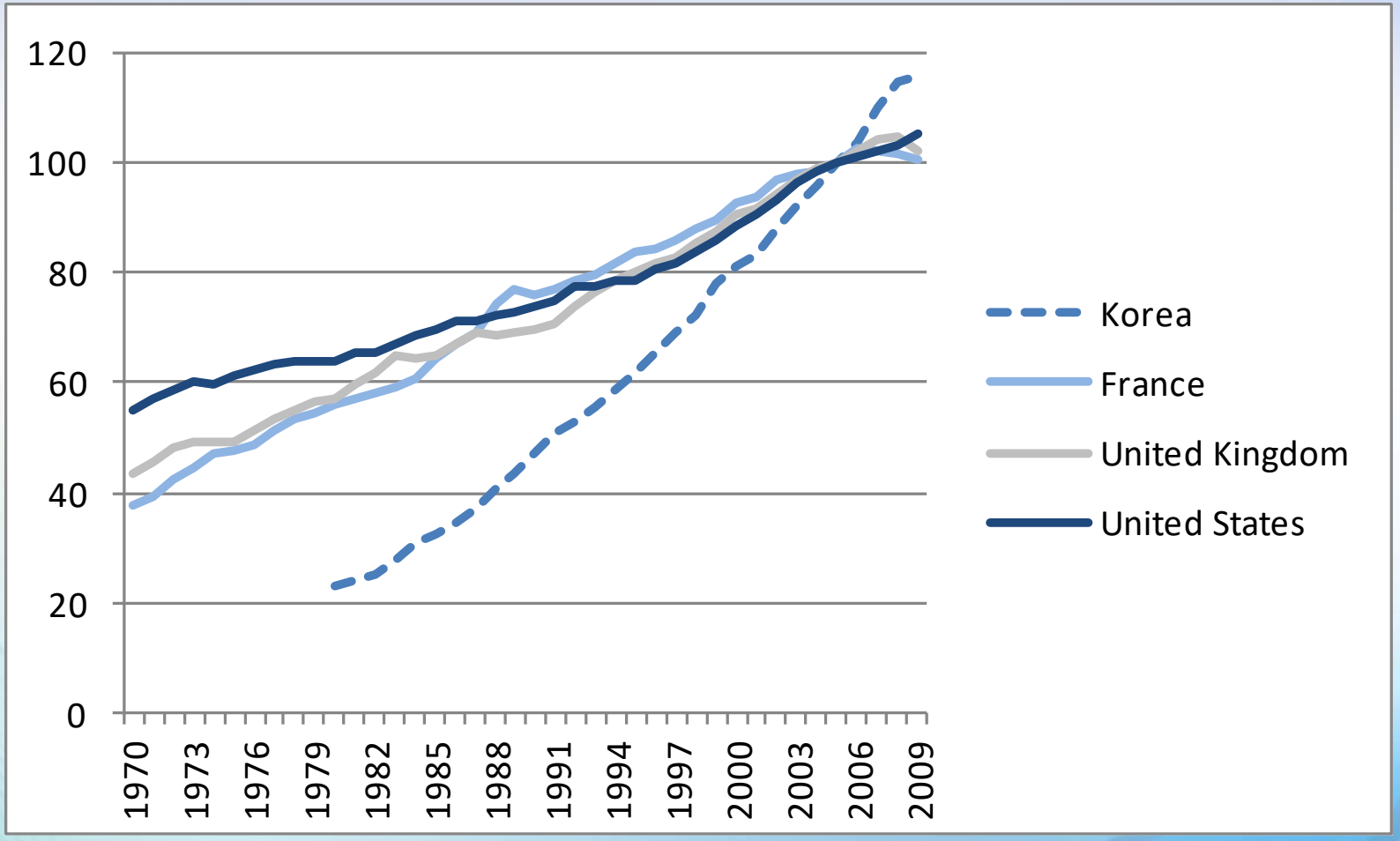
5. High Dependence on Human Resources

- Korean large conglomerates – *chaebols* employed hardworking Koreans who have empowered the Korean engines.
- Korea had nothing to rely on during the early stages of its industrial development and has had to intensively take advantage of the abundance of human resources (from simple labor forces to technicians and scientists).
- Fortunately, suitable human resources, workers, engineers and researchers were available to support the appropriate industries.
  - These well-educated Koreans worked very hard for Korea's success (Koreans worked the longest hours among industrialized countries).
  - 1960s: unskilled and cheap labor forces for labor intensive industries
  - 1970s: skilled labor forces (engineers) for heavy and chemical industries
  - 1980s: researchers and scientists for technology-oriented industries

V.1. Driving Forces of Industrialization

Catching up in Labor Productivity, Korea, 1970~2009

Korea and selected OECD economies (labour productivity index, year 2005=100)



Source: OECD Development Centre on the basis of OECD Database.

V.2. Implication of Korean Industrialization

A Smart Industrial Policy Mix

- The active industrial policy mix fostered the transformation of the Korean production structure from an agricultural economy to an industrial economy over 50 years, making Korea one of the most manufacturing intensive countries in the world.

Shift in the Composition of GDP by type of Economic Activity, Korea

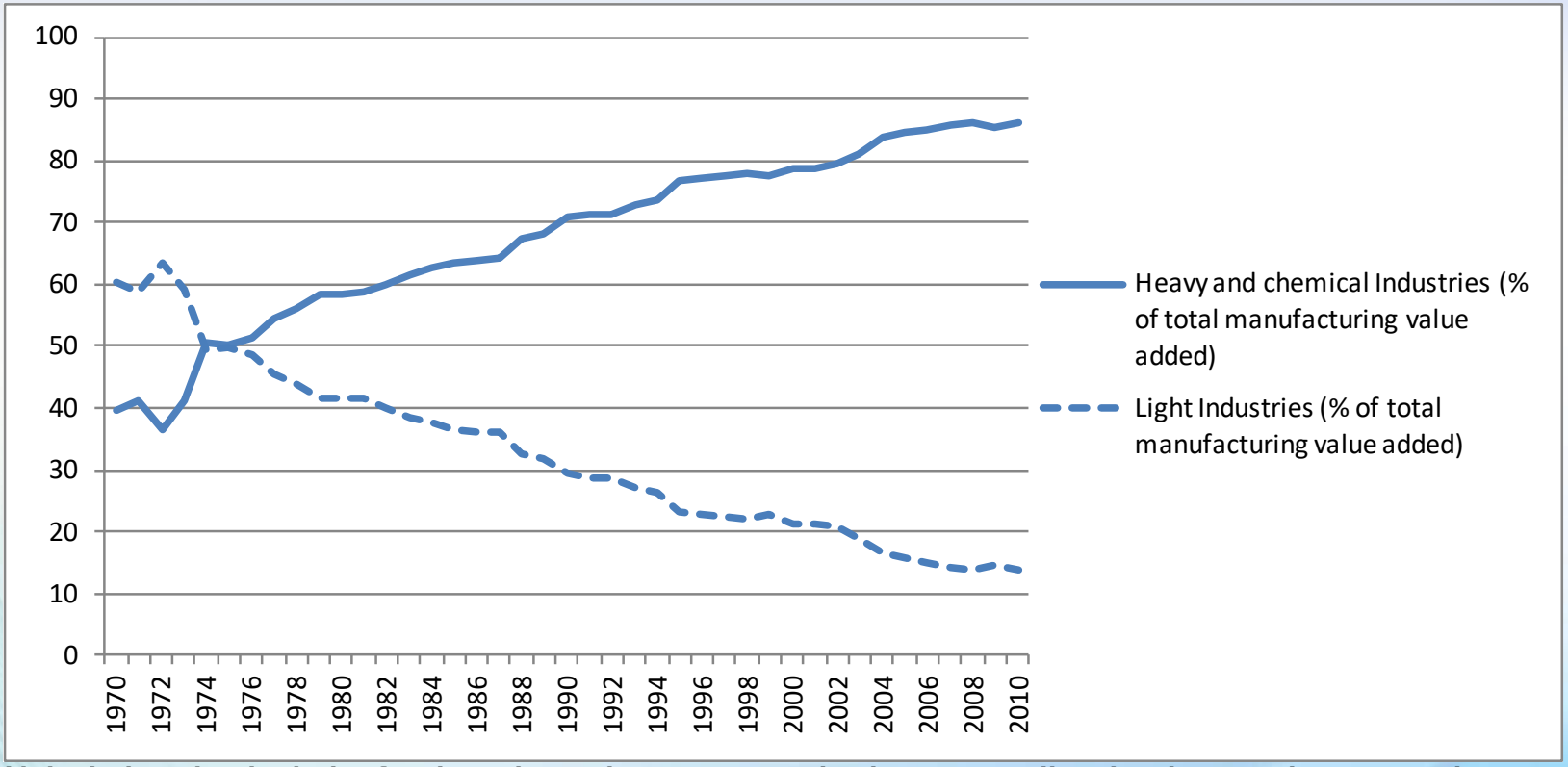
Industrial Structure	1953	1970	1980	1990	2000	2010
Agriculture, hunting, forestry, fishing	47.3	29.1	16.0	8.7	4.6	2.6
Mining & quarrying	10.1	1.6	1.4	0.8	0.3	0.2
Manufacturing		18.5	24.6	26.6	28.3	30.6
Electricity, gas, water supply	2.6	1.3	2.1	2.1	2.5	2.0
Construction		5.1	7.9	10.4	6.9	6.5
Sales, hotels and restaurants	40	16.4	14.7	14.2	12.4	10.8
Transport		5.7	6.5	4.7	4.5	4.1
Finance and insurance		2.1	5.5	5.2	5.8	6.9
Real estate and renting		4.1	3.9	6.5	9.2	7.1
Communication		1.4	2.1	3.0	4.5	4.1
Business services		0.9	1.8	3.0	4.4	5.1
Other services		13.7	13.5	14.8	16.6	20.2

source: OECD, 2011

V.2. Implication of Korean Industrialization

A Smart Industrial Policy Mix

Structure Change: from light to heavy and chemical industries, Korea



Light industries include: food products, beverages and tobacco; textiles, leather products; wood, paper, printing and publishing products; furniture and miscellaneous activities. Heavy and chemical industries include: petroleum, coal and chemical products; non-ferrous metals; metal; general machinery; electrical and electronics; precision equipment; transport.

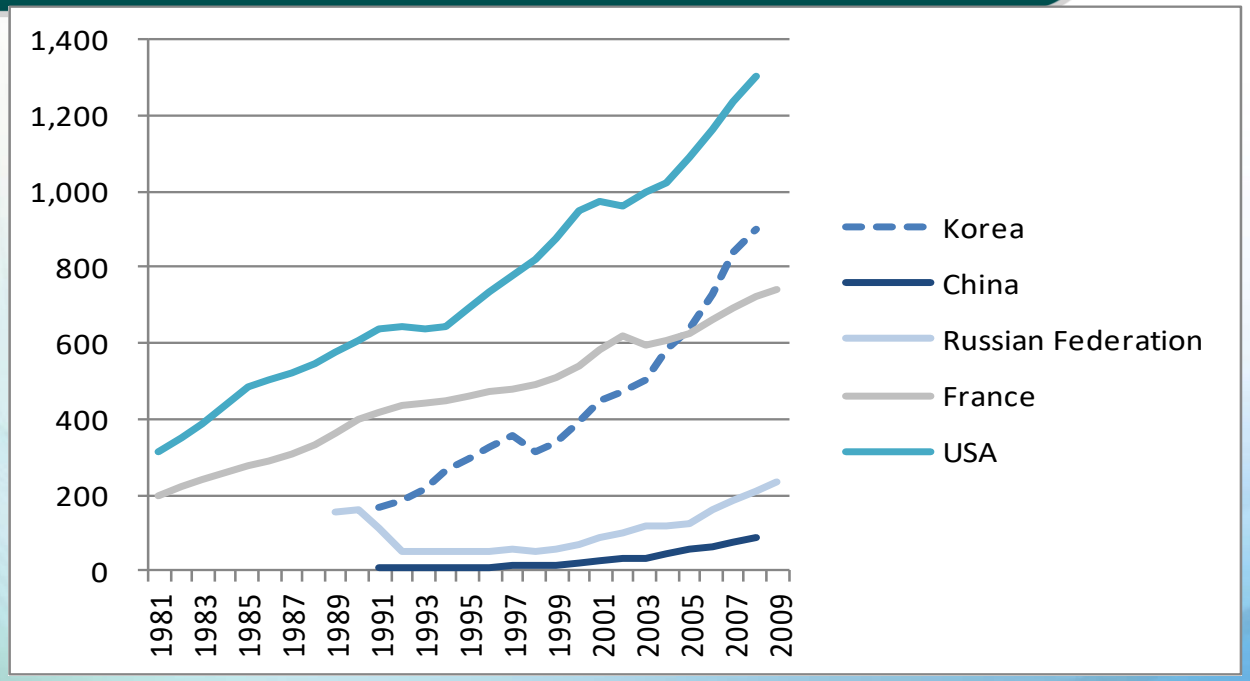
source: OECD, 2011

Ⅴ.2. Implication of Korean Industrialization

Technology Catching up

- In proceeding, Korean firms reverse the sequence of technology development in advanced countries.
- In anticipation of increasing demands for R&D, the government established R&D infrastructure and GRIs when the private sector faltered in R&D investment for capability building.

Korea Continued to Catch up in R&D per capita



source: OECD, 2011

Ⅴ.2. Implication of Korean Industrialization

Implications from Korean Clusters

- The role of the government in technological innovation is the promotion of the technological development of the main actors (companies, research institutes, universities).
- Specialized industrial complexes with basic imitation of advanced technology in the early stage(Capacity Building) → Industrial clusters with reform through assimilation and absorption → Innovation Clusters with adequate governmental support (Capability Building) in the process of securing proprietary technology for some sectors.

The Engine of Industrial Growth: Clusters

- Industrial complexes in Korea have played a major role in the rapid industrialization and economic growth in Korea by enhancing the efficiency of the industrial agglomeration effects in the process of Korean industrialization since the 1960s (as capacity building).
- Successful shift from industrial complexes to innovation clusters (as capability building) is also very important for regional endogeneous growth in Korea.

Ⅴ.2. Implication of Korean Industrialization

Contributions to the Regional Economies

- Korean cluster(from industrial complexes to RIS) development used one of the key strategies of industrial location policy in Korea.
- The Korean clusters have been positioned as a foundation of development for the local economies as well as key bases of the national economy.
- The Korean RIS secured the firm position as a key clusters of the national main industries including the primary industry, the next-generation strategic industry and the next-generation growth engine industry in 2000s (KICOX, 2011).

  - The share of the KIC export to total export in Korea is 80.7% in 2012.

[Status of Contribution of Industrial Complexes to the National Economy]

unit: %, %p

Share of	2000	2003	2006	2010	2012	Growth Rate (2000 ~ 2010)
Number of Firms	7.9	10.0	13.1	16.3	17.8	8.4
Production (Output)	51.1	52.2	59.9	62.3	68.6	11.2
Export	59.4	68.6	80.4	79.1	80.7	19.7
Employment	28.9	30.8	37.1	42.1	46.5	13.2

Source: KICOX, 2012

V.3. The Characteristics of Korean Industrial Complexes

1. Strong Government Leadership

- **One of the most conspicuous characteristics of Korean industrial complexes is the strong government leadership and its orchestrating role.**
  - The government held the wheel and supplied the fuel, while private firms, particularly large conglomerates - *chaebols*, functioned as the engines.

2. Agglomeration Effects with Large Conglomerates and SMEs

- **Behind the remarkable industrial growth are big businesses, which have emerged as powerful engines with targeting industries in the past decades, also networking with SMEs in the value chain.**

3. Speed Economies of Constructing KIC with Targeting Industries

- **Land provided by the Ministry of Construction and Transportation(MOCT) or public utility corporations (LH Corporation) in a very fast way.**
  - Access roads, industrial water supply, electricity, communication system, pollution control, land scraping and other facilities(e.g. schools, housing, recreation, medical centers) provided by MOCT and/or public utility corporations such as LH Corporation, K-Water Corporation, and Agriculture Promotion Corporation, etc.

V.3. The Characteristics of Korean Industrial Complexes

4. System Economies of Managing KIC with Export-oriented Industrialization

- Korea pursued an export-oriented industrialization strategy from the very beginning, when import substitution was still in its early stage.
- Financial support by central (MOTIE) or local governments and managed by Korea Industrial Complex Corporation (KICOX) with export-oriented industrialization strategy, supporting by KOTRA.
  - The government pushed and pulled firms with threats and promises.
  - During the 1960s and 1970s, the period of Korea's development of major industries, export growth outpaced GDP growth.

5. High Dependence on Human Resources in KIC

- Korean large conglomerates – *chaebols* in KIC employed hardworking Koreans who have empowered the Korean engines.

Ⅴ.4. Innovation Sharing with Iran

Innovation Sharing Programs (ISP)

Win-win strategy through "Innovation Sharing Program, ISP"

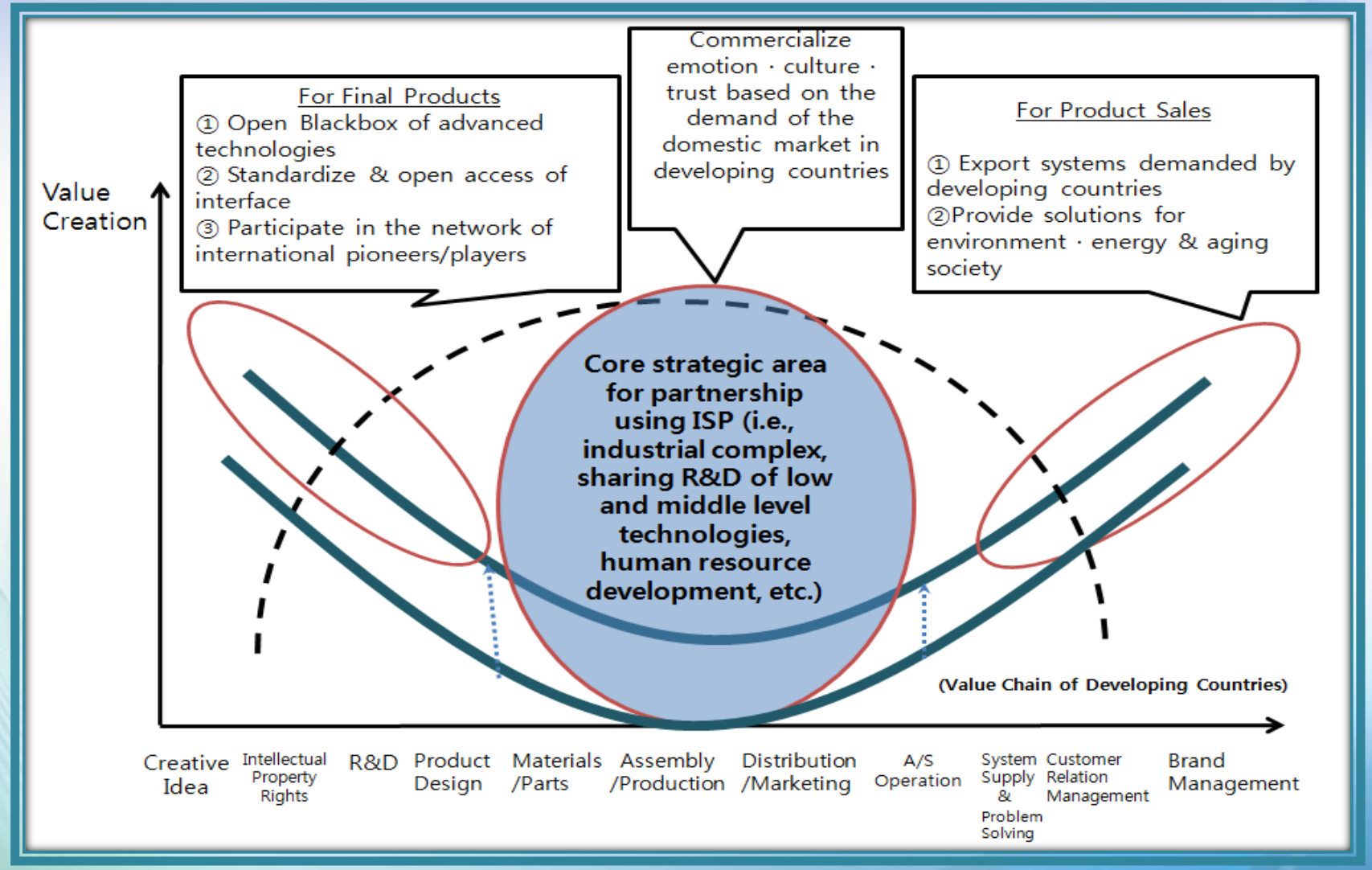
- Korea can benefit from creative ideas, intellectual property rights and R&D which are on the left-side of the value chain, as well as from customer relations management and brand management on the right-side of the value chain in the smile curve.

- At the same time, Iran can benefit from the ISP partnership by applying and leveraging on Korea's technology and service expertise to materials, parts, and final products which are in the middle of the global value chain in the smile curve.

- Finally with the partnership of ISP, Iran will become catching up with advanced countries in a short period just as Korean industrialization: "from imitation to innovation."

V.4. Innovation Sharing with Iran

Industrial Partnership through "Smile Curve"



Source: Lee, D. (2011)


Thank you!
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