Introduction of Diversification Issues : Country Case Study for Korea

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본 발표는 아래의 자료를 기반으로 구성되었음

Sanghoon Kim, '4th Industrial Revolution and Manufacturing Innovation, UNIDO Report (2018)

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Concept

Diversification ? (Various Examples)

Biology and agriculture

- Diversification (biology) emergence of subpopulations that have accumulated independent genetic changes
- Agricultural diversification involves the re-allocation of some of a farm's resources to new products or non-agricultural activities

Economics, business and finance

- Diversification (finance) involves spreading investments
- Diversification (marketing strategy) is a corporate strategy to increase market penetration
- Diversification of firms through mergers and acquisitions

Others

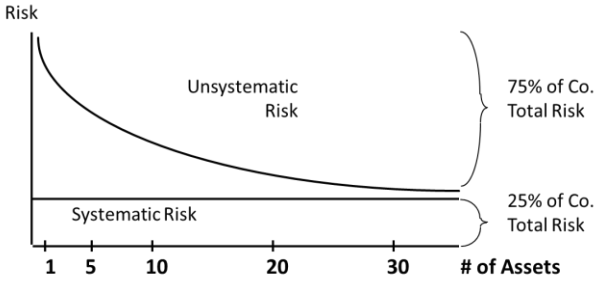
Effects of Diversification on Risk

The Dominance Principle

States that among all investments with a given return, the one with the least risk is desirable; or given the same level of risk, the one with the highest return is most desirable. Assume that all investments are reducible to two elements – risk and return.

Normal Diversification

This occurs when the investor combines more than one asset in a portfolio

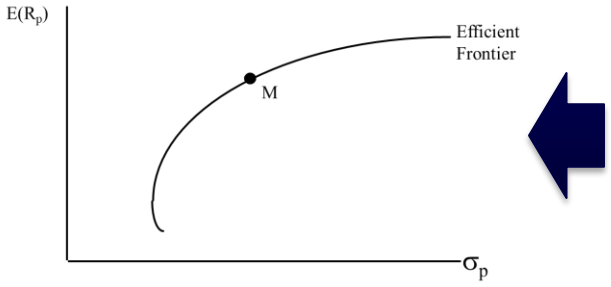


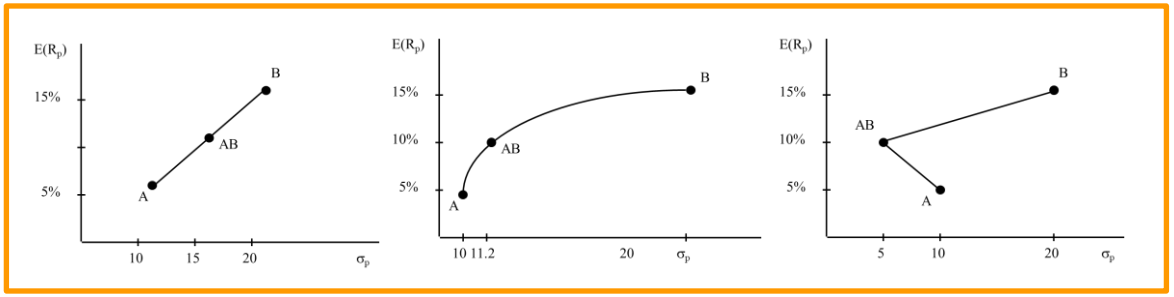
Markowitz Diversification

This type of diversification considers the correlation between individual securities. It is the combination of assets in a portfolio that are less then perfectly positively correlated.

Consider 3 possible relationships between A and B.

- Perfect Positive Correlation
- Zero Correlation
- Perfect Negative Correlation





Diversification vs Risk

Finance Perspective

consider a portfolio of two stocks (stocks A and B in portfolio P)

Expected Return of portfolio = (Weight on A)* (Expected Return of A)

+ (Weight on B)*(Expected Return of B)

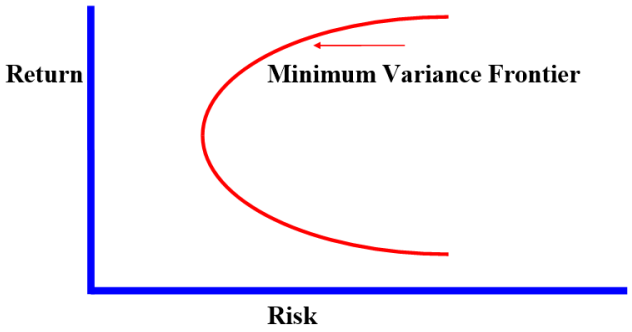
Variance of Portfolio = (Weight on A)^2 * (Variance of A)

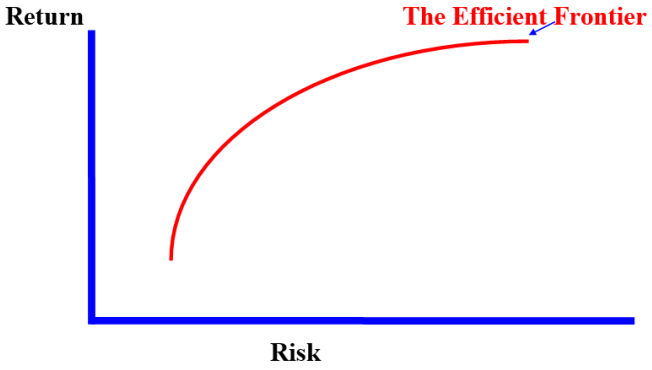
+ (Weight on B)^2 * (Variance of B)

+ 2 * (Weight on A) * (Weight on B) * Covariance of A and B

Covariance of A and B = Correlation of A and B * Std. Deviation of A * Std. Deviation of B

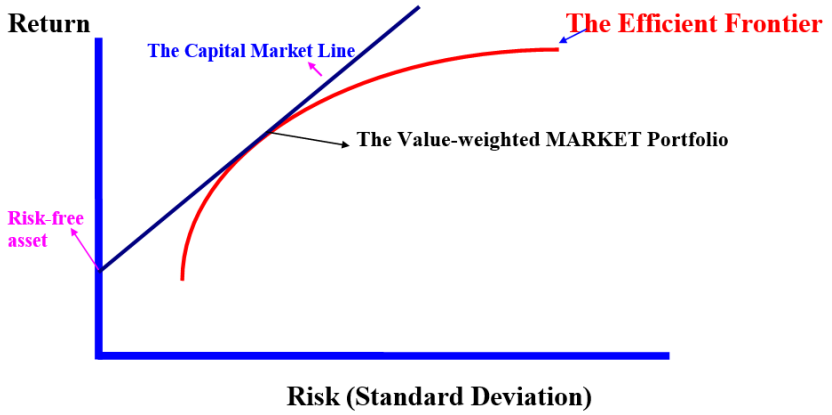
Diversification vs Risk





Efficient Frontier: Upward sloping part of the Minimum Variance Frontier. A portfolio is said to be efficient if it has the least risk for a given level of return, or the most return for a given level of risk.

Rational investors (that is, investors that attempt to maximize their returns and minimize their risk) attempt to hold efficient portfolios.



Equation of the Capital Market Line:
Expected Return of an efficient portfolio
= Risk-free rate +{[Expected return on the market portfolio - Risk-free rate] / [Std. Dev. of the Market Portfolio] } * Std. Deviation of the efficient portfolio

How should investors measure the risk of an individual stock, say ABC, (when held in a well-diversified portfolio)?
asking: How does adding one additional share of the stock of company ABC change the variance of their portfolio?

Mathematically,
Risk of stock ABC = Change in variance of well-diversified portfolio when one share of ABC is added to this portfolio

Risk of stock ABC = (D V_p) / (D w_{ABC})
(d V_p / d w_{ABC}) = 2 * Covariance (Stock ABC, Market)
Beta is a standardized measure of covariance.
b_{ABC} = [Covariance (Stock ABC, Market)] / [Variance of Market]
Beta of portfolio = (Weight on A)* (Beta of A) + (Weight on B)* (Beta of B)

Economic Diversification

Source: UN (2016), FCCC/TP/2016/3

[Definition]

A strategy to transform the economy from using a single source to multiple sources of income spread over primary, secondary and tertiary sectors, involving large sections of the population

[Status]

Studies are continuously being undertaken by researchers to understand the complexities, linkages and performance of implemented economic diversification policies, including: developing and testing reliable empirical methods to measure economic diversification; understanding the performance of various determinants driving economic diversification; and understanding the effect of various policies on sustainable development (e.g. impact on labour market, employment generation, export growth).

→ owing to the complexity created by differing national circumstances, standardized conclusive strategies are not advised; there are only lessons learned from experience to be tested and followed up on.

[Remarks]

Recent developments under the climate change regime have added another dimension to the objective of economic diversification. Countries are implementing mitigation policies at the national or international level through bilateral and/or multilateral agreements to mitigate climate change.

Economic Diversification

Source: UN (2016), FCCC/TP/2016/3

[Objective]

The objective has been to improve economic performance for achieving sustainable growth; for example, (1) building resilience against fluctuations in extraregional economic activity (Nourse, 1968), (2) reducing vulnerability to income loss due to volatility of product price on the international market, (3)creating job opportunities and alleviating poverty and so on

[Drivers]

1. Various drivers of economic diversification can be grouped them into 3 categories (The World Bank) :

   economic reforms, structural factors and macroeconomic variables

2. A recent study on exporting firms classified the drivers as internal and external (Navarro-García, 2016);
   - internal drivers include export commitments and the experience level of staff and the structure of human resources;
   - external drivers include competitive intensity and distances between the export firms and markets

◆ *There are many factors other than the impact of the implementation of response measures that drive economic diversification. Because many of these factors act simultaneously, they need to be understood holistically. In addition, the factors may vary by national circumstances, and are more quantitative determinants at the firm level.*

Economic Diversification

Drivers and their impacts on economic diversification

Determinant	Impact on economic/export diversification
Economic reforms: Trade liberalization and access to finance	Positive driver of export diversification at both intensive and extensive margins, including unilateral trade liberalization
Economic determinants: Income (gross domestic product (GDP) per capita) and productivity	Positive; quadratic relationship between the Theil index and GDP per capita is mainly driven by the extensive margin
Macroeconomic variables: Real exchange rate, inflation, terms of trade and preferential market access	Preferential market access has an impact on both intensive and extensive margins
Net inflows of foreign direct investment (as percentage of GDP)	Concentrates export value on some products and thereby increases concentration on intensive margin
Investment as a share of GDP	Positive
Country's population, human capital, quality of institutions and education	Quality of institutions, larger population and education have positive impacts; about 10 per cent increase in years of schooling decreases Theil index by 1.1 per cent and number of products
Infrastructure	Better infrastructure increases diversification on both intensive and extensive margins Once GDP per capita is controlled, infrastructure still appears to be an important driver of diversification; a 10 per cent increase in infrastructure decreases Theil index by 0.7 per cent
Non-economic determinants: Volume of products, number of products and volume of trading market	Positive
Remoteness (distance between trading markets)	Negative (more remote, low diversification, high concentration index), especially for extensive margin and number of products

Sources: (1) Longmore R, Jaupart P and Cazorla MR. 2014. Toward Economic Diversification in Trinidad and Tobago. World Bank Policy Research Working Paper No. 6840; (2) Cadot O, Carrère C and Strauss-Kahn V. 2011. Trade diversification: drivers and impacts. In: M Jansen, R Peters and JM Salazar-Xirinachs (eds.). Trade and Employment: From Myths to Facts. International Labour Office and European Commission.

Business Diversification : Definition

Definition and Concept – Still Changing

(1) Ansoff (1965)
Market Activity – Penetrate into new market with new product

(2) Gort (1962)
Heterogeneity in product range produced by the enterprise

(3) Barry (1974)
Industry range which the enterprise take part in

(4) Rumelt (1974)
Degree of different businesses simultaneously pursued by the enterprise

(5) Kaimen & Schwalts (1975)
Degree of production categorized by different industry sector by the enterprise in certain industry sector

Business Diversification : Method and Objective

Method

(1) M&A
(2) Internal Development
(3) Joint Venture

Objective

(1) Growth and Value addition
(2) Spreading Risk
(3) Economy of Scope
(4) Market Domination
(5) Internal Market Untilization
(6) Decrease in Transaction Cost : Coase (1937), Williamson (1975)

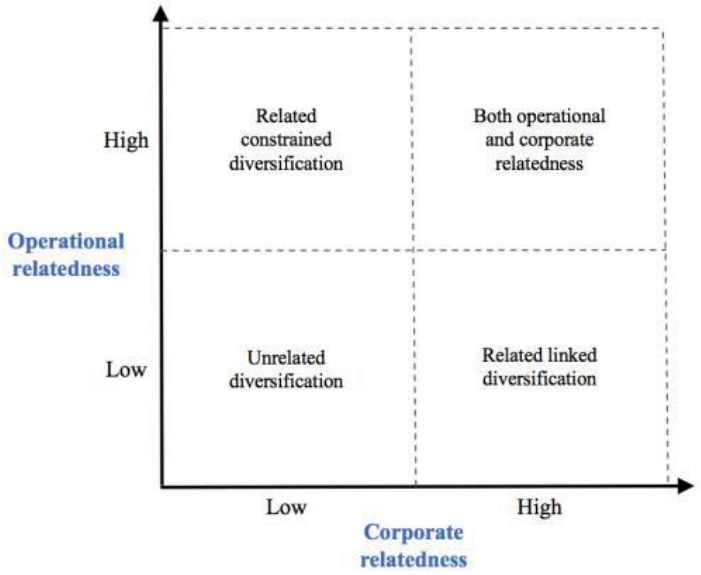
Business Diversification : Type of Strategies

Vertical diversification refers to a firm moving along (upwards or downwards) the value chain within an industry to secure access to critical resources and to counteract bargaining power of suppliers and/or customers. As this form of diversification is aimed at improving the competitive situation of a firm within the industry it already operates in. Horizontal diversification on the other hand refers to a firm establishing itself along similar steps of the value chain but within a different industry

Within the area of horizontal diversification (the product scope), a further distinction can be made between the degree of relatedness of the home and target industries. While diversification into related industries enables firms to potentially exploit the most synergies, they are also prone to react in a correlated manner to market forces. Unrelated diversification, entering industries with no meaningful value chain relationship or demand-side synergies with the original business, on the other hand, offers the potential benefits of diversifying business risk and achieving an optimal and information-asymmetry-free capital allocation. However, it comes at the risk of increased coordination costs (from managing unrelated businesses), the lack of industry specific know-how, and moral hazard.

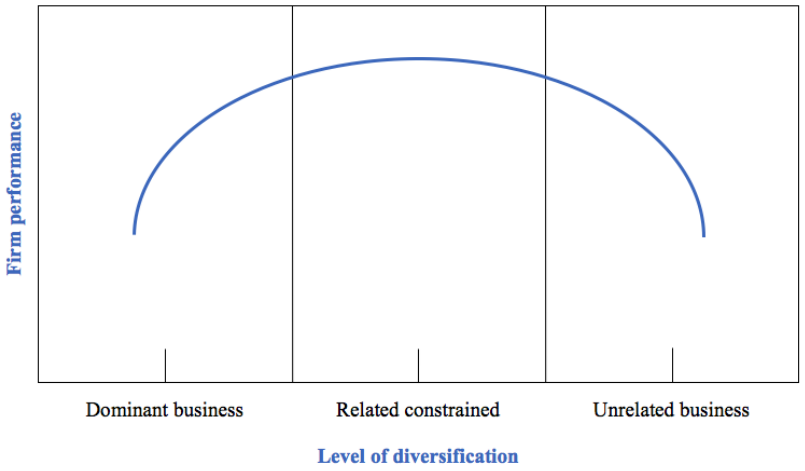
Business Diversification : Type of Strategies

Types of diversification strategies



A distinction can be made between operational and corporate relatedness. The former refers to the sharing of operational activities between businesses of a group, the most extreme form being vertical integration while the latter refers to the transfer of core competencies between individual businesses.
Both diversification approaches seek to create value through the sharing of resources i.e. by exploiting economies of scope. The key difference is the types of assets being shared. While operational relatedness is typically based on sharing physical assets, corporate relatedness stems from the transfer of intangible assets such as specific knowhow, brands, or patents

The curvilinear relationship between diversification and firm performance



Diversification into related industries is traditionally viewed as a firm's preferred mode of portfolio expansion since it allows the company to take advantage of existing knowledge, technologies, and resources and as such is deemed less risky. Although extensive research on the relationship between diversification and firm performance has been conducted, the results are contradictory. Nonetheless, a certain acceptance for the curvilinear relationship between diversification and firm performance has established itself as the predominant paradigm throughout the years. This concept argues that firm performance increases when a company engages in related diversification and decreases with decreasing levels of relatedness between the core and target industry

Hitt, Ireland & Hoskisson (2004, 2007)

Business Diversification : Type of Strategies

Due to the long-lasting interest, numerous studies from different schools of thought have been conducted on the topic of diversification strategies over the last 60 years.

While all theories cover important aspects of the diversification performance dichotomy, some tend to over-simplify the real-life complexity or over-emphasize particular parameters of diversification strategies.

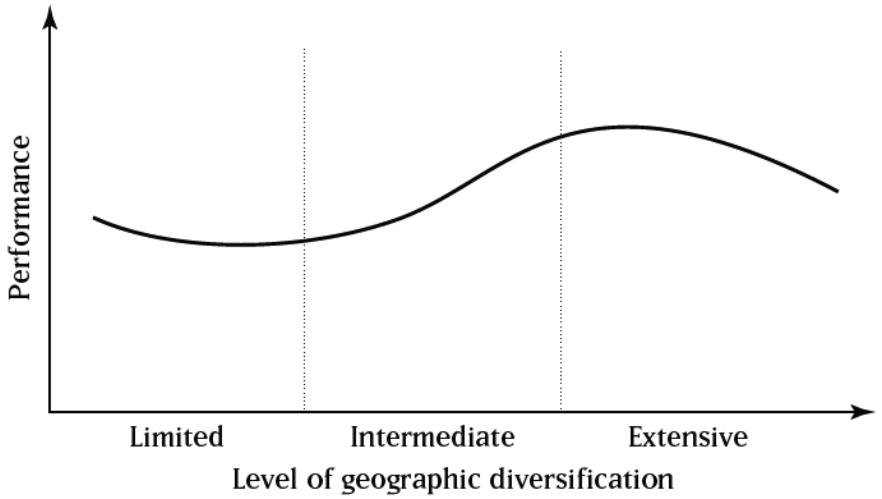
Perspectives	External	Internal	Financial
Predominant findings in developed economies	• Related diversification yields the best results if accounting measures are used to assess firm performance. • Industry profitability plays a major role. • Unrelated diversification yields the best results if market measures are used to assess firm performance.	• Related diversifiers that are able to create structures through which strategically important resources can be transferred, will be successful.	• As systematic risk is not diversifiable, diversification is not beneficial. • A diversified firm can benefit from internal capital markets. • Diversification decisions may be motivated by managers seeking personal gains.
Predominant findings in emerging economies	• As institutions are inefficient, greater diversification can be beneficial.	• As emerging markets mature, diversified firms must learn not only to acquire, but also to share intangible resources and capabilities across other firms within the same business group.	• Un- or underdeveloped capital markets lead to the development of diversified, hierarchical firms.

As the results of these studies are often contradictory between the different perspectives as well as within (especially in the context of developed vs. emerging economies), the table above summarizes the predominant conclusions that can be drawn from each of the three schools of thought (internal perspective, external perspective, financial perspective). As the following case study will show, a complex set of factors, from all three theoretical perspectives, influences the success of diversification strategies.

Purkayastha, S., Manolova, T. S. and Edelman, L. F. (2012). Diversification and Performance in Developed and Emerging Market Contexts: A Review of the Literature. International Journal of Management Reviews, 14 (1), pp. 18-38.

Geographic Diversification

Geographic Diversification and Firm Performance



Combining Product and Geographic Diversification

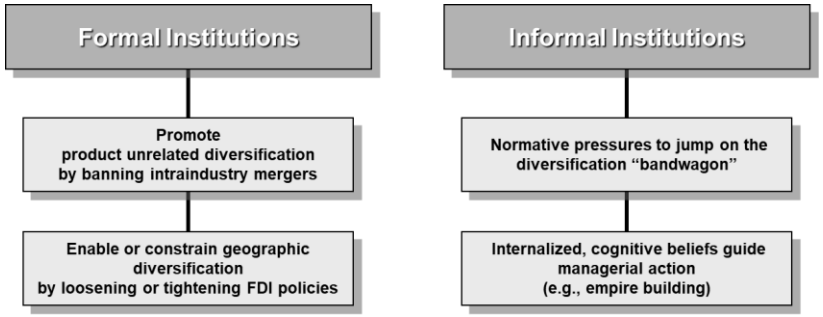
Geographic Scope \ Product Scope	Related	Unrelated
Extensive	(Cell 1) *Multinational replicator*	(Cell 2) *Far-flung conglomerate*
Limited	(Cell 3) *Anchored replicator*	(Cell 4) *Classic conglomerate*

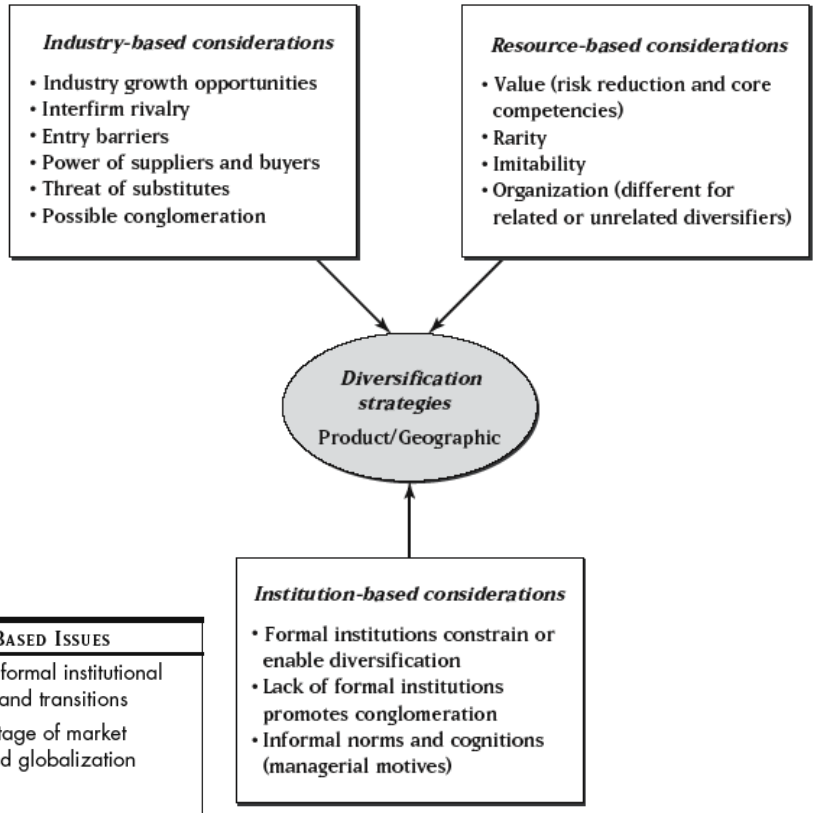
Source: Adapted from F. Contractor, S. K. Kundu, & C.-C. Hsu, 2003, A three stage theory of international expansion: The link between multinationality and performance in the service sector (p. 7), Journal of International Business Studies, 34: 5–18.

A Comprehensive Model of Diversification (Examples)

	Product-Related Diversification	Product-Unrelated Diversification
Synergy	Operational synergy	Financial synergy
Economies	Economies of scale	Economies of scope
Control emphasis	Strategic (behavior) control	Financial (output) control
Organizational structure	Centralization	Decentralization
Organizational culture	Cooperative	Competitive
Information processing	Intensive, rich communication	Less intensive communication

Institution-Based Considerations



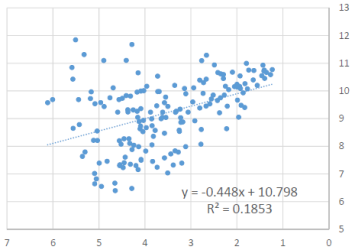


	Industry-Based Issues	Resource-Based Issues	Institution-Based Issues
Synergistic motives	▮ Enhance and consolidate market power ▮ Overcome entry barriers ▮ Reduce risk ▮ Scope economies	▮ Leverage superior managerial capabilities ▮ Access to complementary resources ▮ Learning and developing new skills	▮ Respond to formal institutional constraints and transitions ▮ Take advantage of market opening and globalization
Hubris motives		▮ Managers' over-confidence in their capabilities	▮ Herd behavior—following norms and chasing fads of M&As
Managerial motives			▮ Self-interested actions such as empire-building guided by informal norms and cognitions

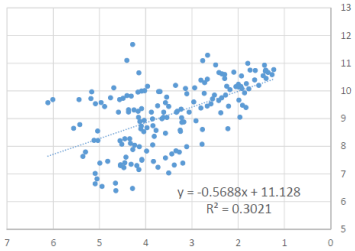
Diversification vs Economic Growth

Economic diversification (Theil index) and growth

170 countries for which data are available



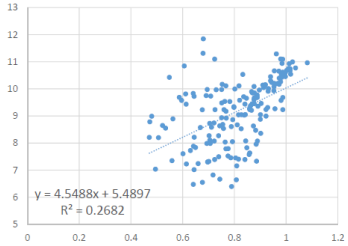
164 countries, all except six GCC countries



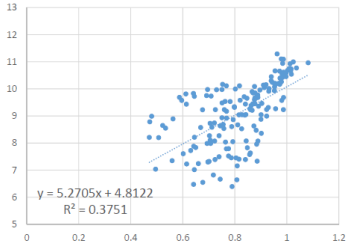
Note: Log of per capita GNI on vertical axes; Theil index of diversification on horizontal axes.

Product quality (IMF index) and economic growth

174 countries for which data are available



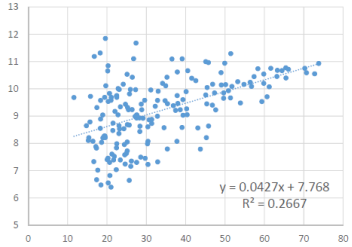
168 countries, all except six GCC countries



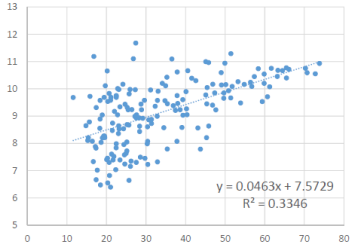
Note: Log of per capita GNI on vertical axes; Product Quality Index on horizontal axes.

Export diversification (Finger-Kreinin index) and economic growth

181 countries for which data are available



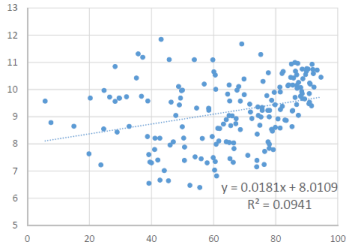
175 countries, all except six GCC countries



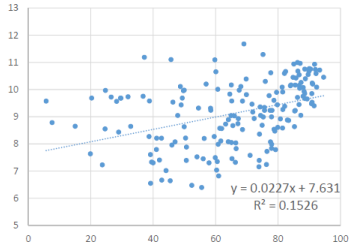
Note: Log of per capita GNI on vertical axes; export diversification index on horizontal axes.

Export dispersion (Herfindahl index) and economic growth

180 countries for which data are available



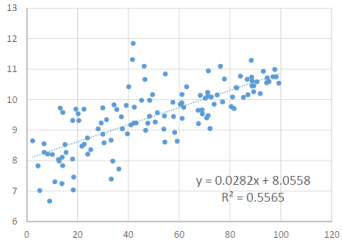
174 countries, all except six GCC countries



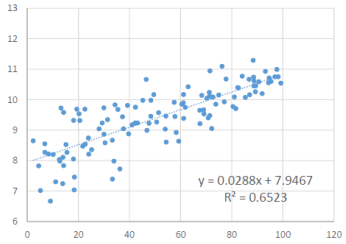
Note: Log of per capita GNI on vertical axes; export dispersion index on horizontal axes.

Economic complexity (Hausmann index) and economic growth

121 countries for which data are available

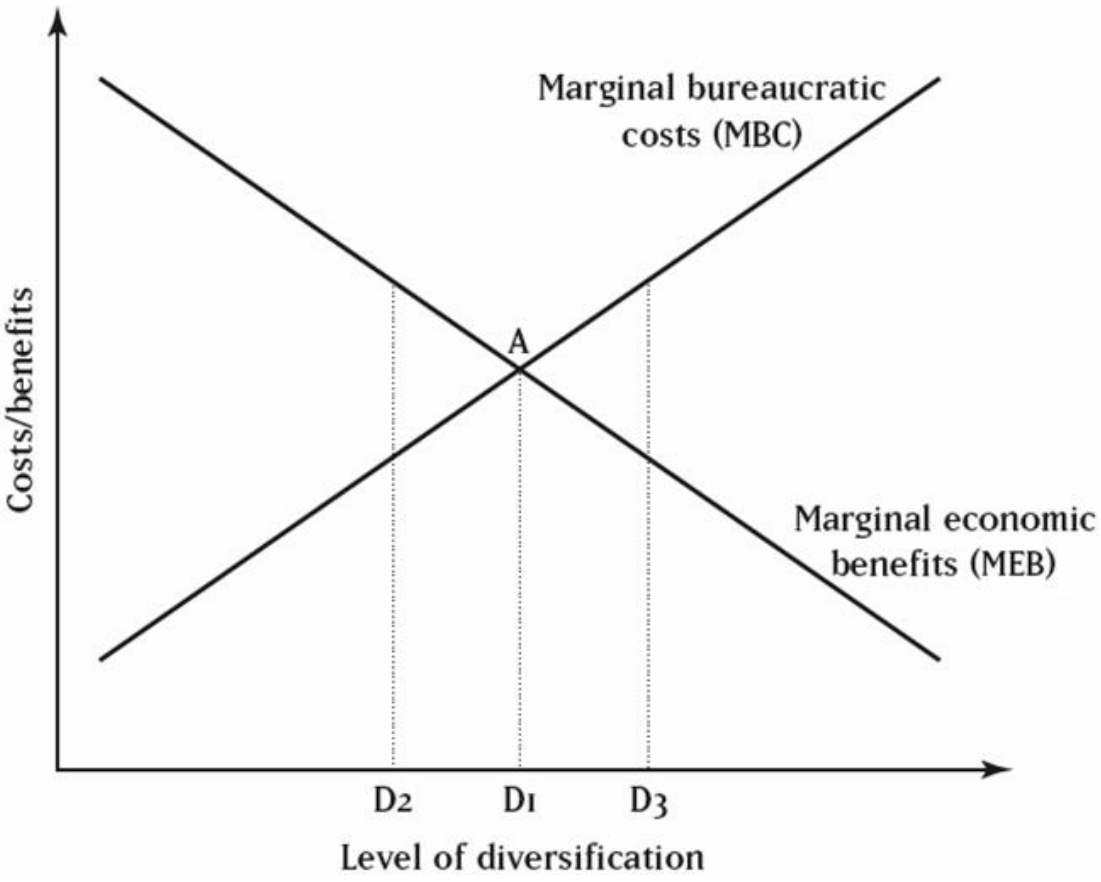


116 countries, all except five GCC countries



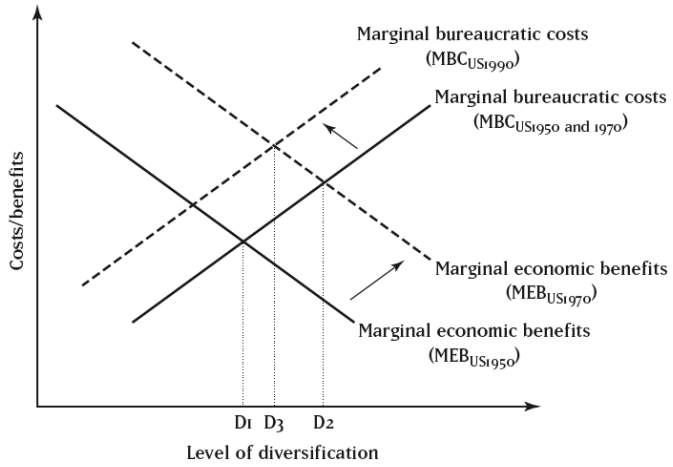
Note: Log of per capita GNI on vertical axes; economic complexity on horizontal axes, computed as 100*(1 – rank/124) where 124 is the number of countries included.

Diversification (Example for countries)

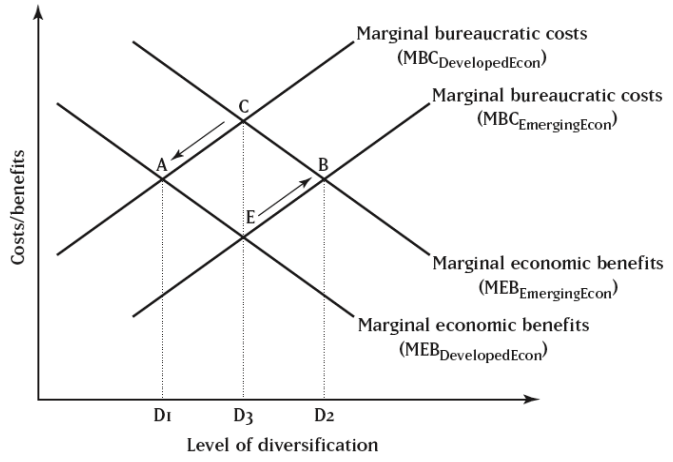


Source: Adapted from G. Jones & C. Hill, 1988, Transaction cost analysis of strategy-structure choices (p. 166), Strategic Management Journal, 9: 159–172.

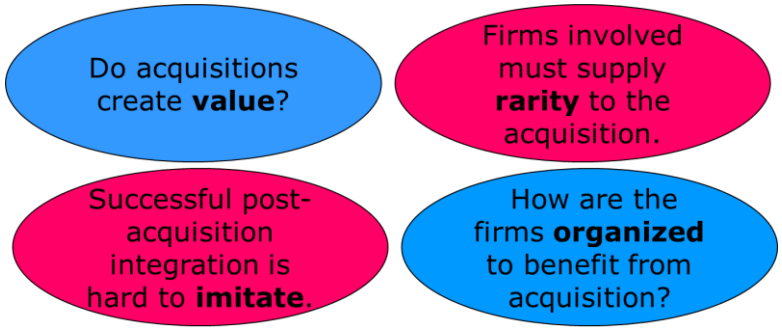
The Evolution of the Scope of the Firm in the United States: 1950–1970 and 1970–1990



The Optimal Scope of the Firm: Developed versus Emerging Economies at the Same Time

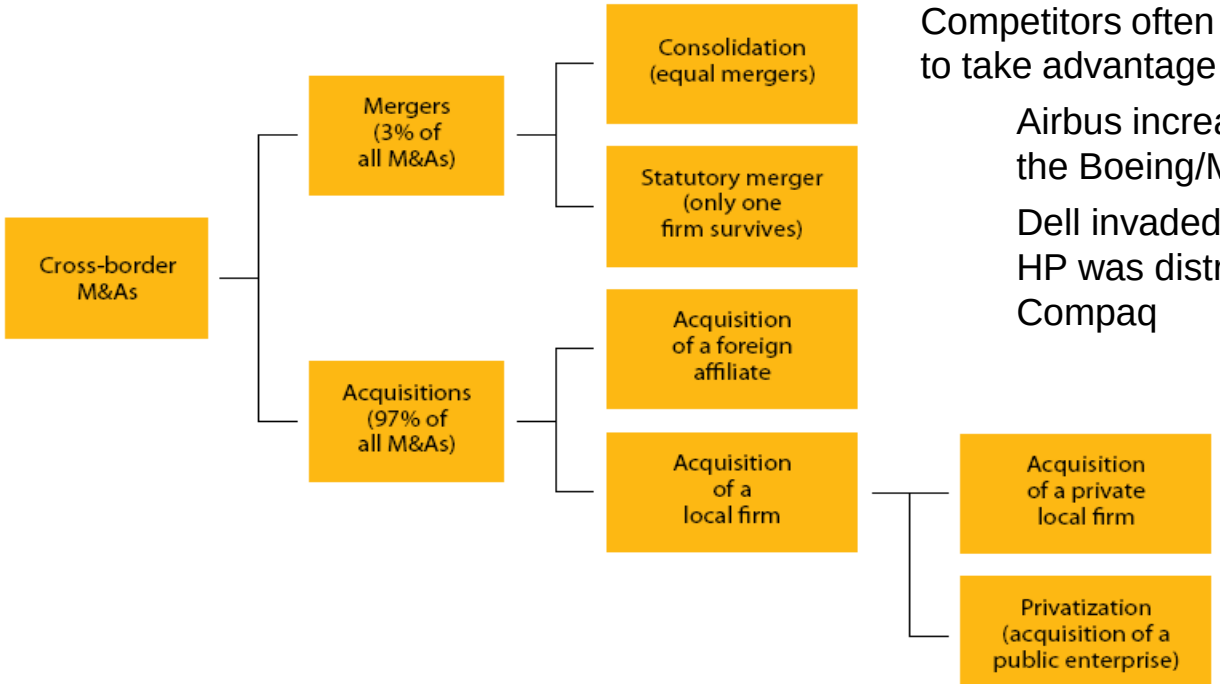


Diversification (Example for Business)



The performance record is rather sobering.

- As many as 70% of M&As reportedly fail.
- On average, acquiring firms' performance does not improve and is often negatively affected.
- Acquisitions are the largest capital expenditures most firms ever make, yet they are often the worst planned and executed business activities of all.
- Competitors often launch aggressive attacks to take advantage of the M&A chaos.
  - Airbus increased market share during the Boeing/McDonnell Douglas merger
  - Dell invaded the printer market when HP was distracted in its merger with Compaq



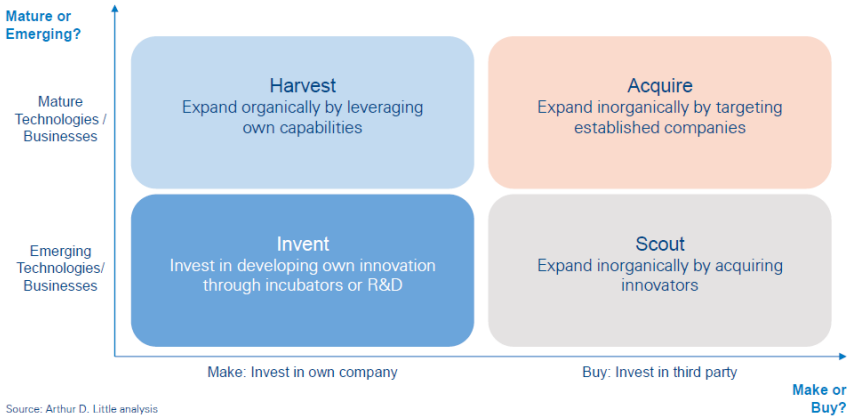
Diversification (Example for Business)

Stakeholders' Concerns During Mergers and Acquisitions

Investors	Will synergy benefits be downscaled?	Optimistic view of return on investment?	Will efficiency & short-term revenues fall?
Top management	Synergies difficult to attain	Internal conflicts: fractious management groups, key staff leave	Unrealistic euphoria
Middle management	Concern over job security	Expected to do M&A + day jobs at the same time	Overwhelmed by scale and scope
Front-line employees	What should I tell my customers?	When do lay-offs begin?	Who is setting my priorities and objectives?
Customers	So what?	Service quality dips, relationship suffers	No one is listening to me. Do I still matter?

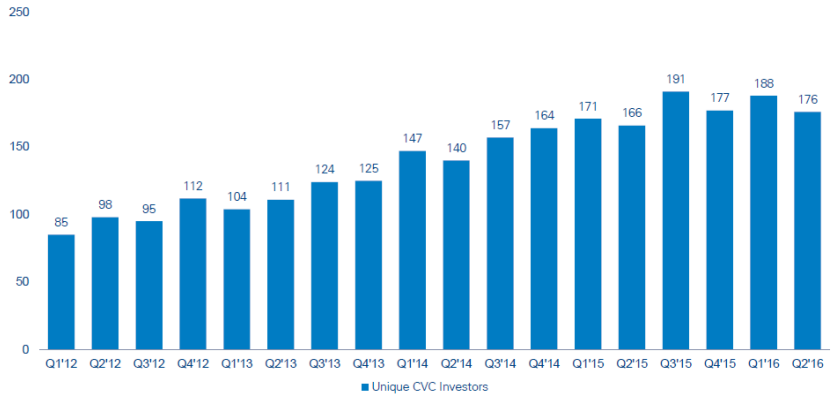
Diversification in the Era of Convergence

Arthur D. Little "Diversification Investment Model" framework



Source: Arthur D. Little analysis

Global number of unique CVC investors



Source : ADL (2017) Diversification in the Era of Convergence

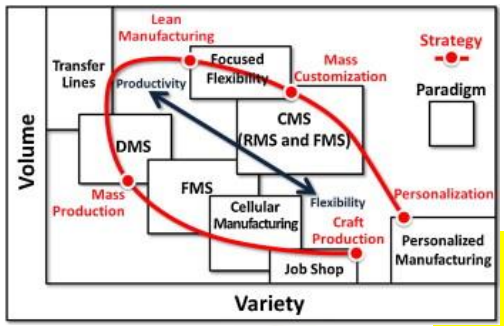
Key dimensions of the four investment models

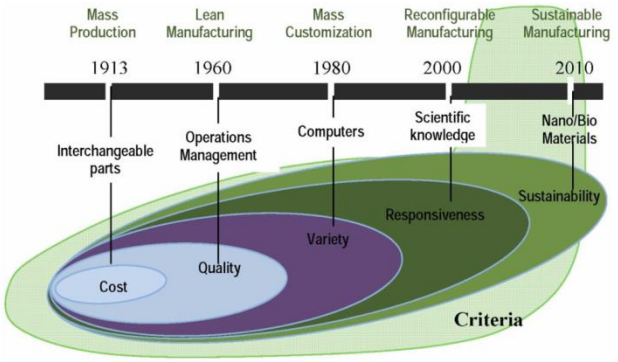
Critically important in Era of Convergence

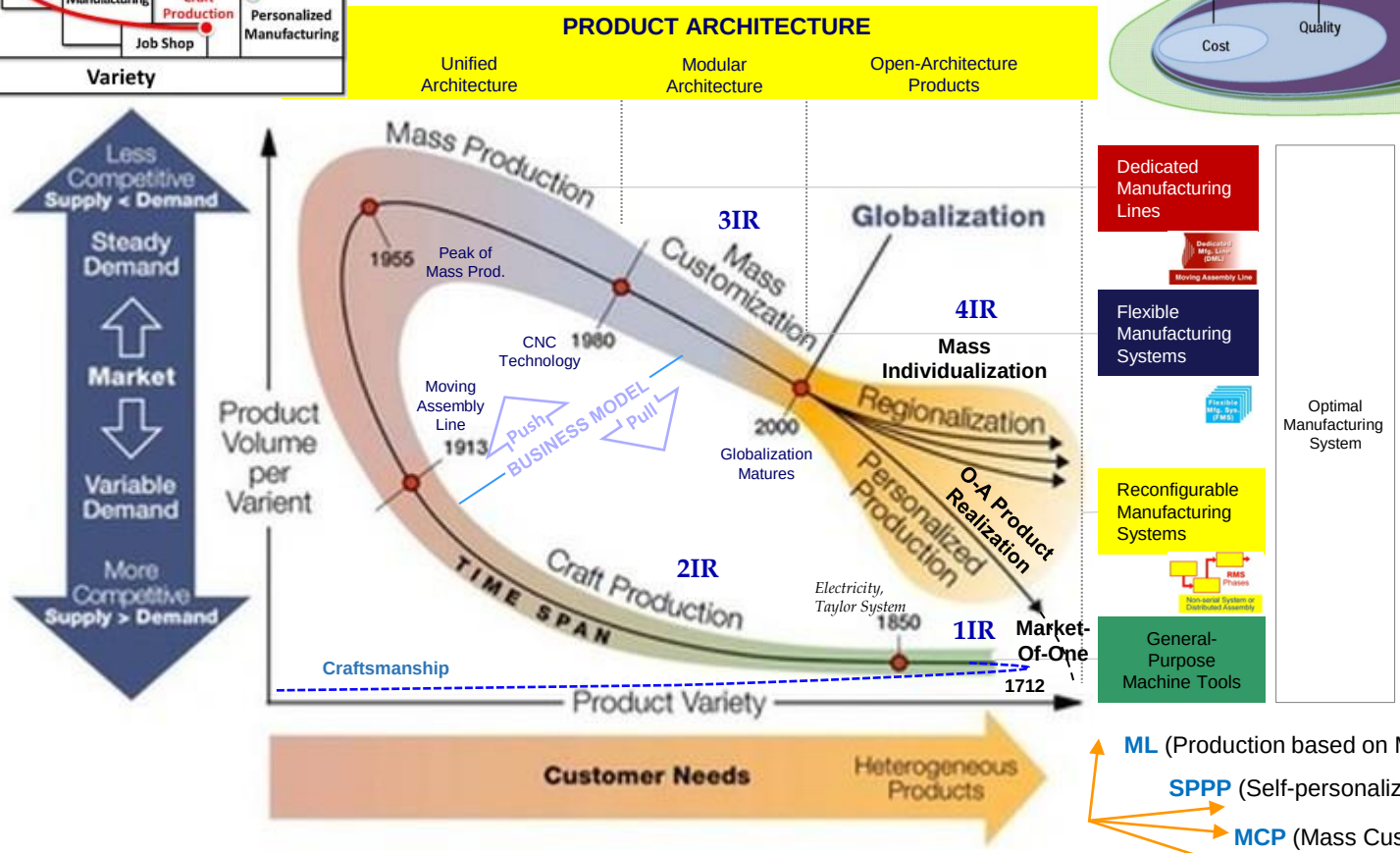
Dimension	Harvest: Invent, Scout; Acquire: Invent, Scout	Harvest: Acquire; Invent, Scout	Harvest, Acquire: Scout	Harvest, Acquire: Invent
1. Sectors to Focus on	Dependent on competencies that will be monetized	Tendency for acquisitions to be within or adjacent to mother company's business	High-technology sectors, focus on convergence and disruptive potential to core business	High-technology sectors within core business area
2. Distance from Core Business	Can vary significantly, depending on the capability/asset that is monetized	Typically within core business area or closely related areas	Broad span from being close to or extremely far from the core business	Within core business area
3. Geographical Focus	Typically local (focus on existing geographies)	Both local and international focus	Global focus on relevant innovation hubs (e.g., Silicon Valley)	Typically local focus (in coordination with global research institutes & universities)
4. Investment Size	Moderate equity or shareholder debt injections, sustained over time	Major acquisitions at infrequent, discrete intervals	Small acquisitions at frequent, discrete intervals	High and sustained R&D spending on a program-by-program basis
5. Investment Stage	Later stage, typically launching a business line in a commercially proven business model	Mature businesses	Early-stage venture capital (Seed to Series B)	Very early, "idea" stage (pre-Seed stage to prototype)
6. Typical Organization	Steered by a centralized investment committee and executed by relevant operational business units	Steered by a centralized investment committee and executed by a centralized M&A unit at the HQ level	Independent CVC investment entity (with substantial autonomy over investment decisions)	Steered by a centralized investment committee and executed by an R&D department
7. Degree of Risk	Relatively low risk; risk is mitigated by existing competency in field of investment	Moderate risk, depends on familiarity of businesses to be acquired	High risk due to uncertainty of emerging technologies	Very high risk that R&D projects will not yield tangible/meaningful benefits
8. FTEs (Effort Required)	High FTEs needed to identify opportunities and manage new businesses launched	Moderate FTEs needed given intensity of due diligence and valuation activities	Low FTEs but with the highly specialized skills needed for venture-capital investments	Moderate FTEs, requires excellent technical expertise and knowledge leadership
9. Time to Realize Returns	Less than 3 years	1–5 years	3–10 years	More than 10 years

4th Industrial Revolution & Diversification

4IR and Diversification







ML (Production based on Machine Learning)

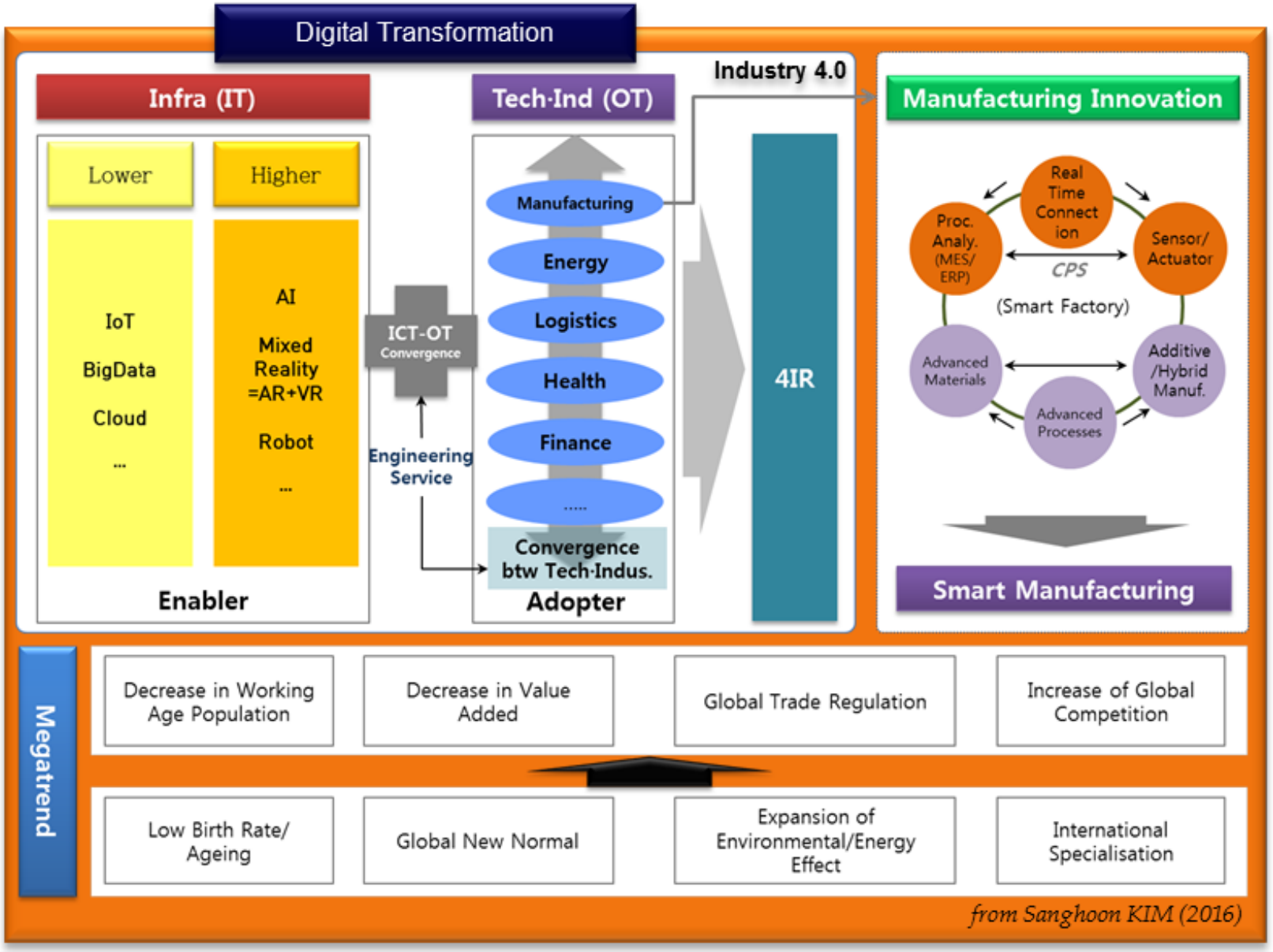
SPPP (Self-personalizing Products)

MCP (Mass Customization Products)

AMP (Additive Manufacturing Products)

Koren and Ulsoy (2004); Koren (2010) *The Global Manufacturing Revolution,* John Wiley

4IR and Convergence



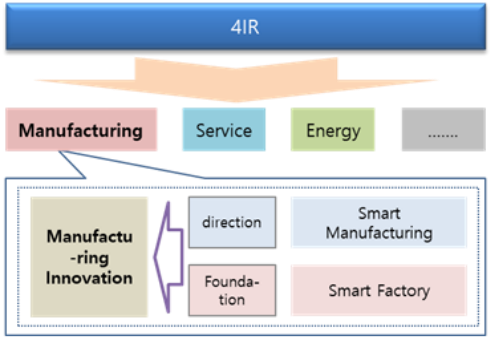
4IR and Convergence

1 AUTOMATION
- Products with high added value and high margins
- CAPEX intensive production
- High level of automation/ modern machine parc

2 OBSOLESCENCE
- Medium or low added value, low margins
- Labor intensive production
- Amortized or obsolete means of production

3 INDUSTRIE 4.0
- High added value products, high margins
- Flexible production
- High ROCE

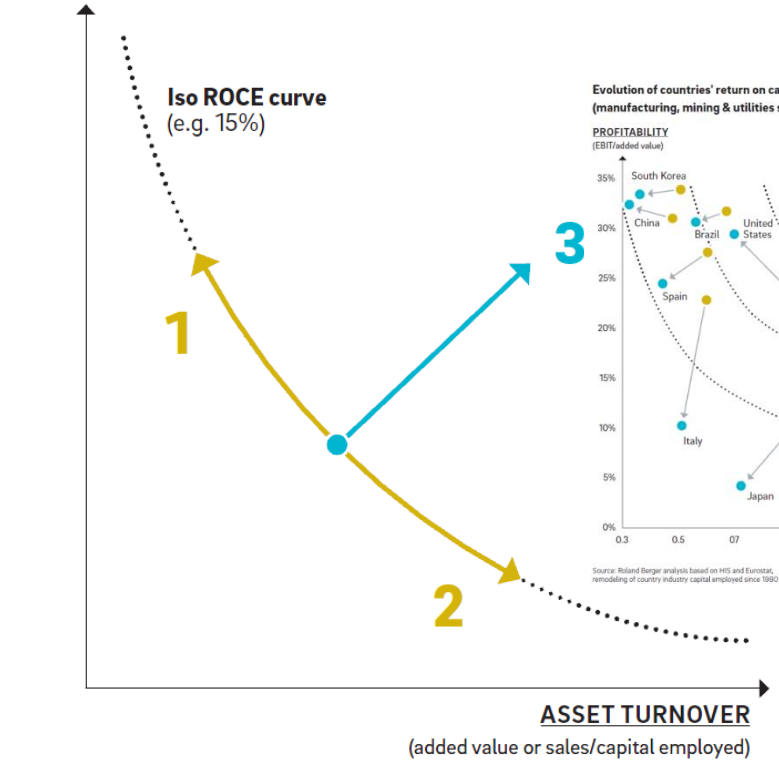
4IR
vs
Industry4.0
vs
Manufacturing Innovation
vs
Smart Manufacturing
vs
Smart Factory

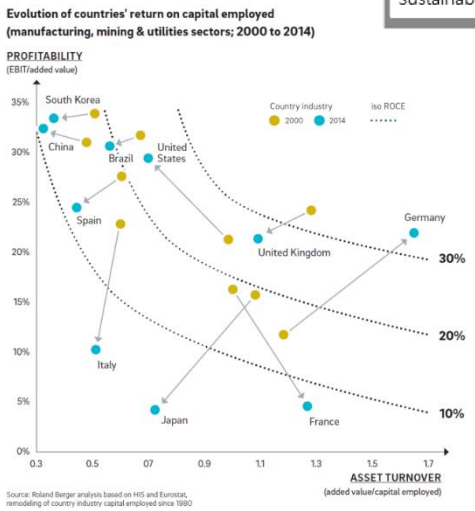


Enabler : IT(Information Tech.)
Integrative Design & Simulation
Sustainable Production

IT OT

Adopter : OT(Operational Tech.)
Overall Equip. Effect./Oper. Time
Process & Energy Optimisation



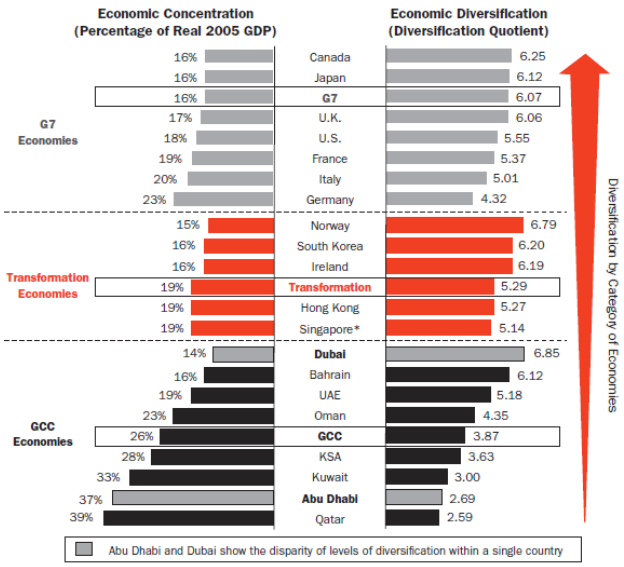


WHAT?	HOW?	WHO?
Added value and competitiveness	Aim for lower labor sensitivity, improve competitiveness, create entry barriers	Germany Japan United States China
Footprint and new business models	Produce personalized products at mass production cost	France Japan United States
Global leadership in 4.0 solutions	Develop technologies and standards, create export solutions	Germany China South Korea
Internationalization and risk management	Build flexible production lines to balance demand volatility, decrease capital cost of geographical expansion	Germany Japan China South Korea
Digital start-ups and ecosystems	Create platform to enable ecosystems, accelerate innovation via incubators and clusters	France China United States
Employee satisfaction at work	Reduce convenience at work, make work more meaningful for life	France Germany Japan
Sustainability and image	Reduce use of natural resources, improve image of industry	France Japan

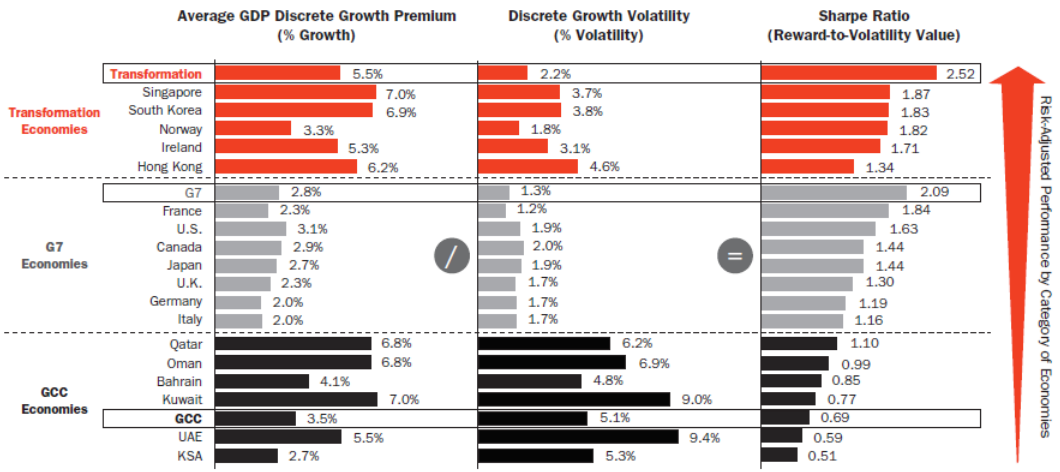
Korean Expriences

Economic Diversification : Key Indicators

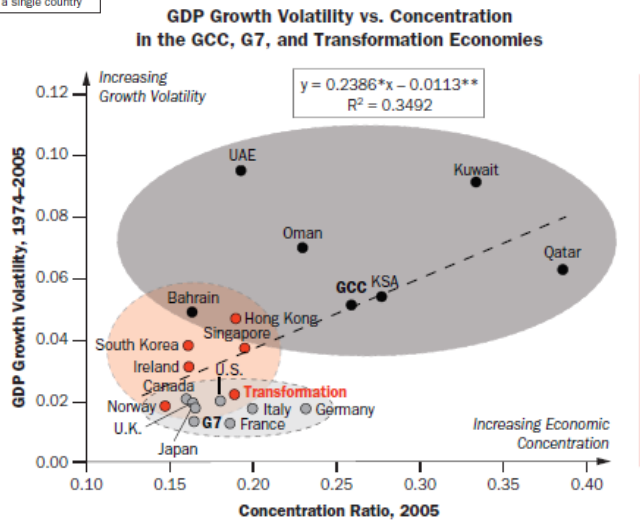
Economic Concentration and Diversification in the GCC, G7, and Transformation Economies, 2005

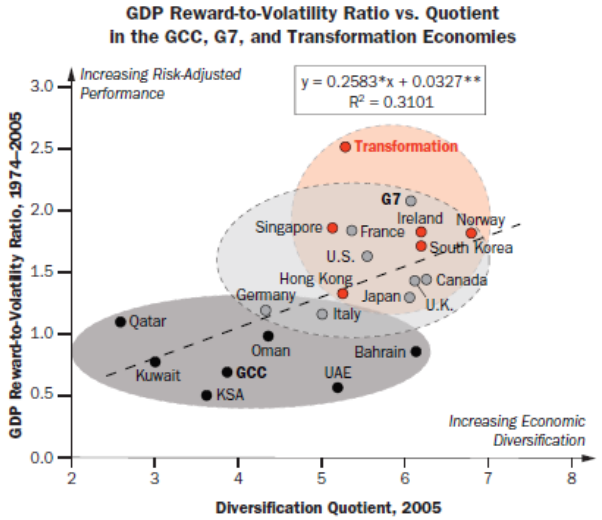


Real GDP Growth, Historical Volatility, and Risk-Adjusted Performance in the GCC, G7, and Transformation Economies, 1974–2005



Relationship between Economic Diversification and Economic Sustainability





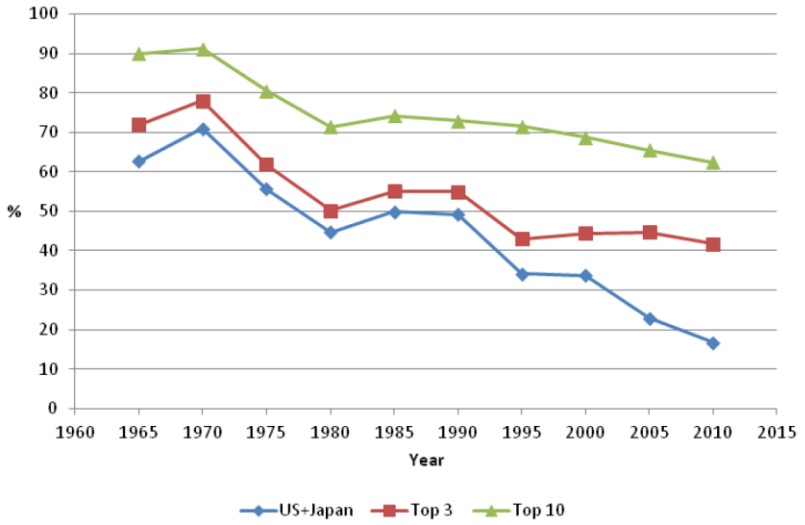
Source Booz&Co (2008) Economic Diversification

Export Diversification : Korea

Diversification of Market

The share of export to the largest trading partners is a common index for measuring export diversification. If we look at the share of export to ten largest markets, the diversification has improved significantly from around 1970 to the present. The share of the top ten countries was around 90% until 1970, but since then it has declined continuously to 60% in 2010. this pattern is an outcome of expanding to new markets. Until 1990, the United States and Japan were the two largest markets, and the share of export to these two countries occupied over 50% of the total exports. This pattern, however, start to change rapidly from the early 1990s due to the export to China. From the early 2000s, China has been the largest market for Korean producers.

Share of Exports to the Highest Trading Partners

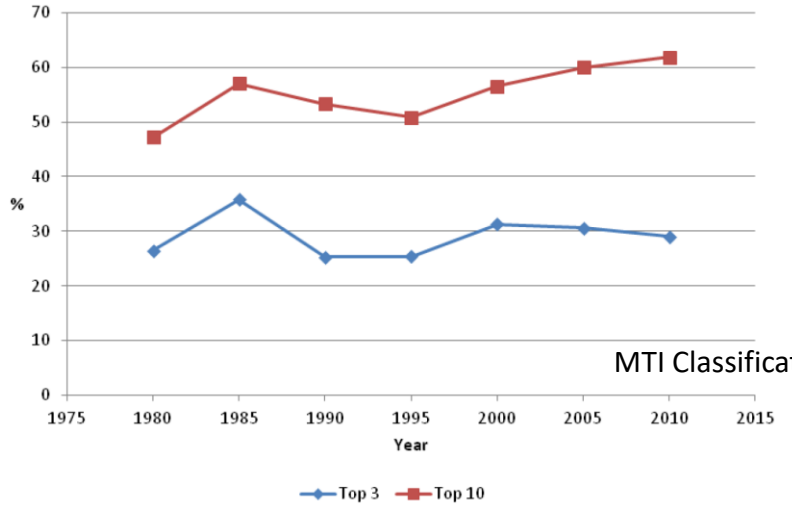


Diversification of Commodities:

Products from labor intensive process have occupied the top ten exporting goods. This pattern still continues even in 1990 when garments/clothes were the largest exporting goods. However, at this year, semiconductor became the second largest exporting goods, and since then, capital intensive goods or products requiring sophisticated technologies has become the major exports of Korea. This shift of product composition seems to contribute significantly to the lower diversification of exporting goods.

The rapid growth of exports for last five decades the Korean exports has got more dispersed across markets but concentration to major product has increased. It is inferred from the theoretical consideration that higher competitiveness has generated these patterns.

Ratio of Top 3 and Top 10 Exporting Goods to Total Export

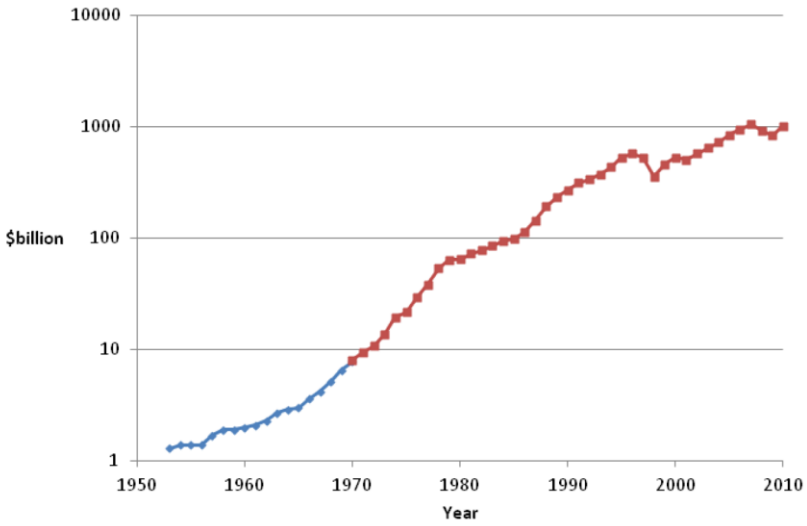


MTI Classification

Source: Korea International Trade Association, various years

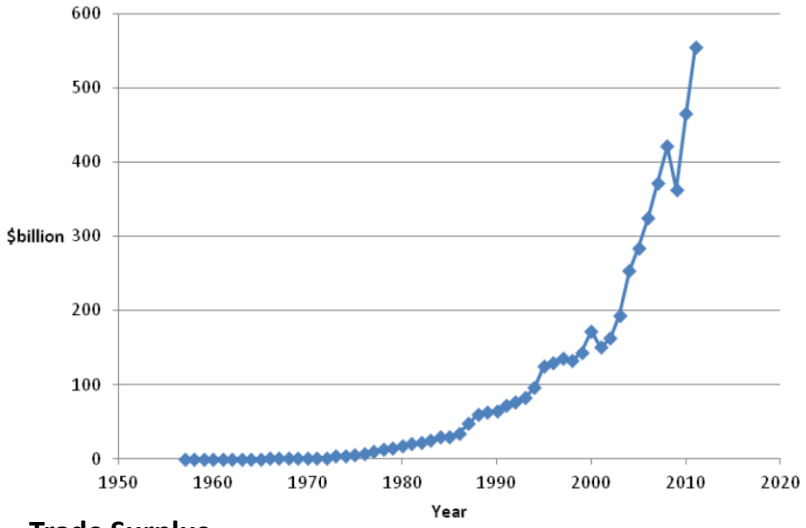
Export Diversification : Korea

GDP of Korea (Nominal)

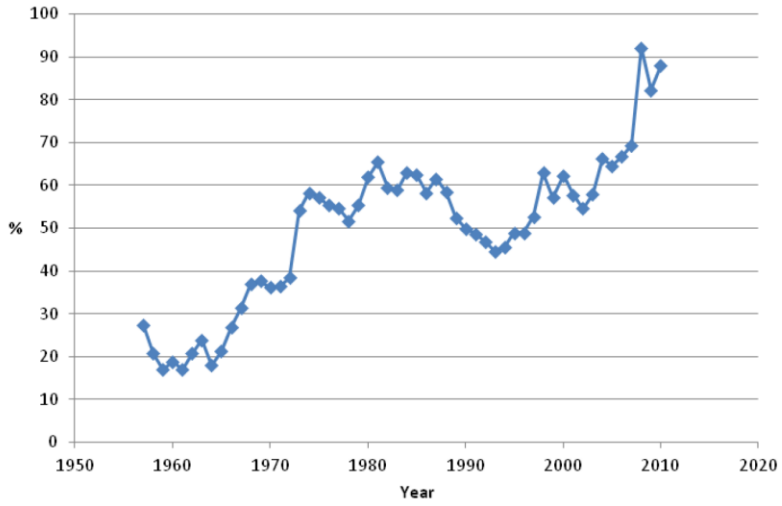


Total Export

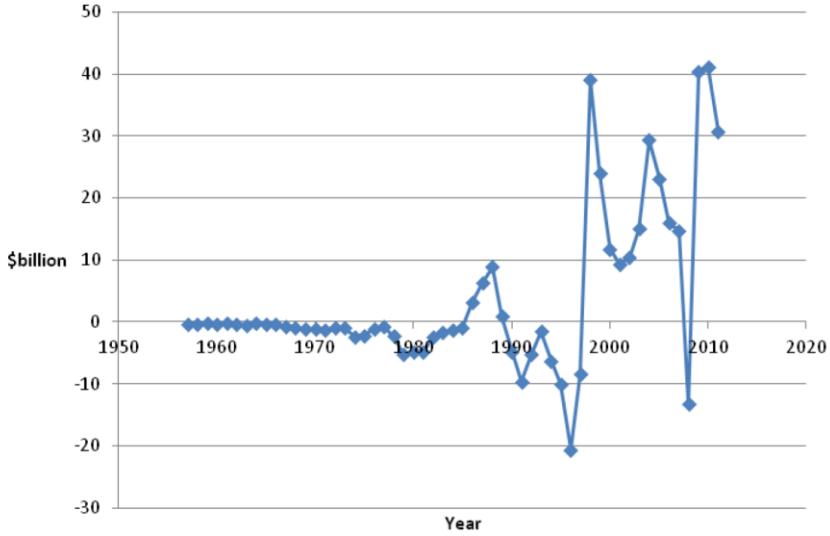
Source: Kim, D (2012), Export Diversification



Ratio of Total Trade to GDP



Trade Surplus



Data Source: Korea International Trade Association, various years

Business Diversification : Market Diversification

Business Groups(Chaebol) as a Percentage of the National Economy (2010)

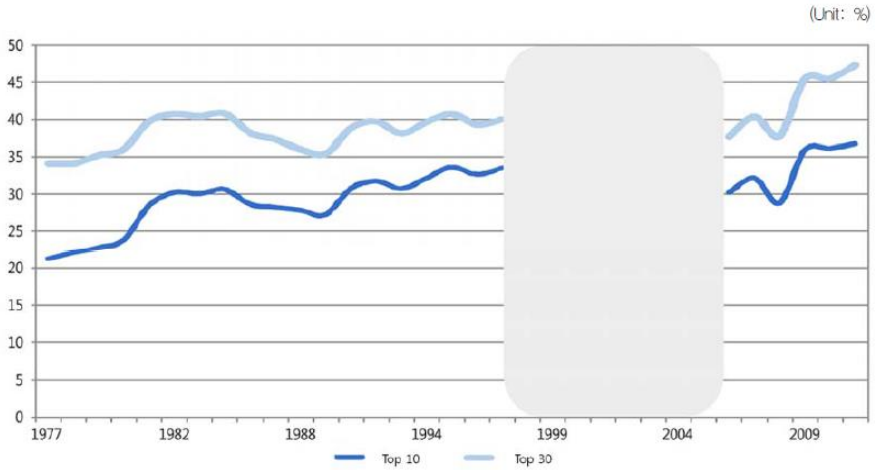
(Unit: %)

Rank	Sales			Workforce		
	All industries	Manufacturing	Services	All industries	Manufacturing	Services
Top 5	11.3	19.0	7.3	2.9	8.4	1.6
Top 10	18.8	36.1	9.9	4.7	13.7	2.5
Top 30	26.1	45.5	16.1	6.7	16.2	4.4
Top 55	29.1	49.9	18.4	8.0	18.7	5.5

Note: Data represents share for business groups out of all businesses with at least one employee.

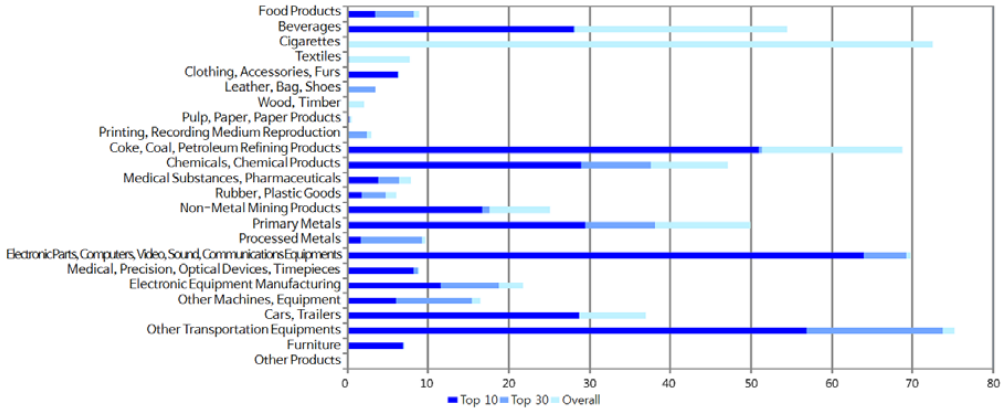
In terms of broader industry categories, business groups represented an overwhelming share of manufacturing (including mining) and a relatively low share of services (industries not including agriculture/forestry/fishing or mining/manufacturing).
The share of the top 30 business groups after 2006 differed little from its level in the mid-1990s. By 2009, however, it began to rise sharply to pass 45 percent. This change may be attributable to an economic trend since the late 2000s of rapid growth for a select few large corporations in mainstay industries like semiconductors, mobile phones, and automobiles, amid a general drop-off in growth for other businesses.

Manufacturing Share of Top Thirty Business Groups (1977~2011)

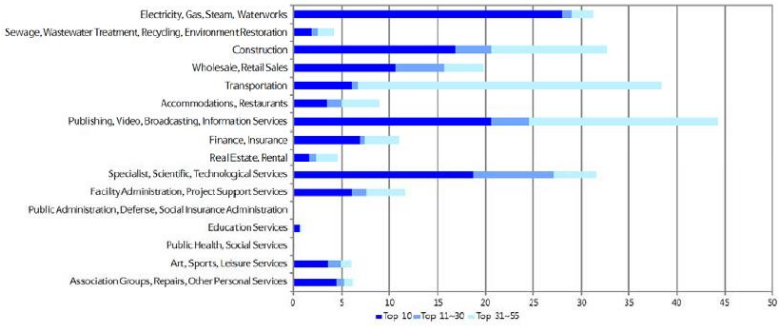


Korean economy underwent a change that was unprecedented in its severity. Because of a seven-year statistical gap that resulted from this period, there is currently no way of knowing how the economic share of business groups changed as a result of restructuring.

Share of Business Groups in Subcategorized Industries, Manufacturing Sector (Unit: %)



Share of Business Groups in General Industries, Services Sector (Unit: %)



Business Diversification : Market Diversification

Market Position for Business Groups: Percentage for Participating Industry Types (2010) (Unit: %)

Business group market position		1st	2nd or 3rd	Other	Total
All industry	No. of industries	23.7	31.7	44.7	100.0
	Sales	48.5	31.1	20.3	100.0
Manufacturing	No. of industries	24.2	20.1	55.7	100.0
	Shipments	69.6	17.5	13.0	100.0
Services	No. of industries	23.6	38.6	37.9	100.0
	Sales	39.3	37.0	23.6	100.0

Business Group Diversification (2010)

	Avg. no. of participating industries (all industries)	Avg. no. of participating areas (mining and manufacturing)	Avg. main industry specialization[1] (%)
1st~5th	88.0	59.3	66.0
6th~10th	80.0	87.8	56.6
11th~15th	78.4	21.0	48.5
16th~20th	29.6	11.0	58.7
21st~25th	49.2	23.4	66.8
26th~30th	31.2	10.0	61.2
31st~55th	29.9	16.1	62.2

Note: 1) Indicates share of main industry (subcategory) out of all business group sales.

Business groups have ventured into various industries, in many cases establishing a monopoly or oligopoly there. For industries where large business groups were represented among the top three ranking companies, the average concentration rate for those three companies (CR3) was 51.8 percent compared to 43.7 percent for industries where they were not represented. In other words, market concentration was higher in industries where large business groups held more of a monopoly or oligopoly.

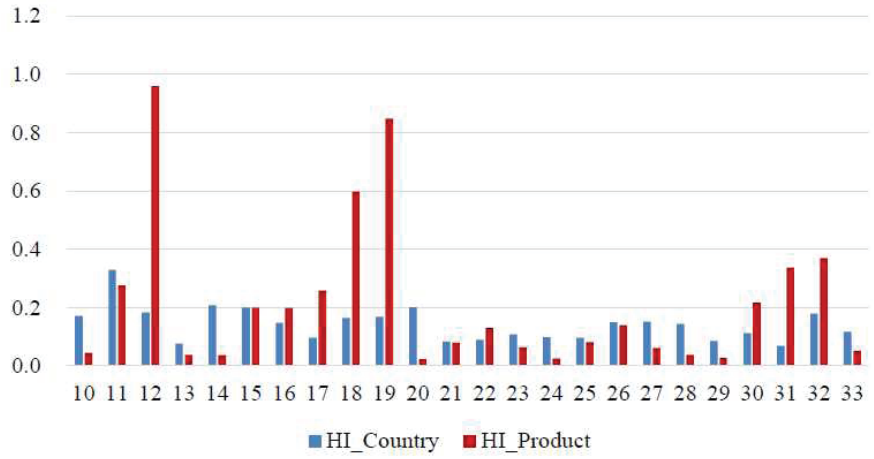
Business groups were present in 626 of the 1,131 total industries in Korea for 2010 (including all subdivisions), or 55.3 percent. In numerical terms, a business group affiliate held the top market share in 23.7 percent of all industries. These industries, however, accounted for fully 48.5 percent of all industry sales. Put differently, the industries where business groups held the top market share tended to be relatively large in scale — a phenomenon that was especially noticeable in manufacturing.

Generally, diversification is found to be more widespread the higher-ranked a business is. The top five business groups are participating in an average of 88 industries each, a number that declines the further one goes down the rankings. Differences in main industry specialization by business group scale were not found to be large.

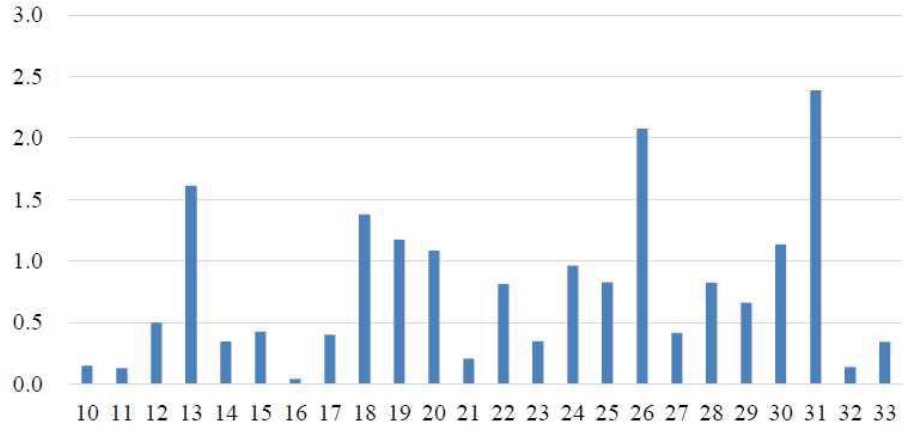
Source: Lee, J., (2014) KDI Policy Forum Vol. 262 November

Business Diversification : Market Diversification

Annual Average Herfindahl Indices for Korean Manufacturing Industries from 1999 to 2015



Annual Average RCA (revealed comparative advantage) Indices for Korean Manufacturing Industries from 1999 to 2015



Source : Lee, J., and Yu, B-K., (2018), BOK Working Paper, No 2018-25

Korean Standard Industrial Classification (Revision 9) for Manufacturing

Division Code	Name of Division
10	Food products
11	Beverages
12	Tobacco products
13	Textiles, except apparel
14	Wearing apparel, clothing accessories and fur articles
15	Tanning and dressing of leather, manufacture of luggage and footwear
16	Wood and products of wood and cork, except furniture
17	Pulp, paper and paper products
18	Printing and reproduction of recorded media
19	Coke, hard-coal and lignite fuel briquettes and refined petroleum products
20	Chemicals and chemical products, except pharmaceuticals and medicinal chemicals
21	Pharmaceuticals, medical chemicals and botanical products
22	Rubber and plastic products
23	Other non-metallic mineral products
24	Basic metal products
25	Fabricated metal products, except machinery and equipment
26	Electronic components, computer, radio, television and communication equipment and apparatuses
27	Medical, precision and optical instruments, watches and clocks
28	Electrical equipment
29	Other machinery and equipment
30	Motor vehicles, trailers and semi-trailers
31	Other transport equipment
32	Furniture
33	Other manufacturing

Business Diversification : Samsung

Fresh fields

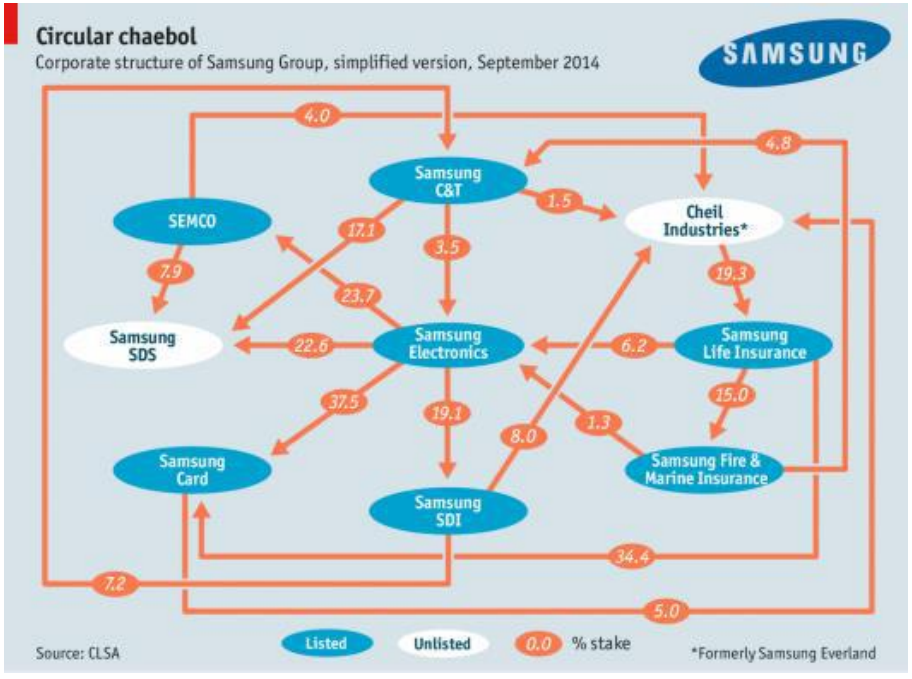
Samsung's new business areas

Sector	Investment, $bn	Ownership	Targets for 2020 Sales, $bn	Jobs	Status
Solar panels	5.1	100% Samsung SDI	8.5	10,000	Production began in January
LED lighting	7.3	50% Samsung Electronics, 50% Samsung Electro-Mechanics	15.2	17,000	Already selling in South Korea
E-vehicle batteries	4.6	50% Samsung SDI, 50% Bosch	8.7	7,600	Initial operations began in November 2010
Biotech drugs	1.8	40% Samsung Electronics, 40% Samsung Everland, 10% Samsung C&T, 10% Quintiles	1.5	1,000	Factory to begin in 2013; developing biosimilars now for patents expiring in 2016
Medical devices	1.0	100% Samsung Electronics	8.5	10,300	Blood-testing unit available, X-ray machine ready in 1-2 years, acquired ultrasound maker

Sources: Samsung; *The Economist*

Circular chaebol

Corporate structure of Samsung Group, simplified version, September 2014



(Frent, 2017a, p. 25)

unit: revenues in billion euros

COMPANY	Country	Revenues	Main medtech activities
Medtronic		26.06	Wide range of therapeutic devices
Philips*		24.52	Imaging devices and healthcare IT
J&J Medical Devices		22.70	Wide range of therapeutic devices
Abbott Laboratories*		18.84	Diagnostics and cardiovascular devices
GE Healthcare		16.54	Imaging devices, life sciences and healthcare IT
Siemens Healthineers		13.54	Imaging devices, life sciences and healthcare IT
Becton Dickinson		11.28	Surgical devices
Roche Diagnostics		10.52	In vitro diagnostics and diabetes care
Stryker		10.23	Orthopaedics, surgery supplies, neurology
Boston Scientific		7.58	Cardiovascular, medical surgery instruments

Source: Maier (2017) 'Corporate diversification strategies'

Patent (USPTO) Registration : LE vs SME

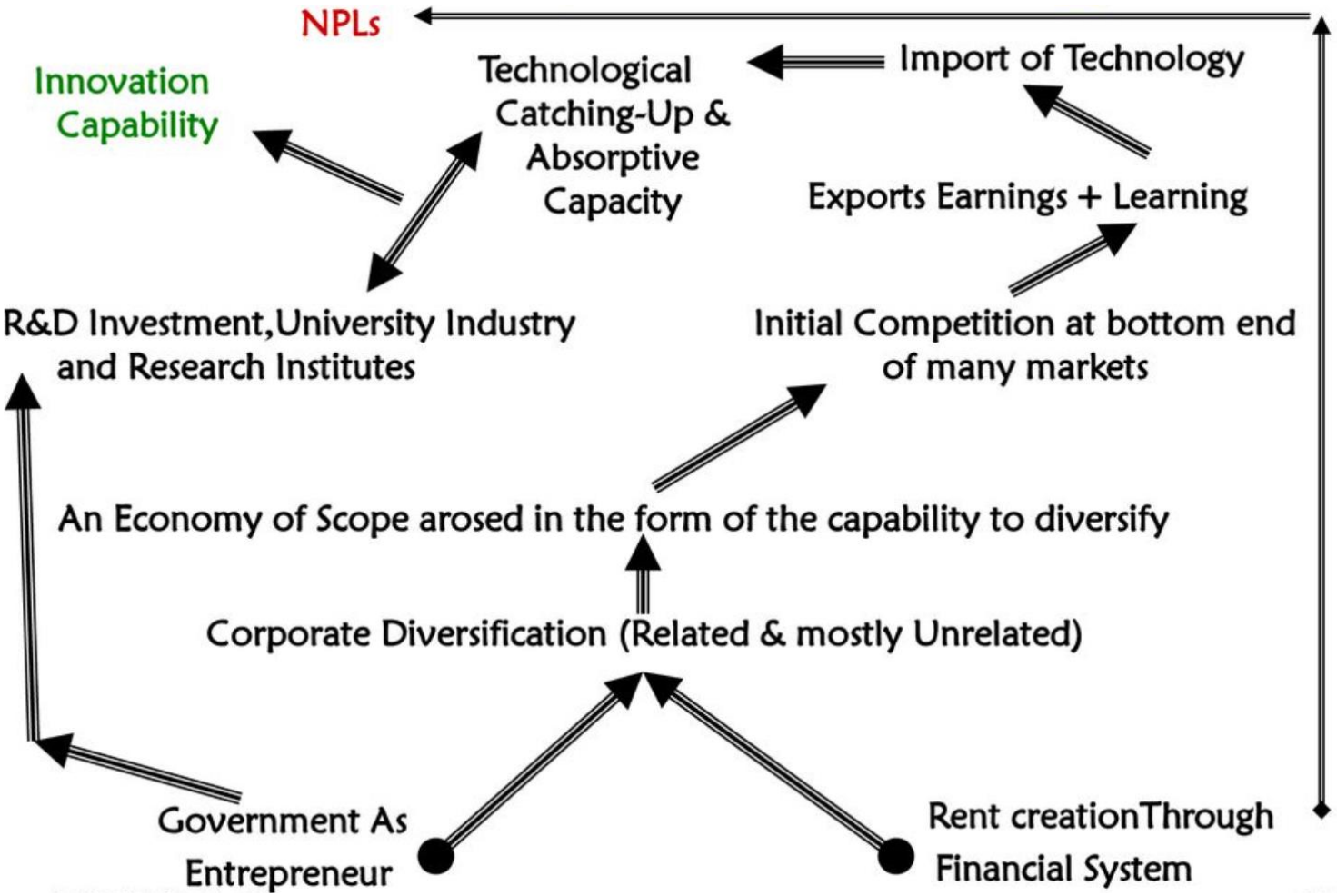
Number of patents registered in USPTO (by Country origin)

World Rank	Country	2007	2008	2009	2010	2011	2012	2013	2014	2015	% ('15)	CAGR ('07~'15)
1	Japan	33,354	33,682	35,501	44,814	46,139	50,677	51,919	53,849	52,409	33.3%	5.8%
2	S. Korea	6,295	7,549	8,762	11,671	12,262	13,233	14,548	16,469	17,924	11.4%	14.0%
3	Germany	9,051	8,915	9,000	12,363	11,920	13,835	15,498	16,550	16,549	10.5%	7.8%
4	Taiwan	6,128	6,339	6,642	8,238	8,781	10,646	11,071	11,332	11,690	7.4%	8.4%
5	China	772	1,225	1,655	2,657	3,174	4,637	5,928	7,236	8,116	5.2%	34.2%
6	Canada	3,318	3,393	3,655	4,852	5,012	5,775	6,547	7,043	6,802	4.3%	9.4%
7	France	3,130	3,163	3,140	4,450	4,531	5,386	6,083	6,691	6,565	4.2%	9.7%
8	UK	3,292	3,094	3,175	4,302	4,307	5,213	5,806	6,487	6,417	4.1%	8.7%
9	Israel	1,107	1,166	1,404	1,819	1,981	2,474	3,012	3,471	3,628	2.3%	16.0%
10	India	546	633	679	1,098	1,234	1,691	2,424	2,987	3,355	2.1%	25.5%
11	Italy	1,302	1,357	1,346	1,798	1,885	2,120	2,499	2,628	2,645	1.7%	9.3%
12	Sweden	1,061	1,060	1,014	1,434	1,711	2,081	2,271	2,767	2,633	1.7%	12.0%
	Others	8,400	8,695	8,994	12,326	12,942	14,361	16,636	18,547	18,705	11.9%	10.5%
Total		77,756	80,271	84,967	111,822	115,879	132,129	144,242	156,057	157,438	100.0%	9.2%

Number of USPTO patents for leading companies

Rank ('15)	Country	No. of Patents in USPTO	No. of firms within in 30	No. of Patents by the firms within rank 30	% (patents within 30 firms/total no. in USPTO)	Average no. of USPTO patent per firm within rank 30
1	U.S.	140,969	12	26,757	19.0%	1.6%
2	JAPAN	52,409	10	19,101	36.4%	3.6%
3	KOREA, SOUTH	17,924	3	9,125	50.9%	17.0%
4	GERMANY	16,549	2	2,017	12.2%	6.1%
5	TAIWAN	11,690	1	1,758	15.0%	15.0%
	미국외 출원인 전체	157,438	30	155,119	98.5%	3.3%

Korean Strategy for Economic Growth

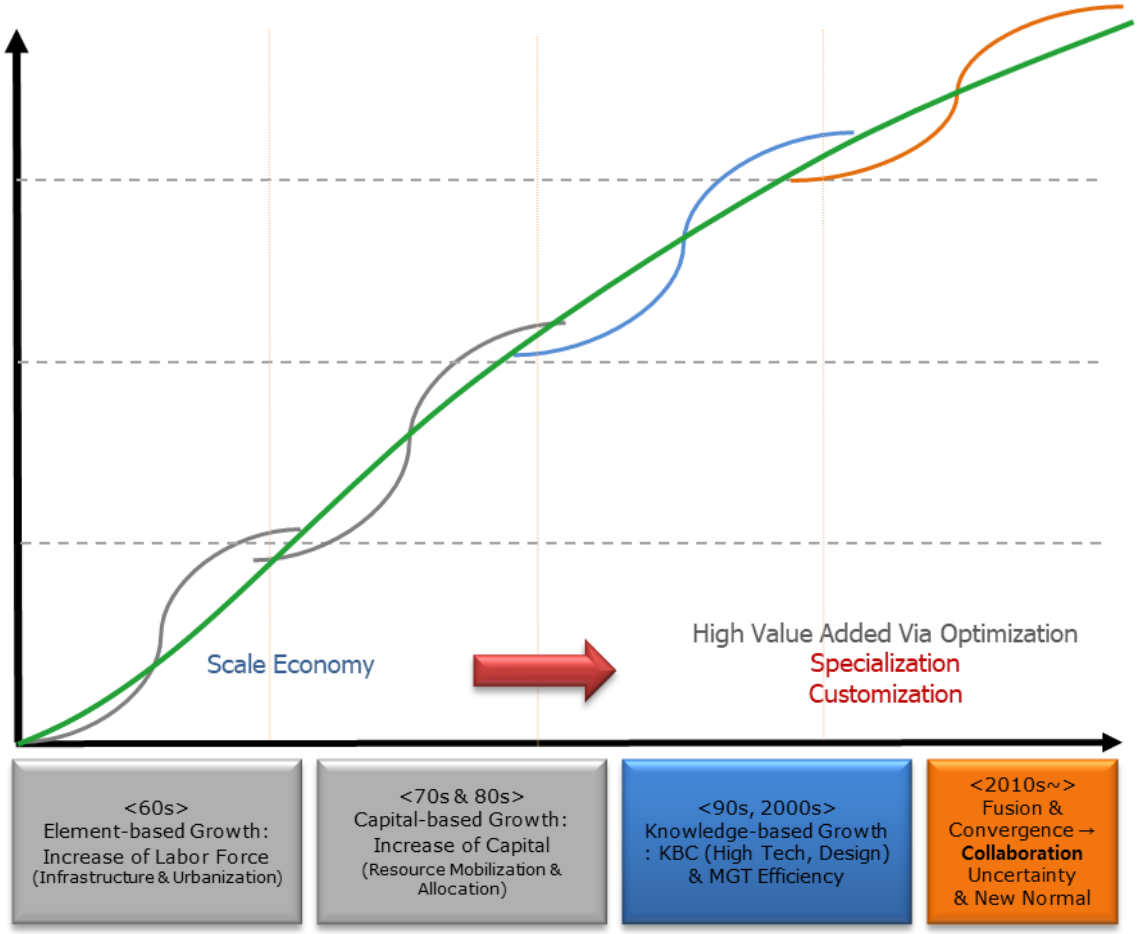


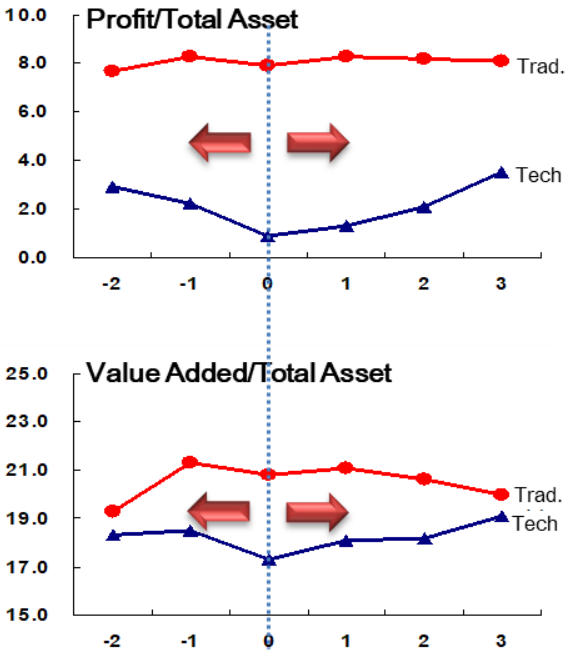
Korean Strategy for Economic Growth

1. Policy Loans (1960-1980)
   : Interest rate was controlled by government for specific sector
2. Export Finance
   : Interest rate subsidies (Korea Export-Import Bank)
3. Export Insurance
   : Korea Re-insurance Corporation (1968) (privatized in 2002),
   Korea Export Insurance Corporation (1992)
4. Corporate Procurement Loan Scheme
   : Introduced by Bank of Korea (2000)
5. Credit Guarantee System
   : Korea Credit Guarantee Fund (1976),
   Korea Technology Credit Guarantee Fund (KOTEC, or KIBO) (1989)
6. Non Performing Loans
   : Korea Asset Management Corporation (1997) (now absorbed to KDB)
7. Government Venture Capital Fund
   : Korea Venture Investment Corporation (2006) (Fund of Funds)
8. Second Tier Stock Market : KOSDAQ (1996), KONEX (2013)

Industry Development Strategies in Korea

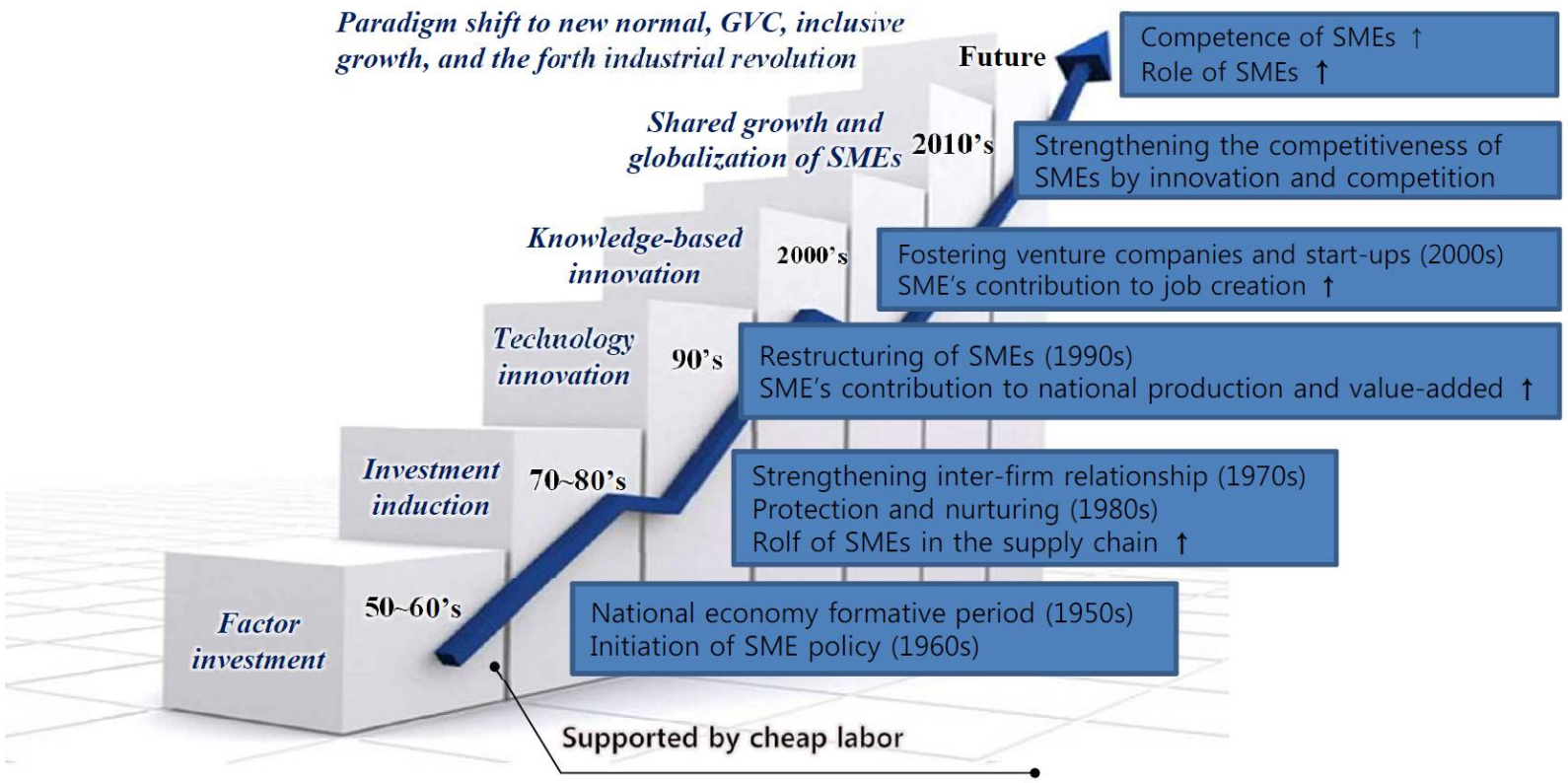
Source of Productivity (Staged)





Tech-Based companies
produce more profits and values

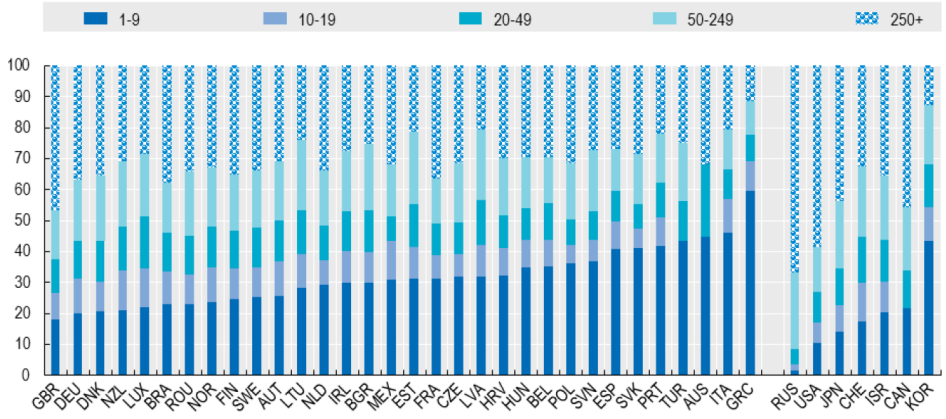
SME Promotion Strategies in Korea



Status of SMEs in Korea

SMEs are the main source of jobs in the business sector

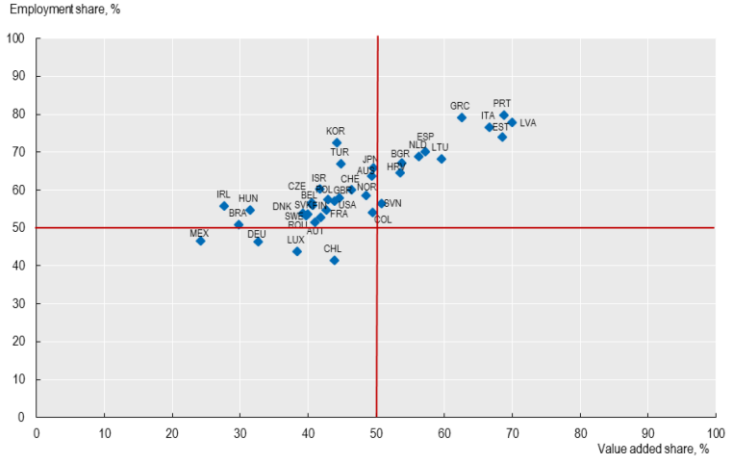
Percentage of all persons employed, total business economy, 2014 or latest available year



Source: OECD (2017), Entrepreneurship at a Glance 2017,

There are large differences in the SME contribution to employment and value added across countries, particularly in manufacturing

Percentage of total employment and total value added in manufacturing, total SME (1-249 employed persons), 2014 or latest available year

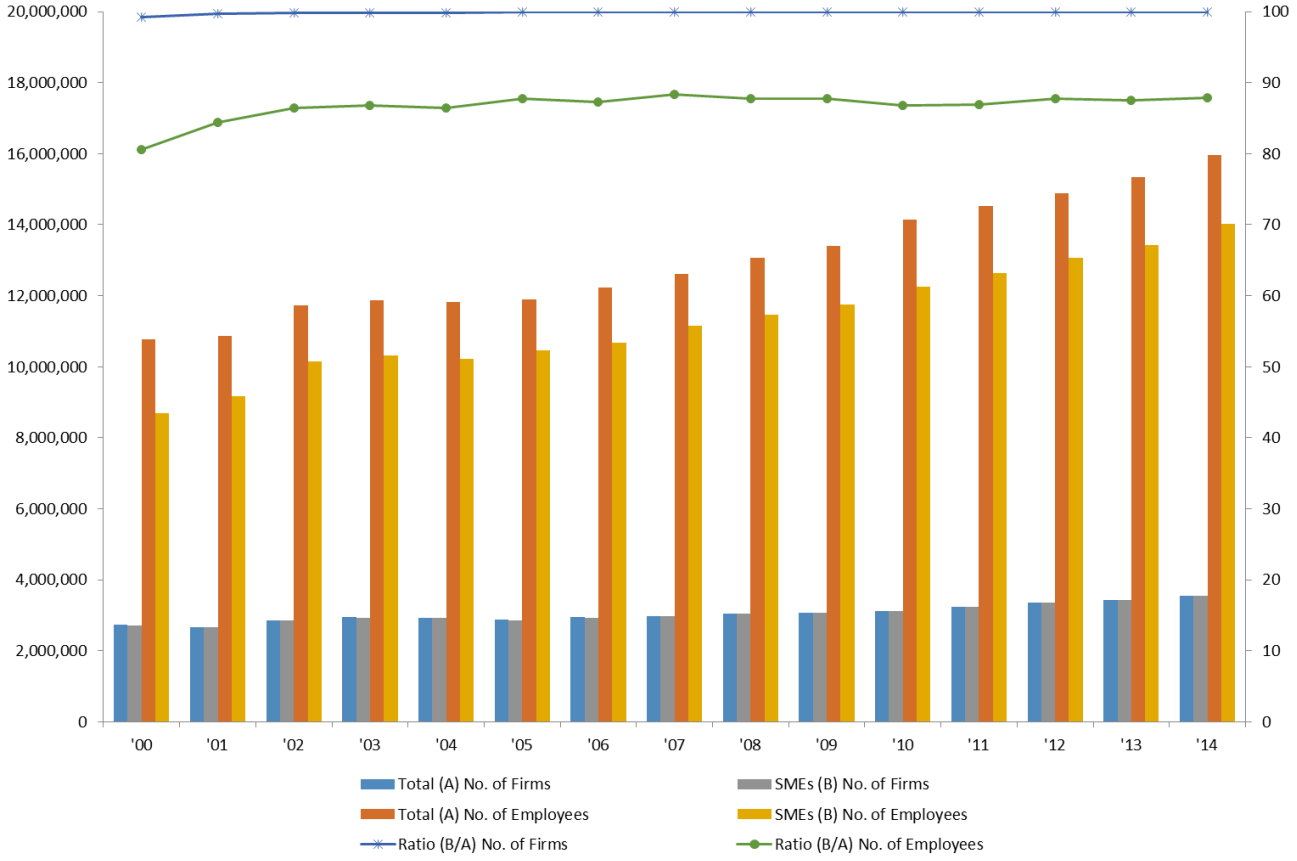


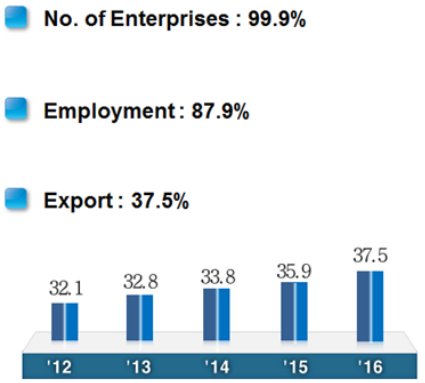
SMEs are less connected than large firms to international knowledge networks

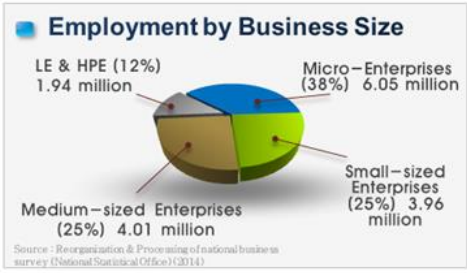
Firms engaged in international collaboration for innovation, by firm size, as a percentage of product and/or process-innovating firms in each size category, 2010-12

Source: OECD (2015), OECD Science, Technology and Industry Scoreboard 2015

Status of SMEs in Korea

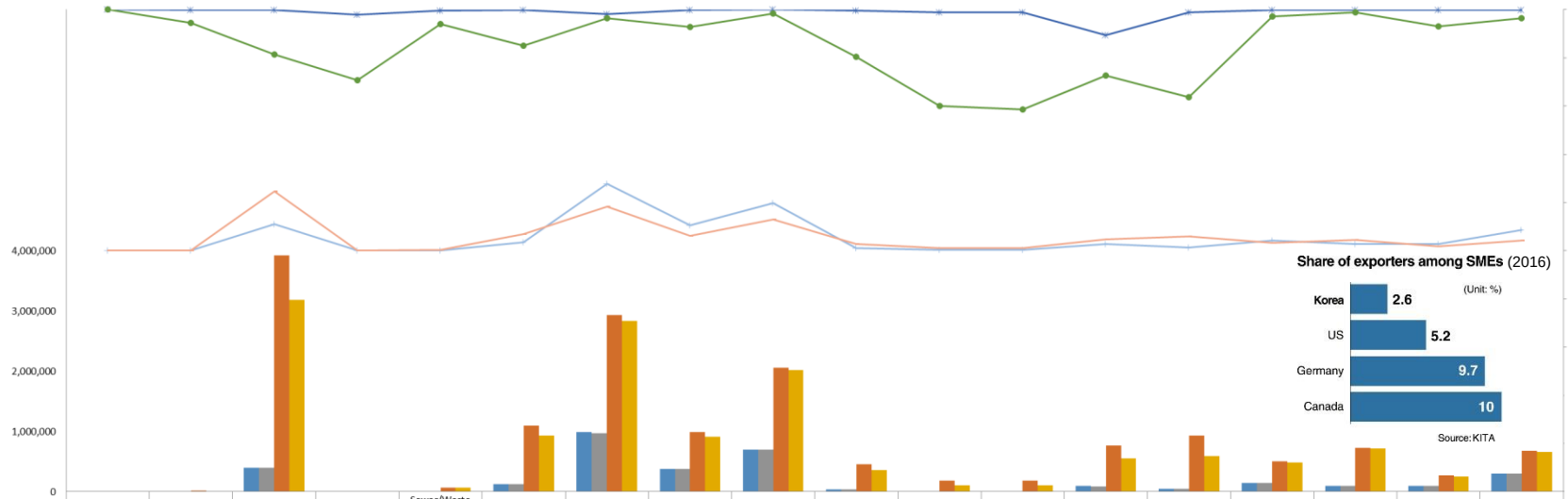






http://www.mss.go.kr/ (2017)

Status of SMEs in Korea

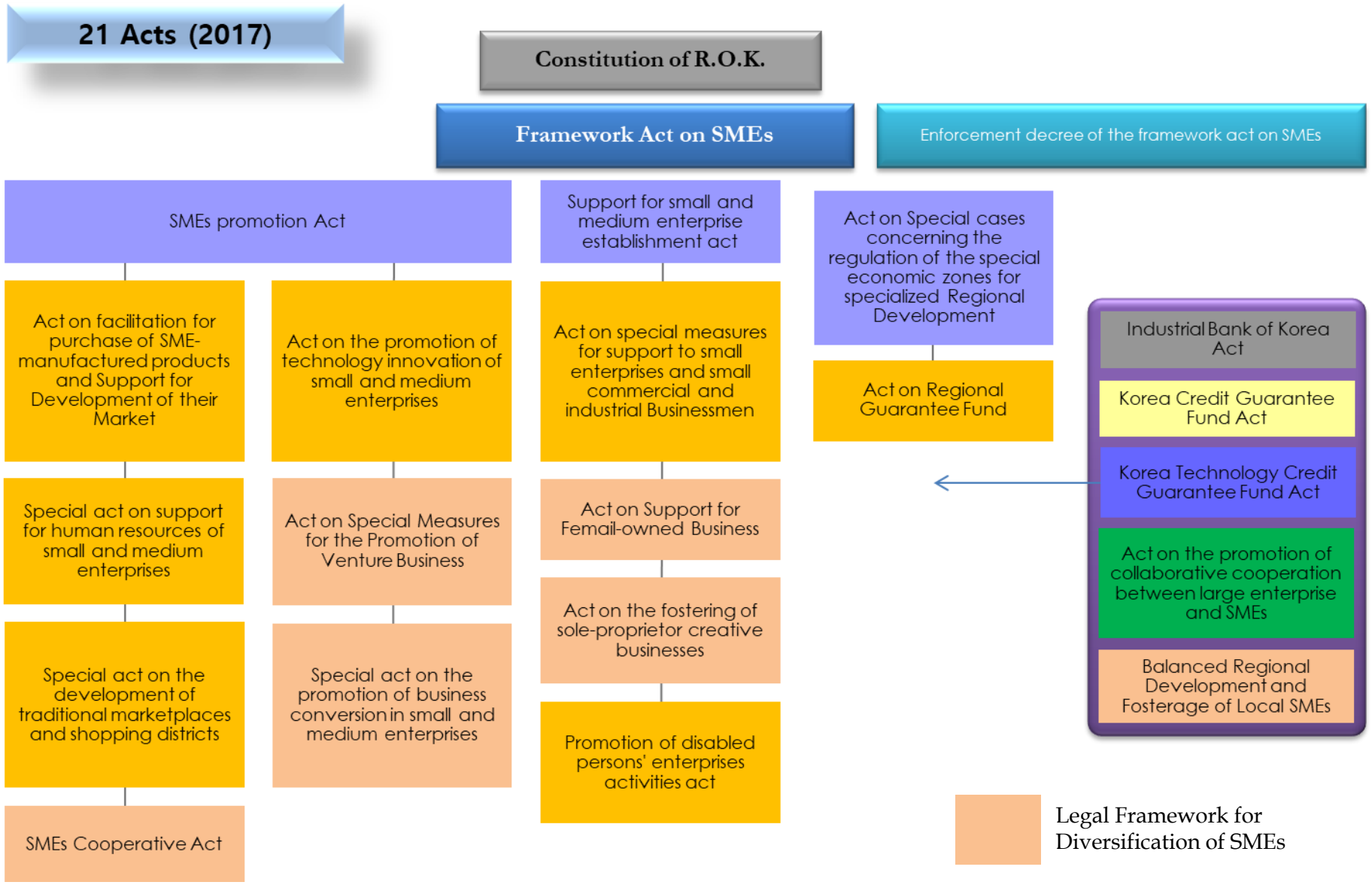


	Agriculture, Forestry & Fishery	Mining	Manufacturing	Electricity, Gas, Steam & Water	Sewer/Waste Treatment, Raw Material Reproduction & Environmental Restoration	Construction	Wholesale & Retail	Transportation	Accommodation & Restaurants	Publishing, Video, Broadcasting and Information Service	Finance & Insurance	Real Estate & Rental	Specialized, Science & Technical Service	Business Facility Management & Business Support Service	EducationService	Health & Social Welfare	Art, Sports & Leisure-related Service	Repair & Other Individual Services
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	P	Q	R	S
Total (A) No. of Firms	1,144	1,998	393,361	607	7,124	128,018	986,370	375,483	701,262	36,628	10,897	11,529	97,607	47,753	149,274	100,703	96,608	300,680
SMEs (B) No. of Firms	1,144	1,997	392,665	594	7,096	127,794	968,662	375,381	701,181	36,506	10,777	11,395	87,391	47,188	149,194	100,680	96,566	300,532
Total (A) No. of Emplyees	11,940	14,331	3,918,150	12,520	71,050	1,093,634	2,935,726	984,789	2,055,340	450,612	183,149	185,278	765,794	932,803	502,751	730,544	273,101	681,435
SMEs (B) No. of Emplyees	11,940	13,538	3,185,560	8,868	66,892	930,813	2,833,469	914,971	2,021,946	362,444	110,129	108,727	557,169	593,499	489,119	721,686	253,823	656,650
Ratio (B/A) No. of Firms	100.0%	99.9%	99.8%	97.9%	99.6%	99.8%	98.2%	100.0%	100.0%	99.7%	98.9%	98.8%	89.5%	98.8%	99.9%	100.0%	100.0%	100.0%
Ratio (B/A) No. of Emplyees	100.0%	94.5%	81.3%	70.8%	94.1%	85.1%	96.5%	92.9%	98.4%	80.4%	60.1%	58.7%	72.8%	63.6%	97.3%	98.8%	92.9%	96.4%
SME Ratio by industry No. of Firms	0.0%	0.1%	11.1%	0.0%	0.2%	3.6%	27.8%	10.6%	19.8%	1.0%	0.3%	0.3%	2.8%	1.3%	4.2%	2.8%	2.7%	8.5%
SME Ratio by industry No. of Emplyees	0.1%	0.1%	24.5%	0.1%	0.4%	6.9%	18.4%	6.2%	12.9%	2.8%	1.1%	1.2%	4.8%	5.8%	3.1%	4.6%	1.7%	4.3%

In Korea,

More than 50% of SMEs are reside in Retail (27.8%), Accommodation & Restaurant (19.8%) and Manufacturing (11.1%) sector
In terms of employees, these 3 sectors are also outstanding, represent more than 50%
Number of employees per firm is approx. 8.1 for manufacturing, while retail is 2.9 and accommodation is 2.8
Most of SMEs, especially in service sector, do not have much competency for diversification!!

Diversified Measurement and Support

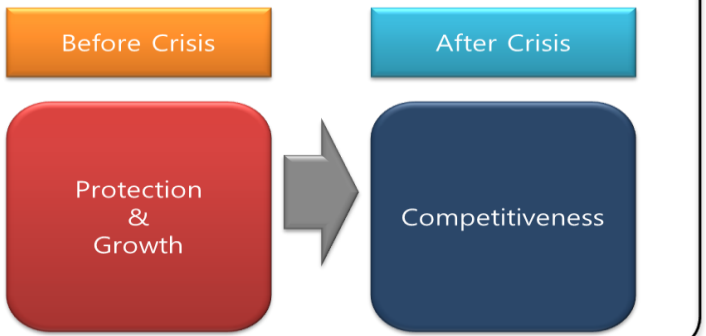


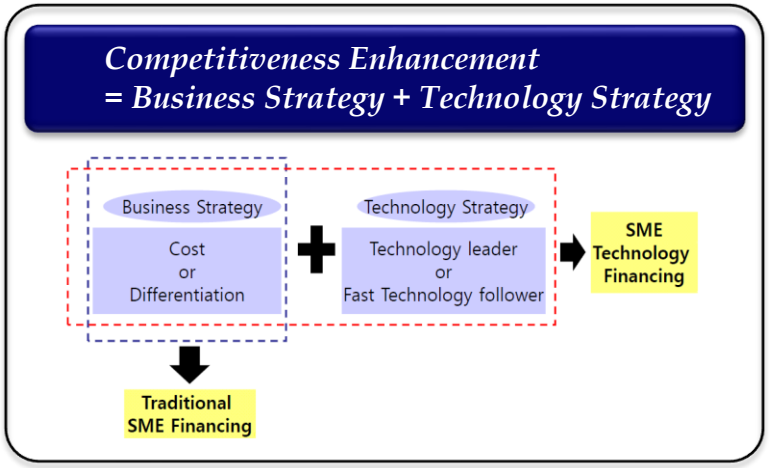
Diversified Measurement and Support

For SMEs and Technology Innovation

The Paradigm Shift Requires Change in Business Strategy of SMEs

The paradigm shift in SME policy also influenced on the further emphasis upon 'Technology Financing' issues.





SME Policy Direction in Korea

SME policy

- Monetary Policy
  (Growth First Distribution Later)
- Focus on SME access to financing
  Mostly Bank Loan
- Credit Guarantee is dominant

More Consorted Focus on Innovative SMEs

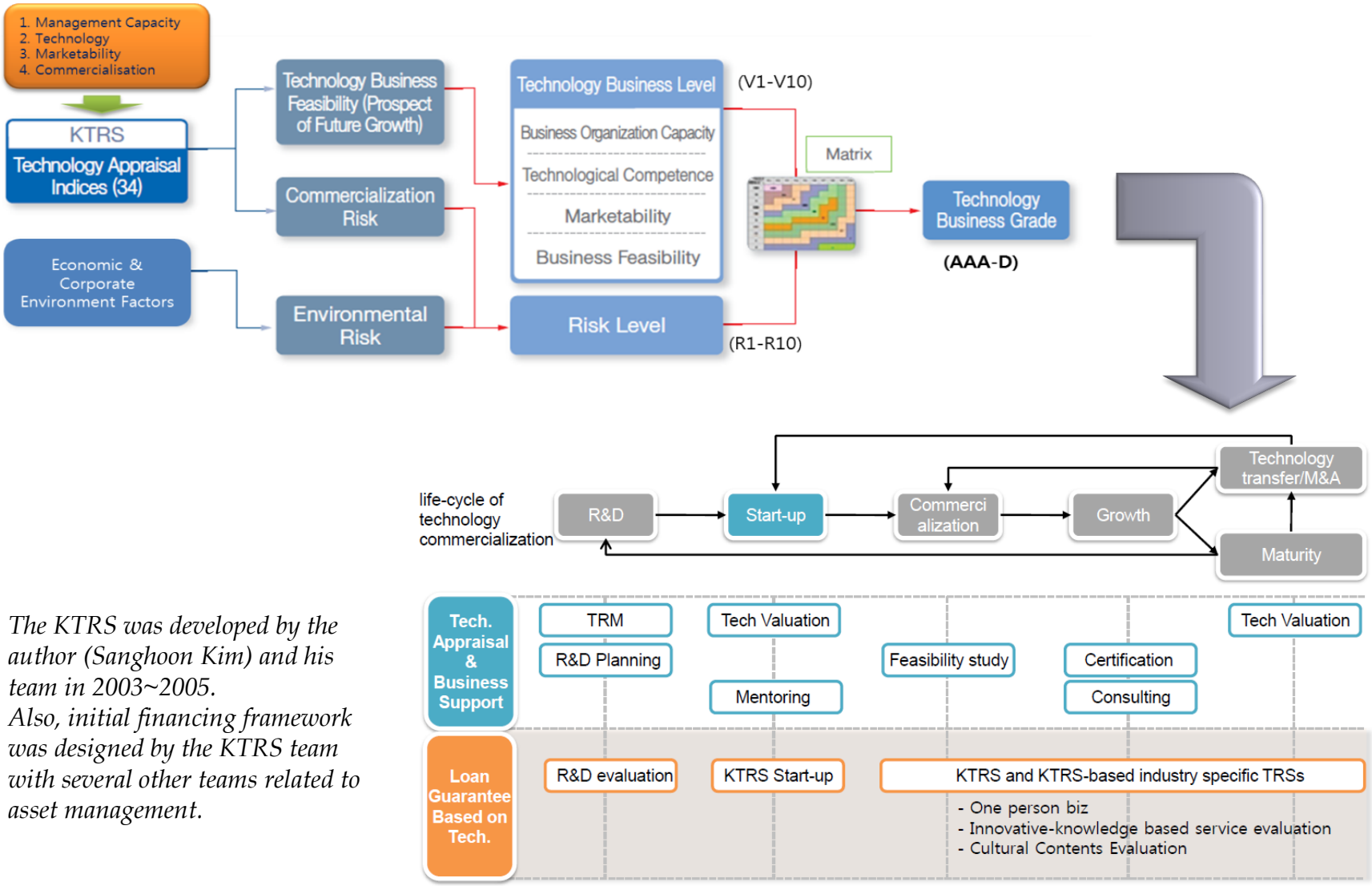
- Industrial Policy (National Strategy)
- Focus on cultivating competitive firms
  ex) Firms with Technological Excellence & Innovation Capability
- Differentiated evaluation is crucial

Dilemma between Efficiencies and Equal Opportunities

- "Selection & Concentration" and "Even Allocation of Resources" → **Initiation of KTRS**

** Korean Venture System (Special measures to overcome "Even Allocation of Resources"*

Diversified Measurement and Support



The KTRS was developed by the author (Sanghoon Kim) and his team in 2003~2005.
Also, initial financing framework was designed by the KTRS team with several other teams related to asset management.

Diversified Measurement and Support

PRO INNO EUROPE®
INNO NETS
INNO-Partnering Forum

European Commission

The SME loan guarantees are based on an SMEs technology and business prospects as opposed to its financial assets. What makes it unique compared to European systems is the **very structured and formalised Technology Appraisal system** which it operates through a network of technology appraisal centres. (page 8)
…..
In terms of transferability, in principle **there is no reason why such a system could not be used in a European context**. There are of course practical challenges which would need to be overcome. (page 24)

(from 'South Korea SME Innovation Support Schemes', Final Report on IPF(Inno-Partnering Forum) Review visit to South Korea, EC, April 2012)

Everything that we do today is less valuable than KTRS…

(from IPF Conference Report, Nov, 2012)

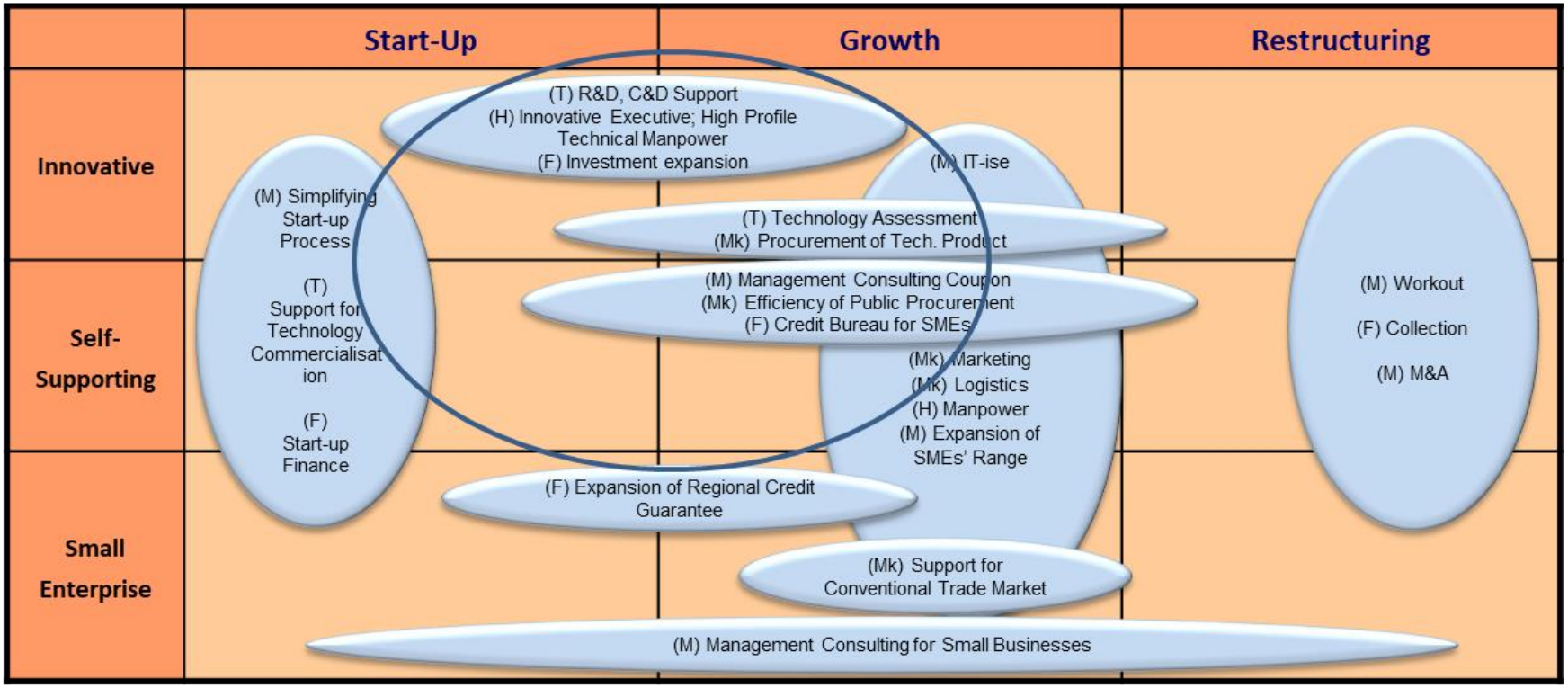
International Exchange Programmes

eu2013.ie *June, 12, 2013*

Japan JFC (2013.2, 2013.12)
Taiwan SMEG (2014.11)
Singapore SPRING(2015.4)
WIPO GREEN & UN : Philippines Manila Seminar (April 2015)
Vietnam KSP (2015.5)

Target Setting : SME Strategy Diversification and Positioning

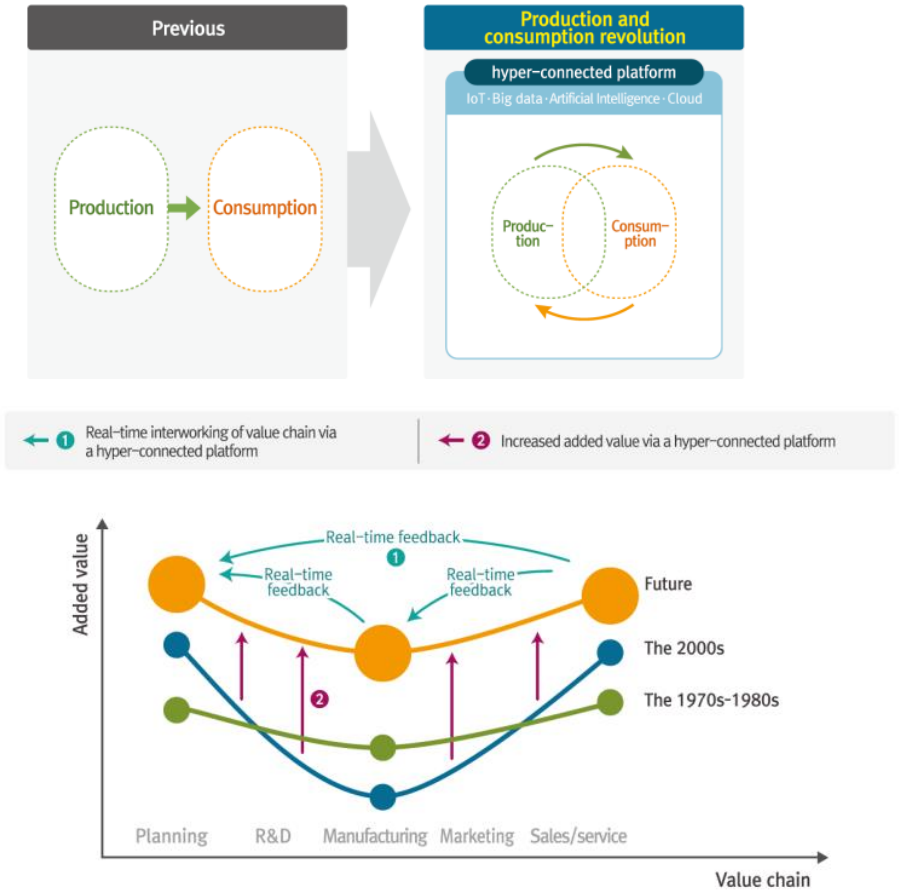
Comprehensive Countermeasure for Enhancing SMEs' Competitiveness



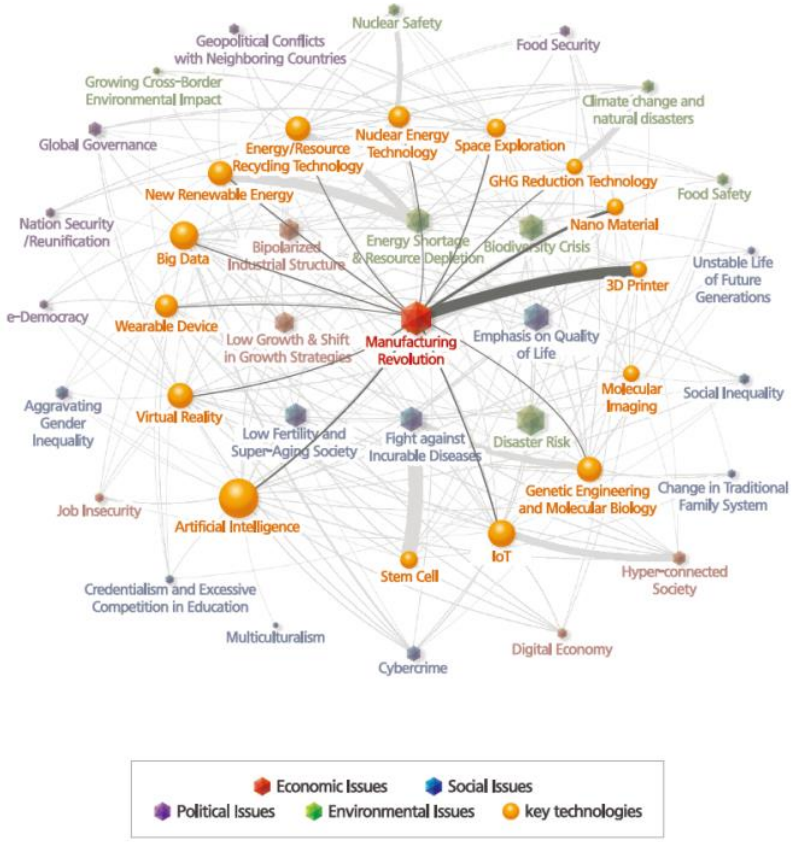
(T) Technology, (H) Human Resources, (Mk) Marketing, (F) Finance, (M) Business Infrastructure

Industry Diversification and Convergence Strategy

Transformation of the value chain due to the production and consumption



Manufacturing revolution: Correlation between future issues and principle technologies



MIST (2017)

Technology & Industry Promotion in Korea

Emerging Technologies / Industries by Korean Government
& Keyword 4IR : Smart, Servitization, Sustainable, Platform

Innovation Growth Engine : MIST (Dec.2017)	
Intelligent Infrastructure	Big Data Next Gen. Communication AI
Smart Moving Object	Autonomous Vehicles Drone
Convergence Service	Customized Healthcare Smart City VR/AR Intelligent Robot
Industry Base	Intelligent Semiconductor Advanced Materials Innovative New Drugs New & Renewable Energy

New Industries MOTIE (Dec.2017)

Electric/Smart Car
IoT Home Appliances
Energy
Bio-Health
Semiconductor·Display

National Strategy : MOTIE (Aug.2016)	
For Growth	For Well-Being
Autonomous Vehicles Smart City AR/VR Light Materials AI	Precision Medical Eqs New Drug Carbon Resource Fine Dust

+ (2017.10)

Momentum for Future Growth : MISP (Mar. 2016)	
Private	Private with Gov.
5G Smart Car Contents for MR Wearables Intelligent IoT Intelgt. Semiconductor	Deep-Sea Plant Virtual Training Wellness Care
Gov. with Private	Government
Unmanned Vehicle Intelligent Robot Big Data Advanced Materials	Smart Bio Production Renewable Energy Disaster Management DC Elec. Distribution CO2 Generation Materials Processing

The Present state and outlook of major industries by sector

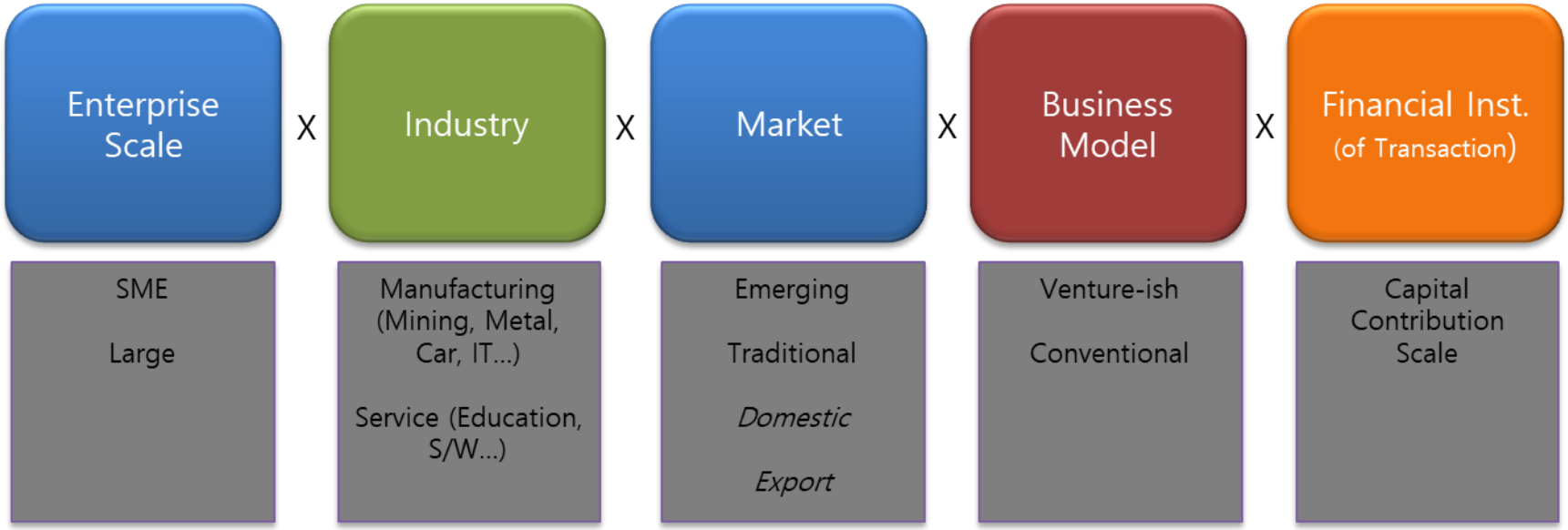
Sectors	Outlooks	Status of Korea
Automobile	• The emergence of self-driving cars • Production tailored for different needs • The introduction of various vehicle-based services	• The development and application of smart car technology • Lack of cooperation between enterprises and industries
Transportation	• Enhanced connectivity of transportation and infrastructure • The emergence of personalized transportation service • Evolve towards eco-friendly transportation	• Preemptive construction of intelligent transportation system • The need for a future transportation system investment strategy
Energy	• Diversification of consumer choice • Shift towards distributed network • Increasing eco-friendliness	• Vulnerable in large-scale SW architecture • Policy obstacles due to stakeholder conflict
Medical Care	• Personalized treatment based on personal big data • Shift in the concept of treatment based on genomics	• Weak interaction between researcher and hospital/medical staff /healthcare providers • Exportation of medical information system and service
Retail	• Integration of various distribution channels • Wide-spread of 3D printing • The development of marketing based on big data and AI • Human-friendly and eco-friendly consumption	• The development of the Internet and mobile shopping • The Spread of O2O omni-channel consumption
Knowledge service	• The establishment and advancement of knowledge-based system • Various livelihood and business services	• High reliance on foreign core technology • Competitive in the area of high capacity distribution processing technology
Food	• Globalization of food chain, diversified consumption patterns • The spread of precision farming and plant factory • The expansion of ICT's linkage to the distribution of agricultural, livestock, and fishery products • Promotion of personalized food market	• Strengthen international competitiveness in the food sector • The development and partial diffusion of plant factory model • Legal grounds, institutions, and social consensus are required
Resources	• Agile supply of resources for personalized production • Increased demand in rare metals for high-tech industry • Increased cooperation despite conflict among nations	• Policy focused on simply quantified goals and technology roadmap • Lack of broad consideration for interested parties

* MOTIE : Ministry of Trade, industry and Energy ;
MITP : Ministry of Science and ICT (MISP for last regime:Ministry of Science, ICT and Future Planning)

Policy Implementation upon Diversified Measures

Support Policy Differentiation may relief **conflicts between stakeholders** as well as promote the activities.

(eg) Evaluation and Financing Model need to be based upon :



Measurement

Diversification Indices

The indices for diversification level can be classified into two groups:

(1) group 1 : measuring a country's absolute specialization

: indicate the level of specialization in a country (e.g. if a small number of industries exhibit high shares of the overall employment of the country or the income of the country).

- (eg) ogive index, entropy index, Herfindahl-Hirschmann index, Gini index, diversification index

(2) group 2 : measuring a country's economic structure from a reference group of industries

- (eg) Theil index, relative Gini index, inequality in productive sectors).

Diversification Measurement

characteristics of economic diversification measurement tools and indices

Method	Underlining Theory	Basis of making judgment on diversification	Relationship between index and diversification
Herfindahl-Hirschmann and ogive indices	Industrial organization theory (absolute specialization indices)	Equal distribution of employment across sectors is the highest benchmark of diversification (McLaughlin, 1930; Tress, 1938)	The lower the value, the more diversified the economy
Entropy index (Shannon entropy index)		Equal distribution of employment across sectors is the highest benchmark of diversification (Palan (2010))	The higher the value, the more diversified the economy
Hachman index and location quotient	Economic base theory (export base theory)	The resemblance of the employment distribution of a State or region to that of the nation is a measure of economic stability (Hachman (1994), Sentz (2011))	The higher the value, the more stable the economy; a sector with a high value is an export sector
National average index	Regional business cycle theory	A region's share of stable or unstable sectors is a measure of economic diversity	As the region's share of economic activity approaches the country's share for all sectors, the index approaches zero
Portfolio variance	Portfolio theory	Captures the characteristics of individual industries, and inter-industry relationships with regional growth and instability (Conroy (1974, 1975), Markowitz (1959))	The lower the variance, the more diversified the economy
Input–output matrix	Economic development theory	Economic diversification is viewed as driven by simultaneous changes in production, consumption and trade patterns	Diversification may be expedited by forces of unbalanced growth, especially the faster growth of sectors with high income elasticity of demand
Input–output model: a unified framework	Portfolio theory	Compares the growth and stability impacts of diversification strategies involving changes in the level and mix of exogenous final demands (Siegel et al. (1995))	Determines the growth and stability impacts of different diversification strategies, resulting from changes in input–output relationships in the input–output matrix
	Location theory	Concerned with the spatial distribution of economic activity, including the development of spatial clusters. The theory holds that the cost of production is lower in industrial clusters, and this is an important reason for specialization and regional competitive advantage (Hoover and Giarratani, 1985)	Economic clusters also benefit from linkages between a region's firms and sectors. However, a diverse economy with unlinked firms and sectors may also benefit from economic clusters.

Diversification Measurement

Bryce & Winter, 2006,2009

The concept of relatedness in strategy research was first employed to assess the linkage between diversification strategy and performance (Chandler (1962)). Building on Chandler, developments in strategic management have emphasized that firm portfolios in which businesses are interrelated should produce higher levels of performance than portfolios in which businesses are unrelated (Rumelt, 1974; Montgomery, 1979; Rumelt, 1982; Teece, 1980, 1982; Ramanujam and Varadarajan, 1989).

The hypothesis is that combinations of related activities are expected to produce economies of scope in production (Teece, 1982; Panzar and Willig, 1981). These economies are an important potential source of performance differences between firms that pursue strategies of related diversification versus unrelated diversification. Since diversification strategy is an aggregate construct, however, relatedness is typically assessed at the aggregate portfolio level, with differing levels of inter-activity relatedness within the company being combined through some explicit or implicit weighting scheme. Accordingly, the most commonly used measures of diversification contain at least two components: (1) A component that assesses the degree of relatedness among activities; and (2) a component that weights activities, providinggreater weight to activities accounting for a relatively greater proportion of the business

Diversification Measurement

Diversification Measures

Measure	Mathematical Form	Empirical Base	Relatedness Component	Primary usage	Source
1. Herfindahl Index	$D = 1 - \sum_{i=1}^{n} s_i^2$ where n = number of activities in portfolio and s = each activities' share	Patterns of firm revenues within portfolio	None in standard measure. Gollop and Monihan (1991) insert Euclidean distances among product class input shares	Diversification research; e.g. Berry, 1971, 1975;	Berry, 1971
2. Entropy	$D = \sum_{i=1}^{n} s_i \ln(1/s_i)$, where s_i is the share of sales in segment i.	Patterns of firm revenues within portfolio; SIC hierarchical structure	Entropy calculated separately for 2- and 4-digit industries; difference in these scores is relatedness.	Diversification research; e.g. Palepu, 1985	Jacquemin and Berry, 1979
3. Wrigley-Rumelt categorizations	Categorization into one of nine categories based on three ratios: specialization, vertical, and related	Patterns of firm revenues within portfolio	Business is related if revenue from largest group of related activities (defined by researcher) is greater than 70 percent (related ratio) while no single industry's revenue is greater than 70 percent (specialization ratio)	Diversification research	Wrigley, 1970; Rumelt, 1974
4. Concentric	$D = \sum_{i=1}^{n-1} \sum_{j=i+1}^{n} s_i s_j r_{ij}$, where s is the percentage sales in industry i or j, and $r_{ij} = 0$ if i and j have the same three-digit code, 1 if they have identical two-digit codes (but not three-digit), and 2 if they have different two-digit codes	Patterns of firm revenues within portfolio; SIC hierarchical structure	Based on distances in the hierarchy of the SIC system; pairwise relatedness decreases as codes share only the same 3-digit, the same 2-digit, or different 2 digit codes, respectively	Diversification research; e.g. Montgomery and Wernerfelt, 1988	Caves, Porter and Spence, 1980

Relatedness Measures

Measure	Mathematical Form	Empirical Base	Relatedness Component	Primary usage	Source
1. Scherer input-output matrix-based	$R = \cos\theta = \frac{\mathbf{x} \cdot \mathbf{y}}{\|\mathbf{x}\| \|\mathbf{y}\|}$, where cos θ is the Pearson correlation coefficient between industry categories **x** and **y**, which are centered vectors of technology inflows from all other industry categories	R&D flows based on patent usage data	Based on similarity between profiles of technology inflows	Tests of the resource-based view	Robins and Wiersema, 1995; Scherer, 1982
2. Occupational categories	$R_{ij} = \sum_{k \in K} (x_{i,k} - y_{j,k})^2$, where x, y are the normalized values of percent employees falling into occupational class k in industries i and j. These distances are further clustered into related industry groups (RIGs)	Occupa-tional classes	Based on similarity between occupational classes between industries	Tests of the resource-based view	Farjoun, 1990, 1994
3. Technological distance (patents)	$R_{ij} = \sum_{c} \Pr(i \mid c) N_{ic}$, where relatedness of firm i to industry j is a sum across patent classes c of the probability that patents of class c are assigned to industry i , multiplied by the number of firm patents in each class	Patents	Based on assignments made by the Canadian Patent Office of patents to industries of likely use, which in turn are matched to the US SIC system using Silverman's (1996) U.S. Patent Class—U.S. SIC concordance	Tests of the resource-based view	Silverman, 1996, 1999
4. Present Measure	$\tau_{ij} = \frac{J_{ij} - \mu_{ij}}{\sigma_{ij}}$, where J is the count of the number of firms diversifying into industries normalized using the hypergeometric distribution; τ is converted to a weighted distance matrix and shortest path scores through this matrix become inter-industry relatedness measures	All diversificati on moves in the US manufac-turing economy	Implicit in methodology and arising from economy of scope arguments	Tests of the resource-based view; examination of longitudinal expansion decisions	Present study

In contrast to diversification measures which operate at the portfolio level, relatedness measures are designed to assess the relationship between two activity classifications and are therefore directly useful at the activity level. Relatedness measures are thus typically used *as a component* in a diversification construct in order to assess a portfolio-level strategy. In the case of the concentric index, for example, the measure is simply a weighting on intra-portfolio relatedness distances.

Herfindahl-Hirschmann index (HHI)

HHI is widely used to measure market concentration and also economic diversity. It is further used for macroeconomic specialization analyses. It measures the extent to which a particular economy is dominated by a few sectors (i.e. if a monopoly exists) and is calculated as follows:

$$\text{Herfindahl}-\text{Hirschmann index} = \sum_{i=1}^{n} S_i^2$$

where S_i is the share of economic activity in sector i of the total economy and n is the number of sectors in the economy (e.g. the share of exports (or employment) by sector i in the total exports)

This theory assumes that the organization of the industrial sector in a country accounts for its level of economic diversification. A greater number of sectors in a country represents less market concentration meaning higher diversification.

The value of the index ranges from zero to one. A country with a perfectly diversified economy will have an index close to zero. A higher value indicates more concentration or greater specialization.

Entropy index

Also called the Shannon entropy index (SEI). This compares the existing economic activity distribution among industries in a country with an equi-proportional distribution, and is calculated as the negative sum of employment shares multiplied by the natural logarithm of employment shares of each single industry, as follows

$$\text{Entropy index} = \sum_{i=1}^{n} S_i \ln\left(\frac{1}{S_i}\right) = -\sum_{i=1}^{n} S_i \ln(S_i)$$

where n is the number of sectors, S_i is the share of economic activity in the i_{th} industry and ln is the natural logarithm.

Considering that equally distributed economic activity is considered more diverse, higher entropy index values indicate greater relative diversification, while lower values indicate greater relative specialization. If employment is used as an indicator of economic activity, the equal distribution of employment among all industries will result in a higher entropy index. The minimum value of zero would occur if employment were concentrated in one industry (i.e. maximum specialization).

Because SEI measures in logarithmic form, the relative weights of large industries are reduced compared with the HHI or the ogive index. This means that countries that are specialized as a result of having large industries will be shown as being more specialized by HHI and the ogive index than by SEI (Palan, 2010).

DT = DR + DU $\quad DT = \sum_{i=1}^{N} P_i \ln \frac{1}{P_i} \quad DR = \sum_{S=1}^{N_S} P_S \sum_{i \in S} \frac{P_i}{P_S} \ln \frac{P_S}{P_i} \quad DU = \sum_{S=1}^{N_S} P_S \ln \frac{1}{P_S}$

S : Upper Industry Classification, i : Lower Industry Classification

Ogive index

The distribution of economic activity (which can be a share of employment, exports, income or GDP) among sectors in a country and is calculated as follows (McLaughlin, 1930; Tress, 1938):

$$\text{Ogive index} = \sum_{i=1}^{N} \frac{(S_i - \frac{1}{N})^2}{\frac{1}{N}}$$

where N is the number of sectors in a country and S_i is the sectoral share of economic activity for the i_{th} sector.

The ogive index can also be explained as a linear transformation of HHI (Palan, 2010).

An even distribution of economic activity among sectors represents higher economic diversity. With N sectors, an equal distribution implies that S_i is equal to $1/N$, the ideal share for each sector, and the ogive index equals zero, meaning perfect diversity.

HHI is an easily computable index and is regarded as superior to other indices used to measure absolute specialization. SEI can be problematic if industries with an employment share of zero are contained in the sample. The Gini index is more time-consuming to calculate and fails to meet other criteria for preferred indices.

Hachman index (+NAI)

Export base theory assumes that economic growth is driven by export demand. This hypothesis was derived by Frank Hachman. The Hachman index is a measure of how closely the employment distribution of a State or region resembles that of the nation as a whole. The index value varies between zero and one, where one means that the State or region has exactly the same industrial structure as the nation and zero means that it has a completely different industrial structure. The Hachman index is calculated as follows:

$$Hachman\ index = \frac{1}{\sum_{i=1}^{N}[S_i^{state}/S_i^{Country}) \times S_i^{state}]} = \frac{1}{\sum_{i=1}^{N}[LQ \times S_i^{state}]}$$

where S_{istate} is the State's share of employment in the i_{th} industry, $S_{iCountry}$ is the country's share of employment in the i_{th} industry, N is the number of industries and LQ is the location quotient for that State in the corresponding industry.

Similar to export base theory, regional business cycle theory assumes economic instability is driven by export demand and measures instability in terms of the difference between stable and unstable sectors. To test this relationship, a region's share of stable or unstable sectors is used as a measure of economic diversity. The economy in a region is considered stable if its sectoral composition is similar to that of the nation. This hypothesis is tested by **the national average index (NAI)**, which is calculated as follows:

$$NAI = \sum_{i=1}^{N} \frac{(S_i^{State} - S_i^{Country})^2}{S_i^{Country}}$$

where S_{iState} is the i_{th} sector's share of economic activity in the State or region, $S_{iCountry}$ is the country's average share of economic activity in the i_{th} sector and N is the number of sectors. As the region's share of economic activity approaches the country's share for all sectors, the NAI approaches zero. As the region's share diverges from the country's economy, the NAI becomes increasingly larger.

NAI can be considered a relative measure of economic diversity because it measures the amount of disparity between a country's and a region's industry distribution.

Portfolio index

Although portfolio theory was originally applied to financial assets, extended its usage to the analysis of economic diversification. Following the portfolio concept of investments, if every sector is considered an individual investment in a region, the bundle of sectors represents a portfolio of investments in the region studied. Similar to financial investments, an economic portfolio of sectors has a relationship with expected returns and associated risk, where expected returns may include income, employment, products, exports, industries, etc., and risk includes economic instability.

Every region has a limited set of resources to be utilized. In this context, economic diversification aims to reduce instability in aggregate returns to the region by allocating its limited resources to the portfolio of sectors.

By capturing the characteristics of individual industries and inter-industry relationships relating to regional growth and instability, the portfolio framework assists policymakers in developing appropriate diversification strategies that can serve the purpose of stimulating economic growth and stabilizing the economy.

A region's **portfolio variance**, representing regional instability : The regional instability is the weighted sum of the variances (individual sector fluctuations) and covariances (intersectoral fluctuations) for a given economic activity. Thus, the regional economic stability is sensitive not only to the fluctuations of the individual sectors but also to the correlation of fluctuations between sectors.

$$\sigma^2_p = \sum_{i=1}^{N} S_i^2 \sigma_i^2(X_i) + \sum_{i=1}^{N} \sum_{j=1, j \neq i} S_i S_j \sigma_{ij(X_i, X_j)}$$

where *Si* and *Sj* are the shares of economic activity (employment, income, output, *X*) of the *ith* and *jth* sectors, $\sigma i2$ is the variance of economic activity in the *ith* sector and σij is the covariance of economic activities in the *ith* and *jth* sectors.

Lower portfolio variance indicates a more diversified economy. Studies have found that portfolio variance is a superior measure of economic diversity in explaining regional economic instability compared with other measures of diversity. However, portfolio variance cannot be used to establish a relationship between diversity and instability because it does not measure diversity independent of instability

Portfolio index

Correlation Coeffcient between Variables

	Tobin's q	ln(EV)	D/E	OIR	RER	Caves	Herfindahl	Entropy	Revenue Growth Rate
Tobin's q	1								
ln(EV)	0.08	1							
D/E	0.12	0.16	1						
OIR	-0.02	0.21	-0.15	1					
RER	0.27	-0.03	-0.07	-0.13	1				
Caves	0.03	0.07	-0.01	-0.02	0.07	1			
Herfindahl	0.05	-0.01	-0.03	-0.09	0.04	0.82	1		
Entropy	0.05	0	-0.02	-0.08	0.04	0.8	0.99	1	
Revenue Growth Rate	0.1	0.03	0.06	0.12	-0.01	0.03	0.01	0.02	1

Data : Korean enterprises enlisted in KRX between 2001-2010 (exclude Finance sector)

(Caves Index) To measure technological diversity, we calculated a concentric measure of diversification originally used by Caves, Porter, and Spence (1980) using firm patents, which we translated to four-digit SIC codes using the concordance index developed by Silverman (1999).

$$Abs\_Capacity_t = \sum_i p_i \sum_j d_{ij} p_j$$

where $i\,p$ = the proportion of patent applications in 4-digit SIC i in year t; $j\,p$ = the proportion of patent applications in 4-digit SIC j; and $ij\,d$ = 1,2,3,4 if i and j are in the same 4,3,2,1-digit SIC, respectively. The index ranges from 0 to 2 and is increasing in diversity.

Economic Diversification : Key Indicators

1

- Finger-Kreinin index of export diversification
  - Index from 1 (no diversification) to 0 (full diversification)
  - Relative to average structure of exports elsewhere
- Herfindahl-Hirschman index of market concentration
  - Index from 0 (no concentration) to 1 (extreme concentration)
  - Sum of squares of the shares of each sector in total output
- Merchandise exports only, not services
- Short coverage, from 1995 to date

2

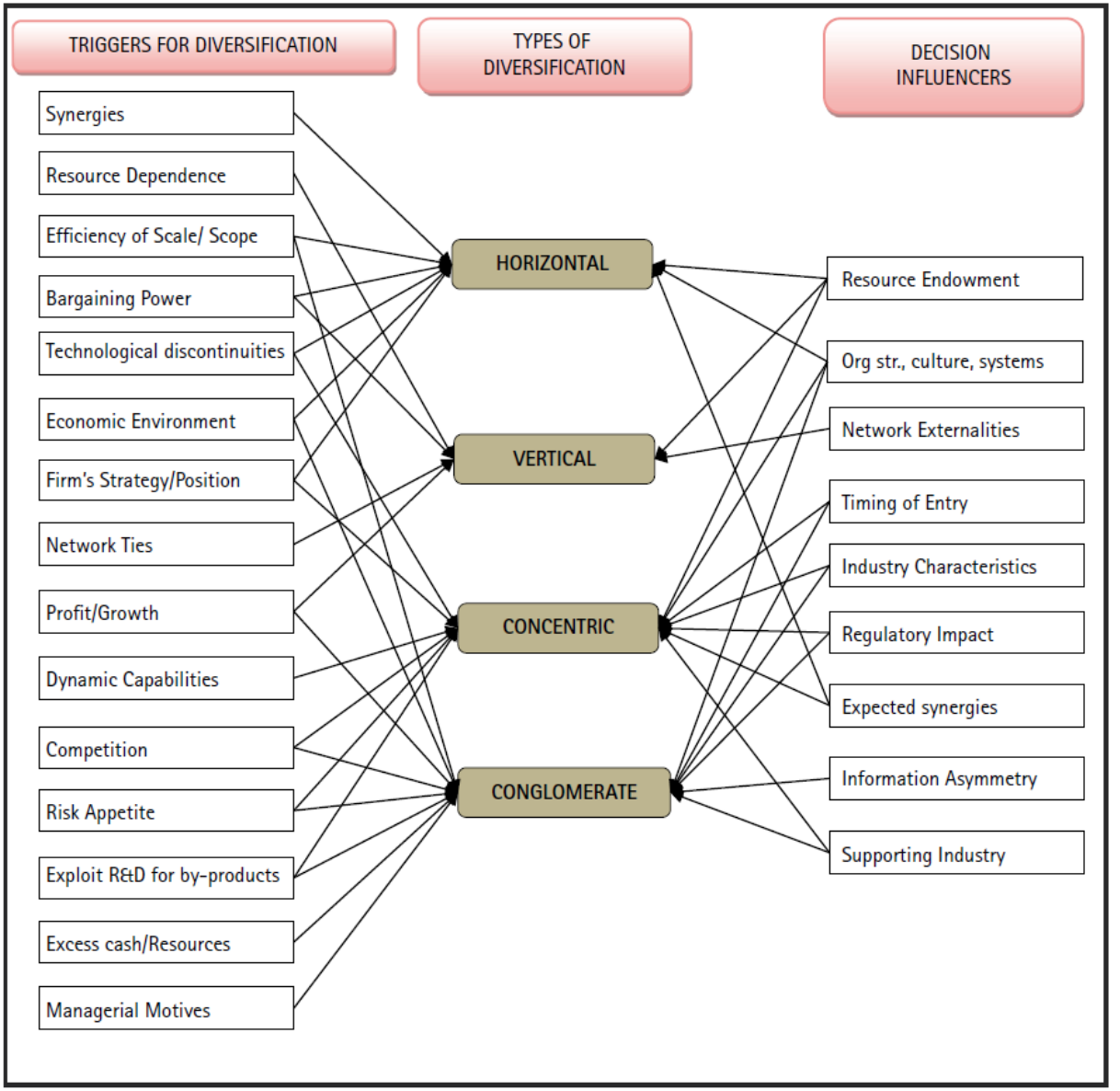
- IMF index of export diversification – what you export
  - Theil index: Sum of measures of diversity across sectors (vertical diversity or extensive margin, meaning new export products or new export destinations) and diversity within sectors (horizontal diversity or intensive margin, meaning a larger volume of exports of old products)
- IMF index of product quality – to whom you export
  - Measures average quality demanded in exporters´ markets
  - Model-based index from 0 (low quality) to 1.2 (high quality)
- Goods only, not services; will be updated to include services

3

- World Bank measure of share of manufactures in exports
- World Bank measure of share of manufactures and services in total output – to include services
- Economic Complexity Index by Hidalgo and Hausmann (2009)
  - Ranks countries by the diversity and complexity of their export structure
  - Limited coverage: Goods only, not services
  - Short coverage, from 1995 to date

Diversification Issues

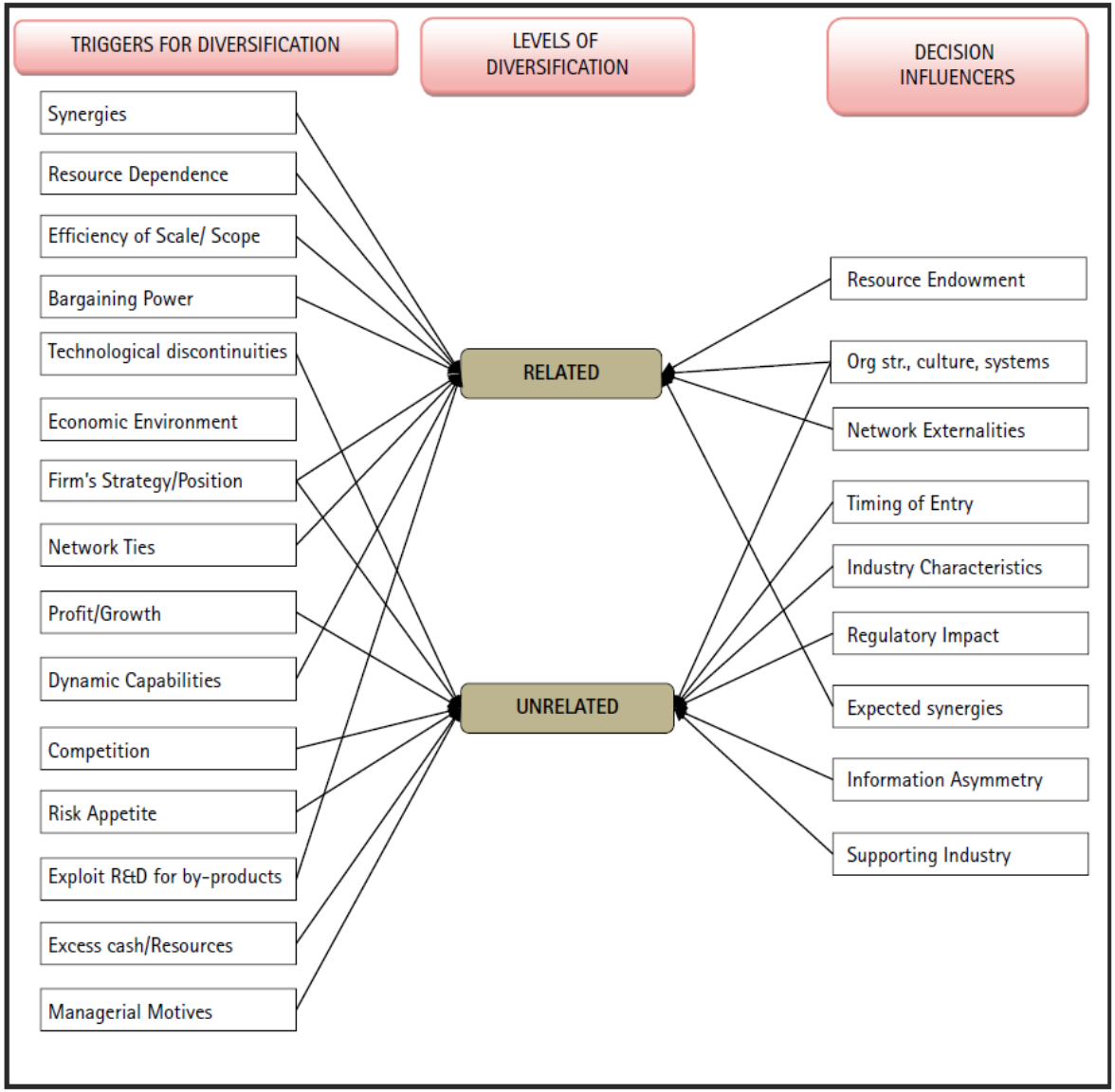
Types of diversification: triggers and decision influencers



Source: Dhir Sanjay and Dhir Swati, (2015), 'Diversification Literature Review and Issues', Strat. Change, Vol. 24 pp.569–588

Diversification Issues

Levels of diversification: triggers and decision influencers



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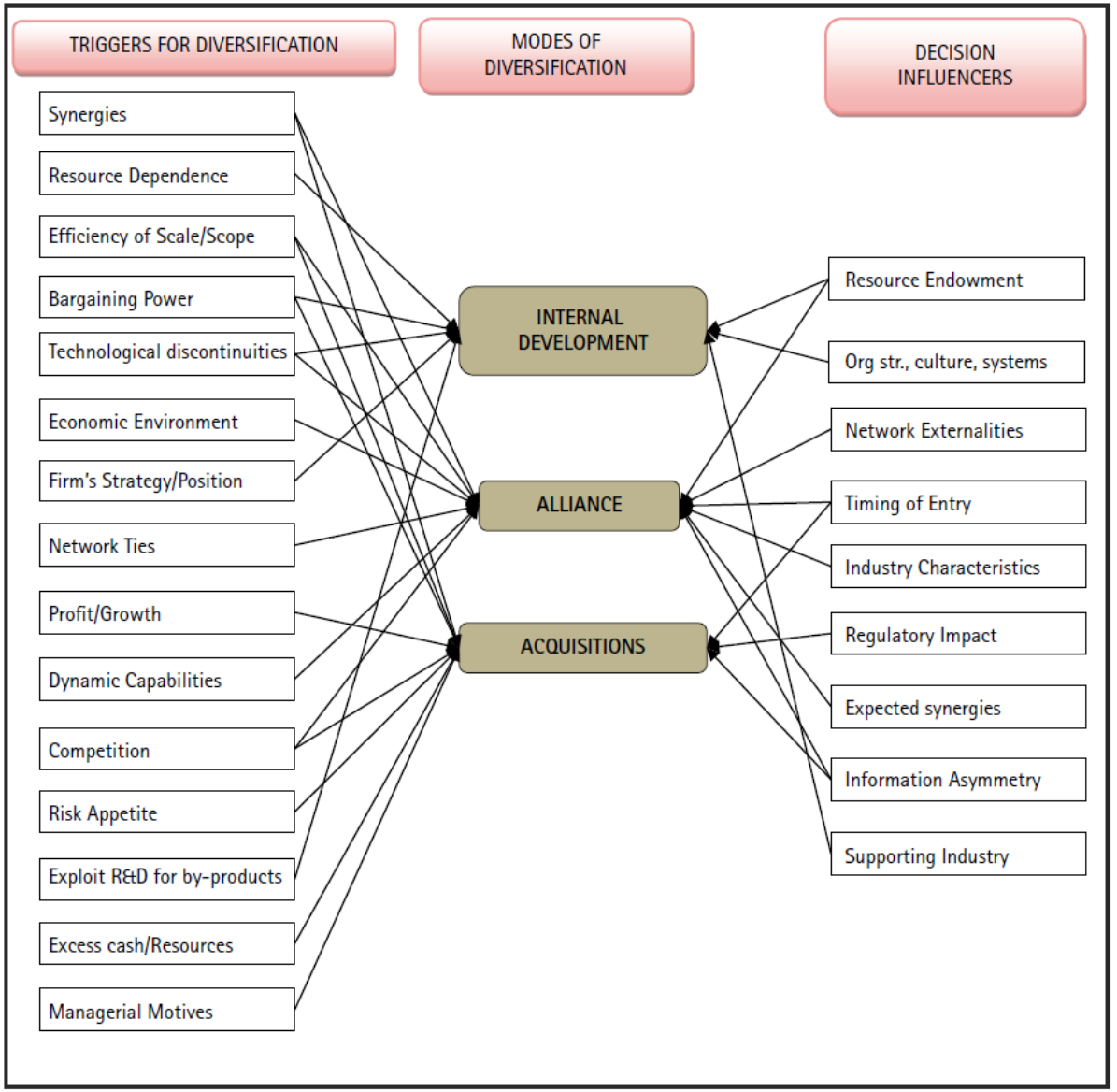
Diversification Issues

Modes of diversification: triggers and decision influencers



Source: Dhir Sanjay and Dhir Swati, (2015), 'Diversification Literature Review and Issues', Strat. Change, Vol. 24 pp.569–588

Thank you

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