
S&T Innovation Capabilities Evaluation

Composite S&T Innovation Index (COSTII) Model

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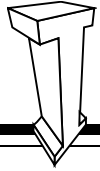
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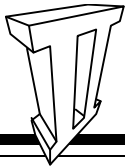
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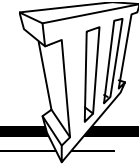
Background

- ✓ S&T is a source of national competitive power in knowledge based economy
- ✓ Limitation of existing evaluation method



Purpose

- ✓ To evaluate a nation's capability of S&T Innovation compositely by the medium of rational model
 - ✧ *National Innovative Capacity*
 - ✧ *Science and Technology Innovation Capability*



1st. Evaluation model establishment

2nd. Detailed indicator selection

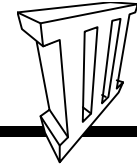
3rd. Basic data collection

4th. Calculate standardized value for each indicators

5th. Calculate Items Value

6th. Derive the COSTII

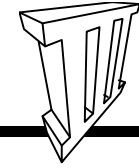
7th. Scoreboard making and analysis



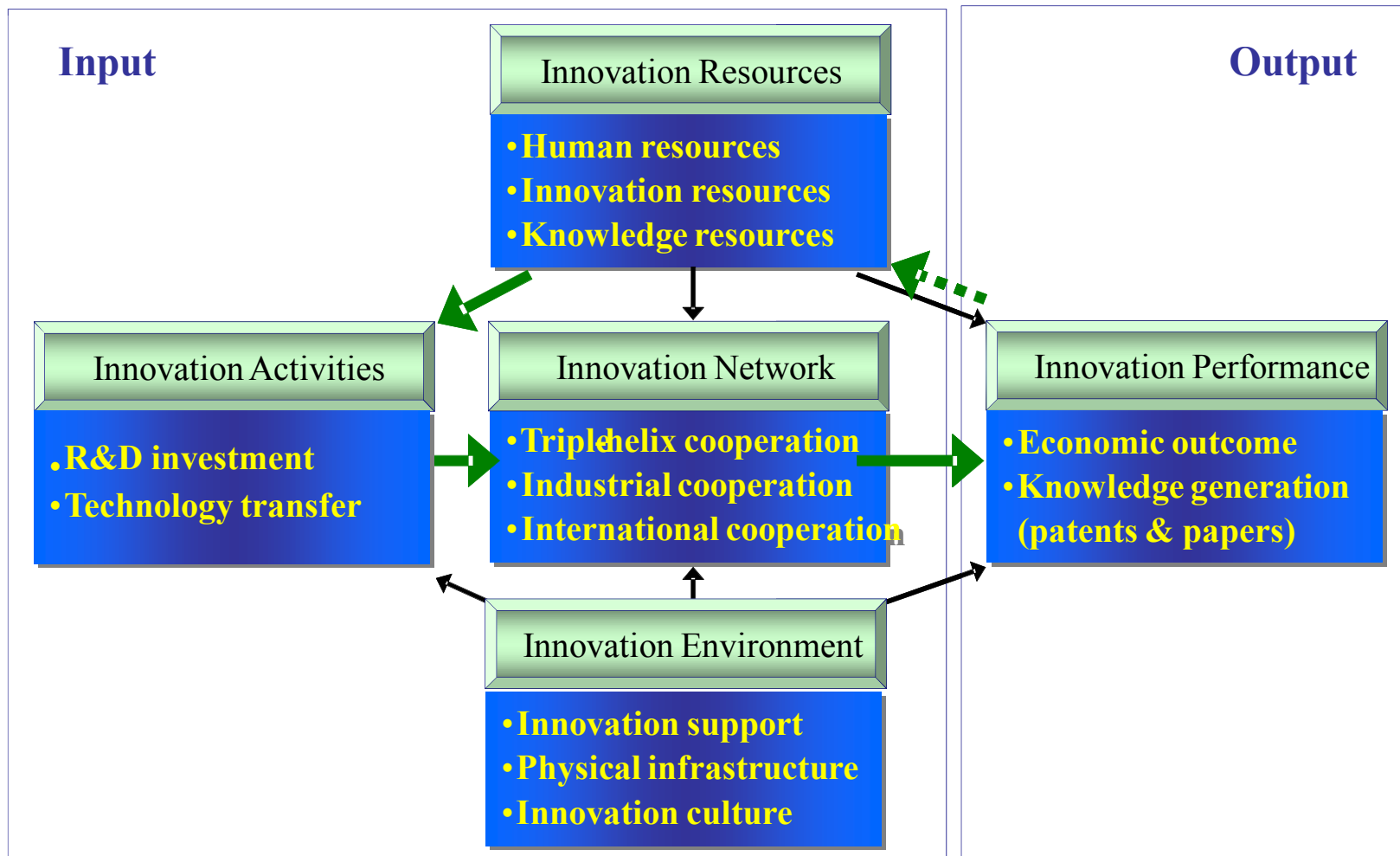
1. Evaluation model establishment

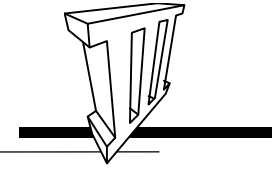
Main Idea of COSTII

- ✓ Based on NIS model
- ✓ Systemized the entire process innovation, from input of resource to the final economic output, into 5 areas based on the framework of NIS



Evaluation Model for National S&T Innovation Capabilities





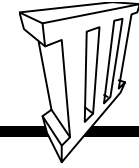
2. Detailed indicator selection

Establishment of indicators pool

- ✓ 5 areas, 13 itemized indicators, 79 indicators

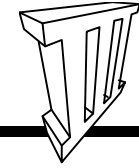
Establishment of weighting among 13 items

- ✓ Weighting among items through expert surveys based on fuzzy set theory
- ✓ Convert the ratio of weighting of items into that of integer numbers



Selection of 31 indicators out of the first selected 79 indicators

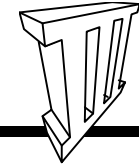
- ✓ Allocation the number of indicators by according to importance of each items
- ✓ Selection the indicators of each items
 - Possibility of acquiring statistical data
 - Rationale for model and upper-level
 - Distinction from other indicators



System and structure of indices

- ✓ 5 elements, 13 items, 31 indicators
- ✓ 26 quantitative, 5 qualitative indicators

Innovation resources(7)		Innovation activities(7)		Innovation Networks(5)		Innovation environment(6)		Innovation outcomes(6)	
Human resources	3	R&D investment	5	Triple-helix cooperation	2	Innovation support system	2	Knowledge creation	3
Innovation organization	2	Start-up activities	2	Industrial cooperation	1	Physical infrastructure	2	Economic outcomes	3
Knowledge resources	2			International cooperation	2	Innovation culture	2		



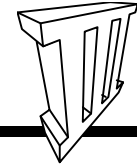
Innovation Resource Indicator

✓ Concept

- shows how much basic resources innovation entities can utilize for science and technology innovation

✓ Structure

- consists of human resources, innovation organization, and knowledge resources



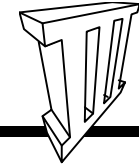
Innovation Activities Indicator

✓ Concept

- identifies innovation entities' activities of creating and utilizing new knowledge, and volition for innovation activities

✓ Structure

- measures each entity's innovation activities according to the scale and distribution of material resources
- R&D investment, the level of R&D activities, and start-up activities



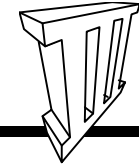
Innovation Network Indicator

✓ Concept

- shows the network among innovation entities and cooperation through the network

✓ Structure

- identifies the status of cooperation among industry·academia·research institutes, major players of domestic research and development, and international cooperation



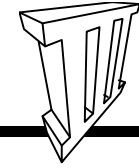
Innovation Environment Indicator

✓ Concept

- shows whether infrastructure is duly established for efficient innovation activities

✓ Structure

- innovation environment is composed of various systems that support or facilitate innovation activities, innovation culture, and physical infrastructure



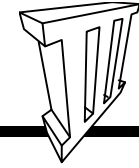
Innovation Outcome Indicator

✓ Concept

- measures concrete outcomes of innovation activities

✓ Structure

- innovation performance can be divided into knowledge creation and economic outcome



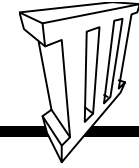
3. Basic material collection

Collect statistical data

- ✓ Garner and utilize internationally recognized statistics and materials

Data source

- ✓ quantitative data : OECD MSTI, OECD scoreboard, USPTO,
Thomson ISI, Global Entrepreneurship Monitor,
World bank
- ✓ qualitative data : IMD competitiveness yearbook,
WEF global competitiveness report



4. Calculate standardized value by indicators

Data standardization

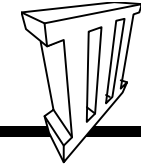
✓ Re-scaling(0-1) method

- the country with the highest value for given indicator shall have standardized value of 1.

$$\text{Standardized Value} = \frac{\text{Value}_{(object)} - \text{Value}_{(lowest)}}{\text{Value}_{(highest)} - \text{Value}_{(lowest)}}$$

✓ Missing value revision

- Item with missing value will be given average value of the rest of the items



5. Calculate Items Value

Deriving each items index

- ✓ Each items value consists of the sum of containing indicators

Calculation formula of items' index

$$CI = \sum_1^n w_i X_i$$

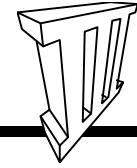
CI = items index X_i : standard value of indicators
 $w_i = 1$

6. Derive COSTII

Calculation formula for composite index

$$COSTII = \sum_1^5 CI_i$$

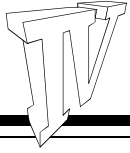
CI = items index



7. Scoreboard making and analysis

Establishment of scoreboard

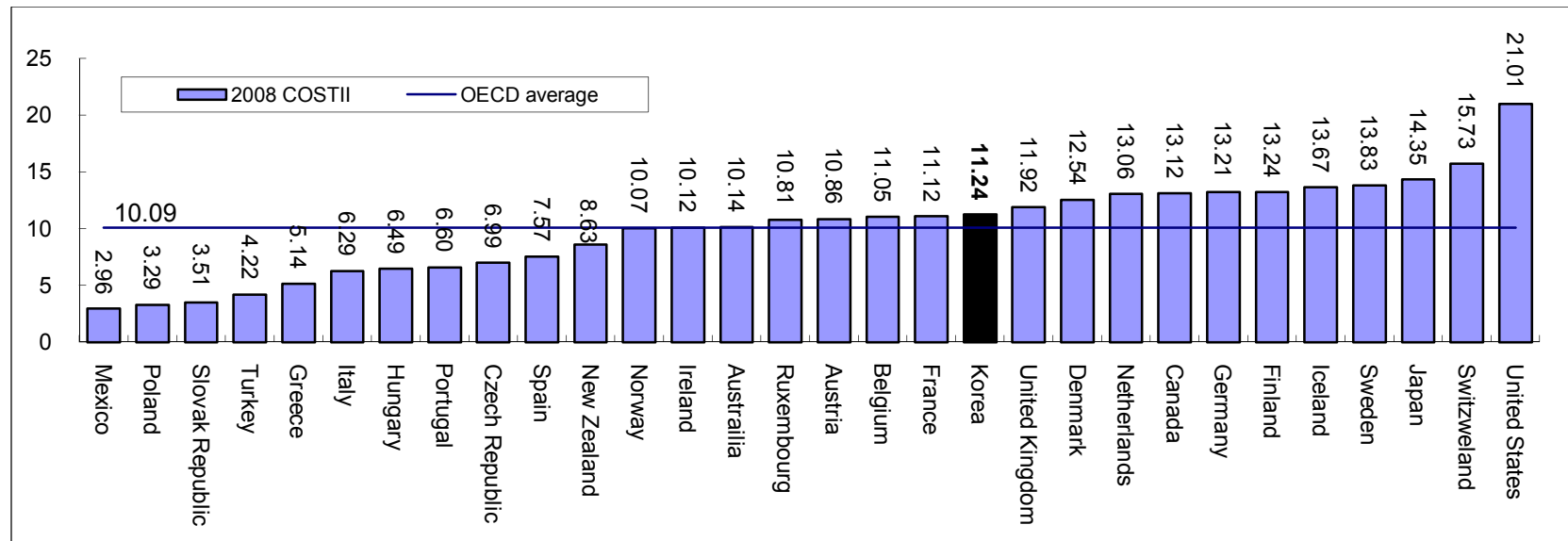
- ✓ Analyze ranks of COSTII and that of elemental indicators
- ✓ Utilization of index
 - International comparison of indices and ranks
 - Identify the current status, strength and weakness of S&T innovation capabilities
 - Policy suggestions
- ✓ Object of evaluation : 30 OECD countries

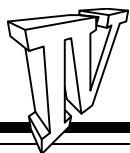


Application

COSTII of 2008

- ✓ United States tops the list with the COSTII of 21.01, followed by Switzerland of 15.73 and Japan of 14.35
- ✓ KOREA, with the COSTII of 11.24, ranks 12th among 30 OECD members, of which the average stand at 10.09

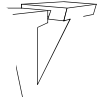




Application

- ✓ United States tops in innovation resource, activity and performance
- ✓ KOREA shows strength in activity and performance

Innovation Area	KOREA		OECD Average	Highest
Resource	1.03	12th	1.13	USA 5.77
Activity	4.07	3th	2.44	USA 5.24
Network	1.31	22th	1.67	Iceland 3.63
Environment	3.02	18th	3.19	Denmark 4.70
Performance	1.81	9th	1.67	USA 4.32
COSTII	11.24	12th	10.09	USA 21.01



Challenge

- ✓ **Internationalization**
- ✓ **Enhancing an application**
- ✓ **Raising a rationality of methodology**

Thank you!

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