

### 3-3. Korea

#### Status of Korean S&T Indicators and Innovation Survey

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##### **Abstract**

From last year Korean government has been interested in building 'Korean S&T Indicators'. Last year we did a literature review about S&T indicators of other countries and international organization, and surveyed the indicators and statistics of Korea S&T activities. This year the next step for Korean S&T indicators has been carried out. I will present about the procedure of building Korean S&T indicators and its details even though it is not completed.

I will also introduce Korean Innovation Survey and its main results. Korean Innovation Survey is provided important statistics for Korean S&T Indicators.

##### **Presentation of Korea**

Niwa: Thank you. I would like to ask Dr. Um for your presentation. And thank you very much for your patience to wait.

Um: Good afternoon, everybody. My name is Um Mi-Jung from STEPI. In STEPI I am in charge of Korean innovation survey since 2002. Today I will present the status of the developing Korean S&T indicators and show only a few results of the innovation survey. This (Slide 2) is the content I will present. Showing the status of Korean S&T statistics shortly, I will explain Korean S&T policy trends and how it connects to S&T indicators development. Finally, I will present Korean innovation survey results.

This table (Slide 3) shows the S&T statistics collected in Korea. As you see, Korea has no comprehensive national indicators, and we just have many statistics collected by different organizations. R&D survey is responsible for MOST and collected by KISTEP. Also SME's Technology Statistics are collected by an agency that belongs to Small and Medium Business Administration (SMBA). And the innovation survey is collected by STEPI with no public relationship with governmental organization. STEPI has the whole responsibility.

## Contents

- Status of Korean S&T Statistics
- Trend of Korean S&T Policy
- Current main Activities on S&T Indicators
  - Developing National S&T Indicators
  - Building National S&T Indicators Database
- Korean Innovation Survey
- Summary

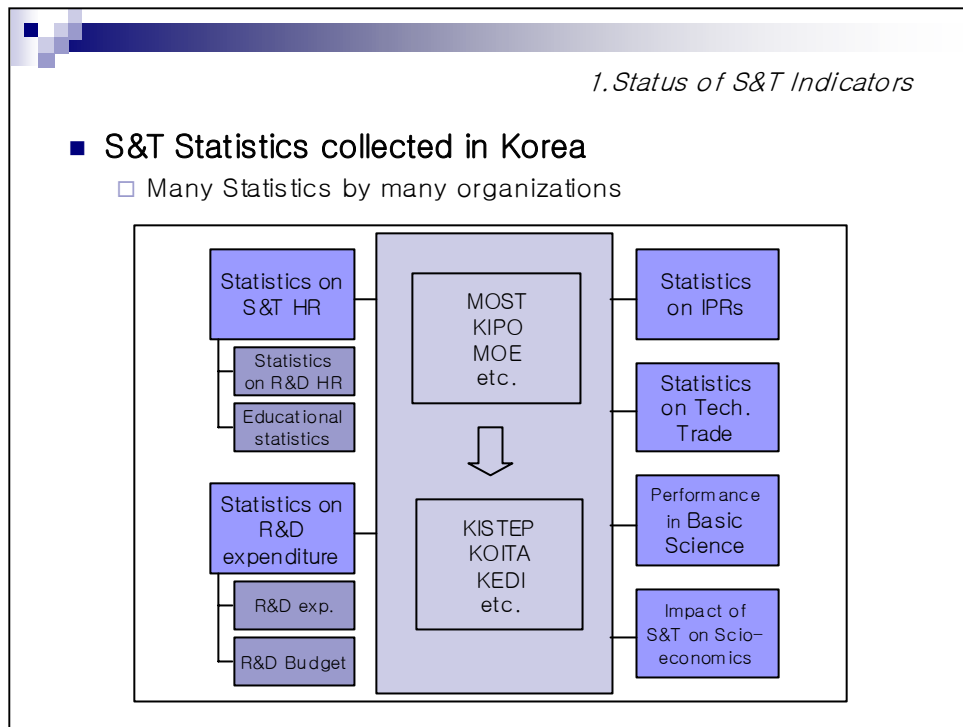
## 1. Status of Korean S&T Statistics

- S&T Statistics collected in Korea

Titles of Statistics	Organization	Period
R&D Survey	KISTEP(MOST)	Annual
SME's Technology Statistics	SMBA	Annual
Innovation Survey	STEPI	3 year
Statistics on Technology Trade	KOITA(MOST)	Annual
Public Awareness of S&T in General	KSF(MOST)	biannual
Statistics on ICT Industry	EMIC	annual
Educational Statistics/ Human Resource Indicators	KEDI(MOE)	annual
Human Resource Indicators	KRIVET(MOE)	annual
Statistics on Industrial Intellectual Property Right	KIPO	annual
...	...	...

This (Slide 4) is the organization structure. Korean MOST is responsible for the most main S&T, and some statistics like IPS is managed by KIPO (Korean Intellectual Property Organization), human resources statistics by Ministry of Education and Human Resources Development. But practical collection was conducted by other agencies under the ministries, such as KISTEP, KOITA, KEDI etc.

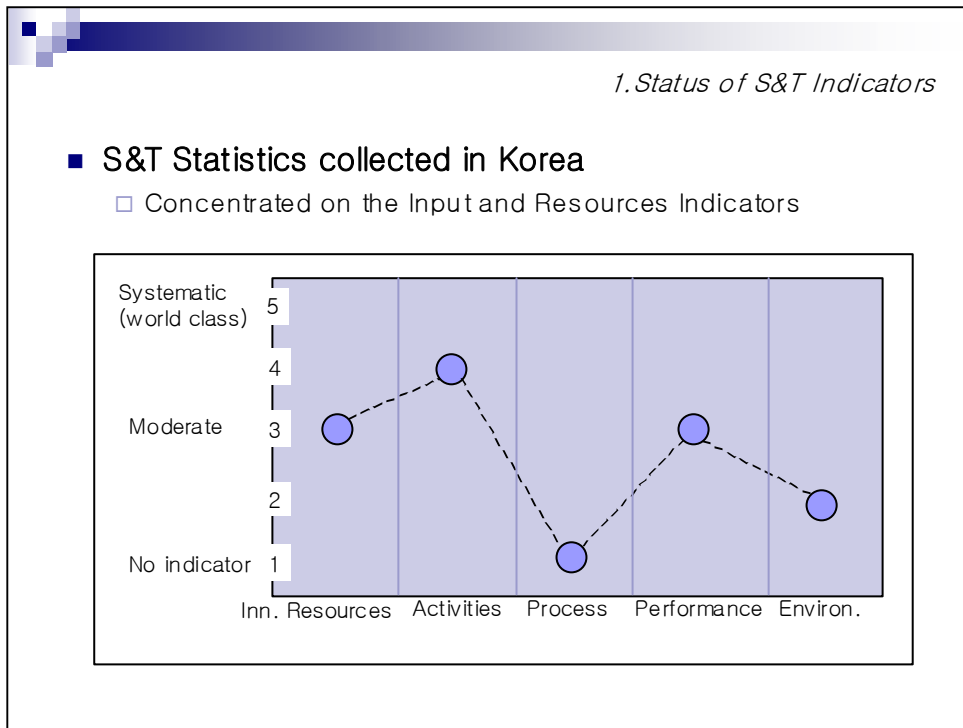
Slide 4



As you show (Slide 5), S&T statistics in Korea has concentrated on the input and resources indicators. We have many indicators about the innovation resources, and activities, but little indicators related to innovation process. This is the reason we give attention to the Innovation Survey. Innovation Survey can cover the process and performance of innovation activity.

This slide (Slide 6) is the comparison result to show the status of S&T indicators in Korea. The first and third columns are the indicators published in the USA and Japan, and the second and fourth are Korean situation. Many indicators are not collected or analyzed in Korea. The structure of Japan's S&T indicators is similar with Korean one; many indicators of Japan are collected already and other ones developing in Korea.

Slide 5



Slide 6

*1. Status of S&T Indicators*

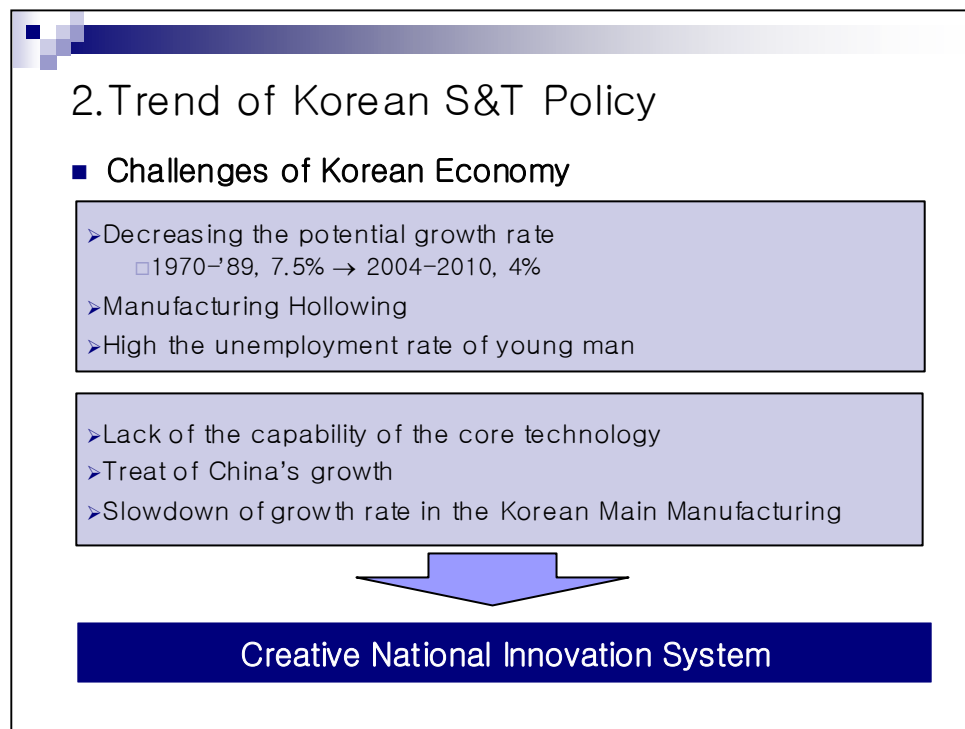
- Comparison of Status of S&T Indicators developed

USA(SEI)	Korea	Japan (STI)	Korea
Higher education in S&E	None	Performance of NIS	Partial
S&E Workforce	None	HR in S&T in K. S.	None
USA and International R&D	None	Researcher in K.S.	Partial
Academic R&D	Partial	Development of HR in S&T in School Edu.	None
Industry, Technology, and Global Marketplace	None	R&D system	Done
Significance of IT	None	R&D Performance	Done
S&T: public attitude & public understanding	None	Transformation of Knowledge Prod.	Done
		Role of the Government	Done
		Universities	Developing
		R&D in Business Sector	Done
		Innovation & Economy & Society	Developing
		Public Interest in S&T	Partial

\* K.S. : Knowledge-based Society

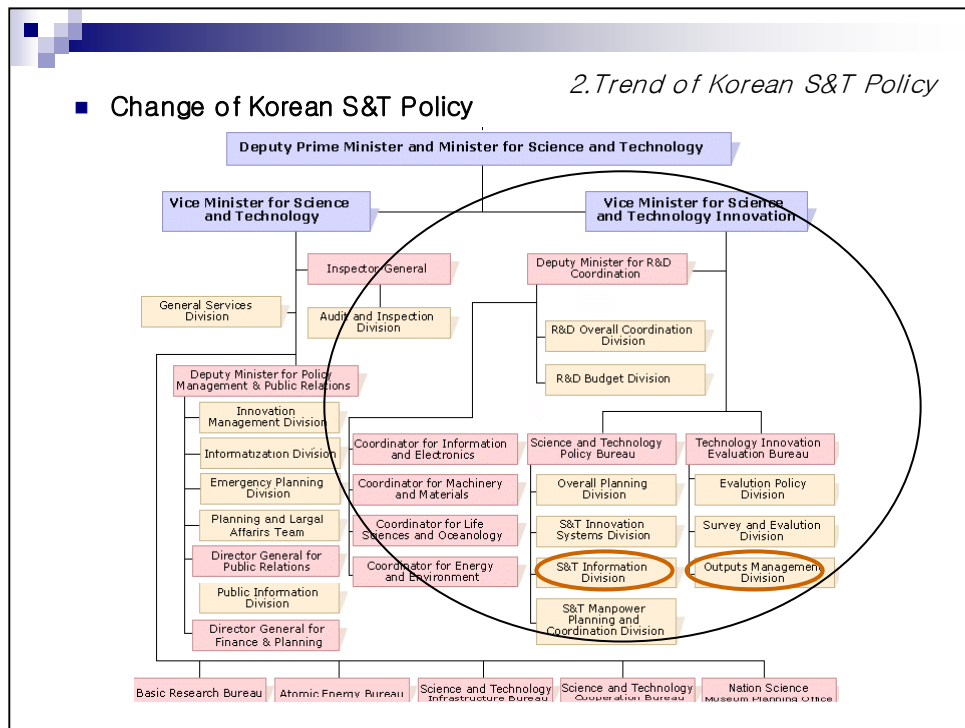
As I mentioned until now, we are publishing various statistics books, but we do not have any comprehensive books to show the Korean science and technology innovation activities. Recently the government recognized that we should analyze the whole structure of the national innovation system. That (Slide 7) is the background the government feels strongly the necessity of developing the comprehensive indicators. We are in lack of the capability of the core technology. China's growth is a threat. Furthermore, the Korean potential growth rate has been slowdown. So we should build a creative national innovation system. From the current innovation system in Korea, which is characterized as a catching-up NIS, we should move into a new national innovation system. New NIS to be rebuilt is characterized as more open and more creative system.

Slide 7




The Korean government makes some reforms in S&T policy and administration system. We organized the national S&T administration system (Slide 9). MOST has been promoted and approved as a position in the whole cabinet. The MOST minister promoted to the Prime Minister. And we newly organized the vice ministry for science and technology innovation. They are responsible for organizing, coordinating and evaluating the whole S&T policy, including other ministries. And we also have an organization to coordinate S&T statistics, such as the S&T Information Division and the Output Management Division.

Slide 9



Next I will show some activities on S&T indicators recently happening in Korea. There are two main activities related to S&T indicators (Slide 10). One is developing national S&T indicators by MOST. Another activity is building a national S&T indicator database. The motives of these activities can be found in changing the environment and direction of S&T policy as I mentioned before. We have to search a new direction with a new pattern. So the government needs to grip the current situation and the problems objectively. Especially MOST, who has the central position of the national S&T innovation policy, wants to monitor and evaluate the NIS system. So that collects the data and analyzes the indicators.

Slide 10

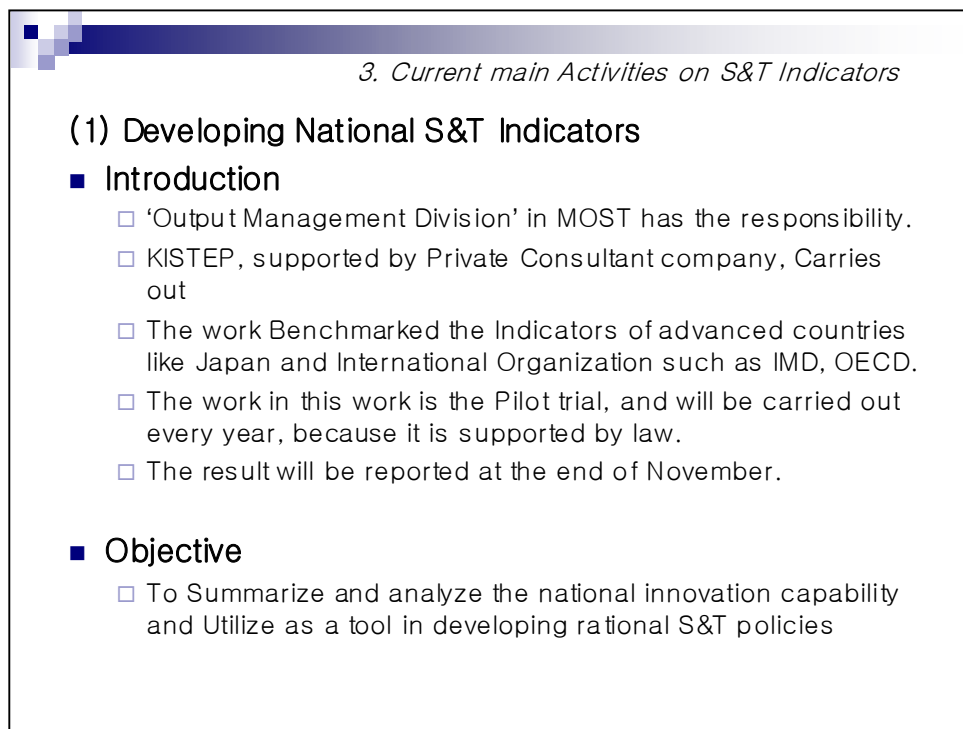


### 3. Current main Activities on S&T Indicators

- **Background**
  - The President insists on the Indicators
  - MOST has the central position of the national S&T Innovation policies: supervising, planning, coordinating roles.
  - Interest in Establishment of new NIS
  - Evaluation of the government performance
- **Main Activities related S&T Indicators**
  - Developing National S&T Indicators
  - Building National S&T Indicators Database

The main objective of the work is to summarize and analyze the national innovation capability and to utilize it as a tool in developing rational S&T policies (Slide 11). The output management division in MOST has the responsibility to analyze innovation activities, and KISTEP is carrying out practical work. MOST launched the project to develop national S&T indicators framework last year, and this year the indicators have been collected and analyzed as a just pilot test level. After this year, the indicators will be built every day. The structure of national S&T indicators is developed by KISTEP like this (Slide 12). It consists of 5 main categories, such as resource, activity, process, performance and environment. Its structure copes with the framework of a national NIS plan, which was established last year by MOST (Slide 13).

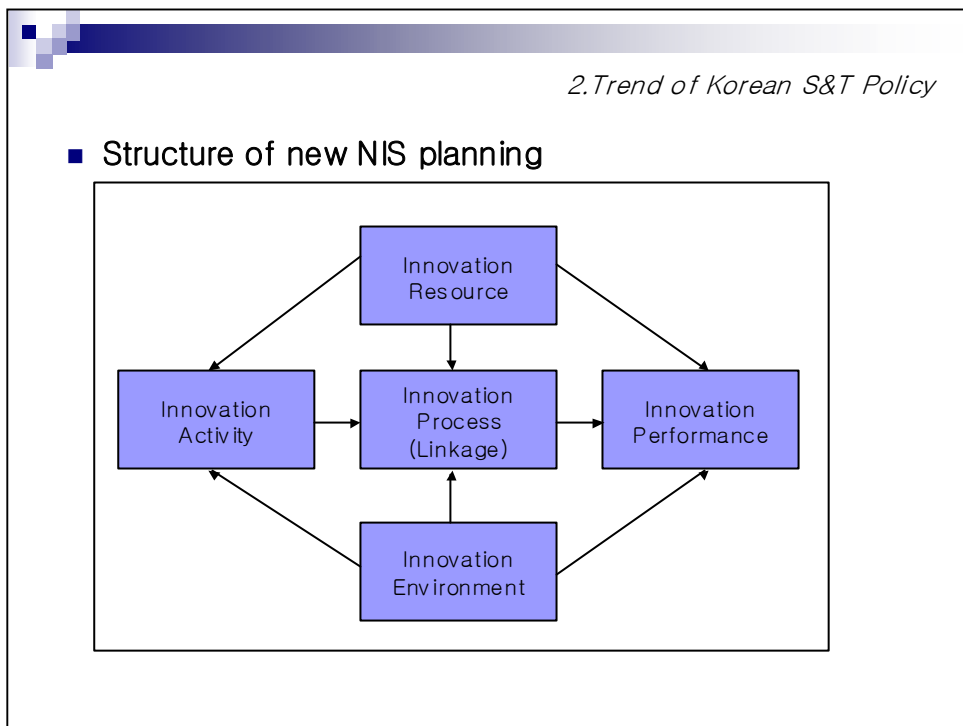
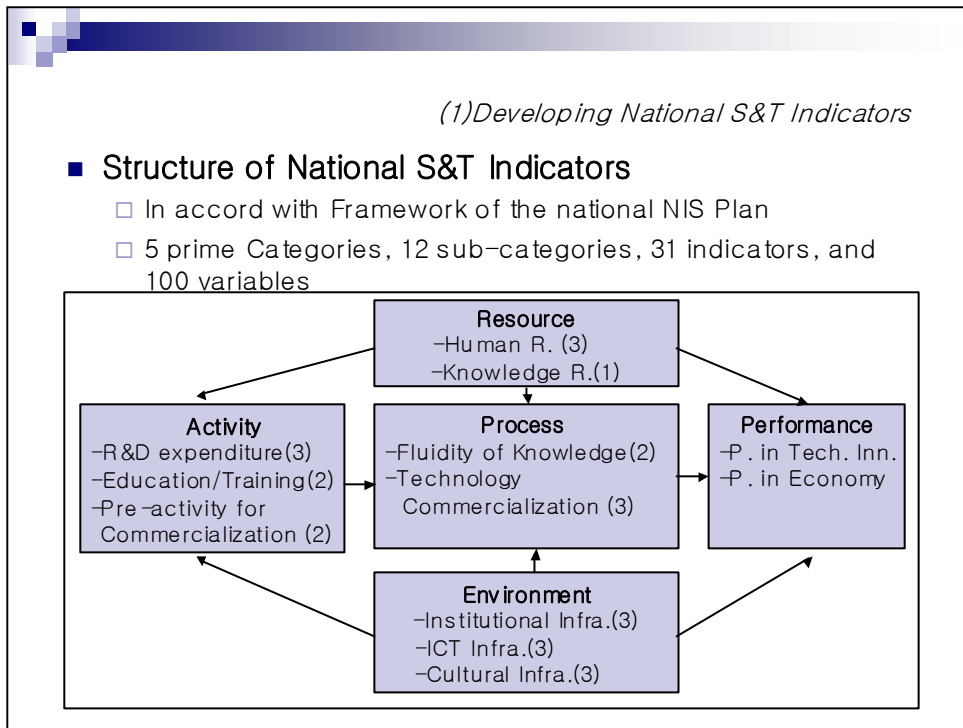
Slide 11



*3. Current main Activities on S&T Indicators*

**(1) Developing National S&T Indicators**

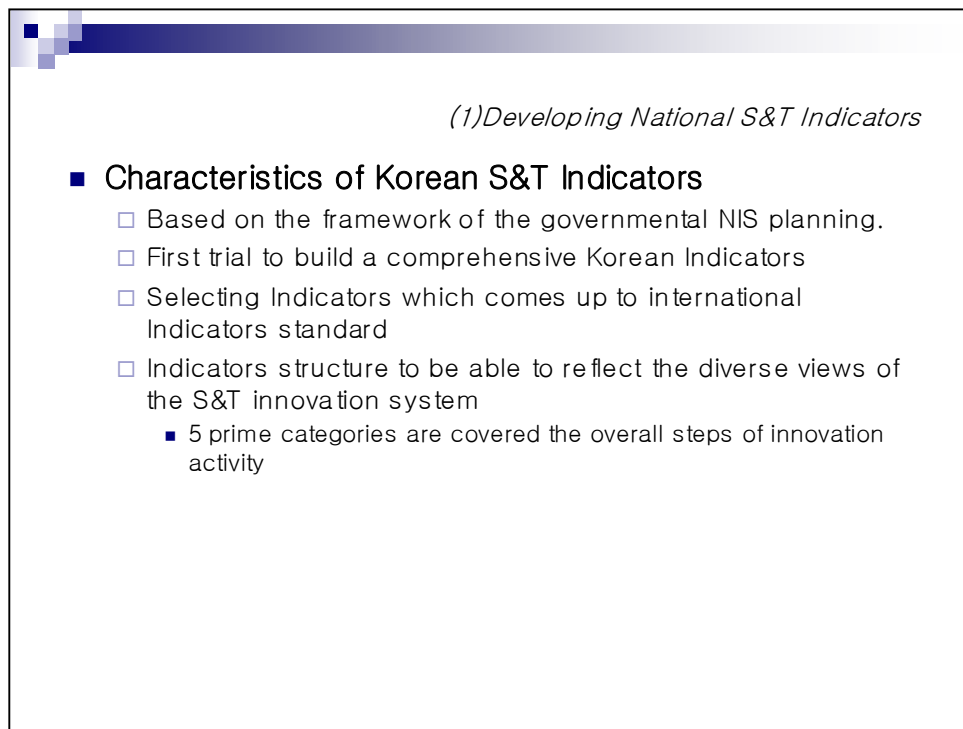
- **Introduction**
  - 'Output Management Division' in MOST has the responsibility.
  - KISTEP, supported by Private Consultant company, Carries out
  - The work Benchmarked the Indicators of advanced countries like Japan and International Organization such as IMD, OECD.
  - The work in this work is the Pilot trial, and will be carried out every year, because it is supported by law.
  - The result will be reported at the end of November.
- **Objective**
  - To Summarize and analyze the national innovation capability and Utilize as a tool in developing rational S&T policies



The whole indicators built are about 100 variables. They are selected by this process: First we build candidate pools referring to the indicators of other countries and international organizations like Japan, OECD and IMD, and select the indicators by expert survey. Then we build the indicators using the OECD database, patent, ISI, IMD, NSF and EIS.

We can summarize the features of the current Korean S&T indicators (Slide 14). As I explained, these indicators are based on the framework of governmental NIS planning, so we can connect the plan and the indicators easily. And indicators are designed to be able to reflect the diversities of the S&T innovation system, and cover overall steps of innovation activity.

Slide 14



*(1) Developing National S&T Indicators*

- **Characteristics of Korean S&T Indicators**
  - Based on the framework of the governmental NIS planning.
  - First trial to build a comprehensive Korean Indicators
  - Selecting Indicators which comes up to international Indicators standard
  - Indicators structure to be able to reflect the diverse views of the S&T innovation system
    - 5 prime categories are covered the overall steps of innovation activity

Another activity, related S&T indicators in Korea, is building a database for S&T indicators (Slide 15). The main activity is to build the framework for national S&T indicators database, to develop a standard format to service the database, and to serve to the Korean public through online. It is ultimately connected to the national S&T indicators. This is the framework (Slide 16). It has three prime categories, 11 subcategories and 214 indicators. The three prime categories consist of input, performance, and infra & awareness. Meaning of these activities is to collect all of the data about the national innovation system at a website, and to find it easily.

## (2) Building National S&T Indicators Database

- **Background**
  - Increasing the needs of utilizing S&T statistics and indicators to answer objectively the diverse question related with S&T Innovation system.
  - Unsystematic situation of developing and managing S&T indicators in Korea; many S&T indicators by many organization
  - Establishing 'the Vice Minister for Science and Technology Innovation' in MOST
  
- **Main works**
  - Build the framework for national S&T indicators database
  - Develop the standard format to service the database
  - Service to the public by online (<http://kistep.ssdb.co.kr/>)

*(2) National S&T Indicators Database*

- **Database Framework**
  - 3 prime categories, 11 sub-categories, 27 detail-categories, and 214 indicators

<b>Input Indicators</b>	R&D expenditure	3 cat. Including Total R&D expenditure
	Human Resource	2 cat. Including R&D Researchers
<b>Performance Indicators</b>	Papers	SCI papers
	Patents	2 cat. Including domestic patents
	Economic Performance	4 cat. Including technology trade
	Cooperative Activity	Technological cooperation
<b>Infra and Awareness Indicators</b>	Scio-Economic Infra.	6 cat. Including GDP
	S&T Infra	2 cat. Including Information level
	S&T Culture	2 cat. Including S&T museum
	Education	2 cat. Including primary & middle students
	Mobility of R&D researchers	2 cat. Including mobility btn organizations

Next I will explain Korean Innovation Survey (Slide 17). Korean Innovation Survey (KIS) is carried out by STEPI without any relation to the government publicly. Since 2003 we got approval as a national statistics from Statistics of Korean National Statistics Office and opened a homepage. Before moving into the KIS results, let's view the history briefly (Slide 18). We conducted the first survey in 1996. I was involved in collecting the data since 2002. Now we collected the manufacturing sector data and the service sector data every three years. The manufacturing and service sector are surveyed at the different year. This year we are collecting the data for the manufacturing sector.

Slide 17 and 18

## 4. Korean Innovation Survey (KIS)

### ■ Introduction

- Carrying out by STEPI without no relation with the government every 3 years
- Since 2003, proven Statistics of Korean National Statistics Office
- 2003, Open the homepage, <http://kis.stepi.re.kr>
- Information collected from Innovation Surveys
  - Product/process innovation
  - Effects of innovation
  - Governmental supporting systems for innovation
  - Innovation co-operation
  - Source of information for innovation
  - Hampered innovation activity
  - Others..

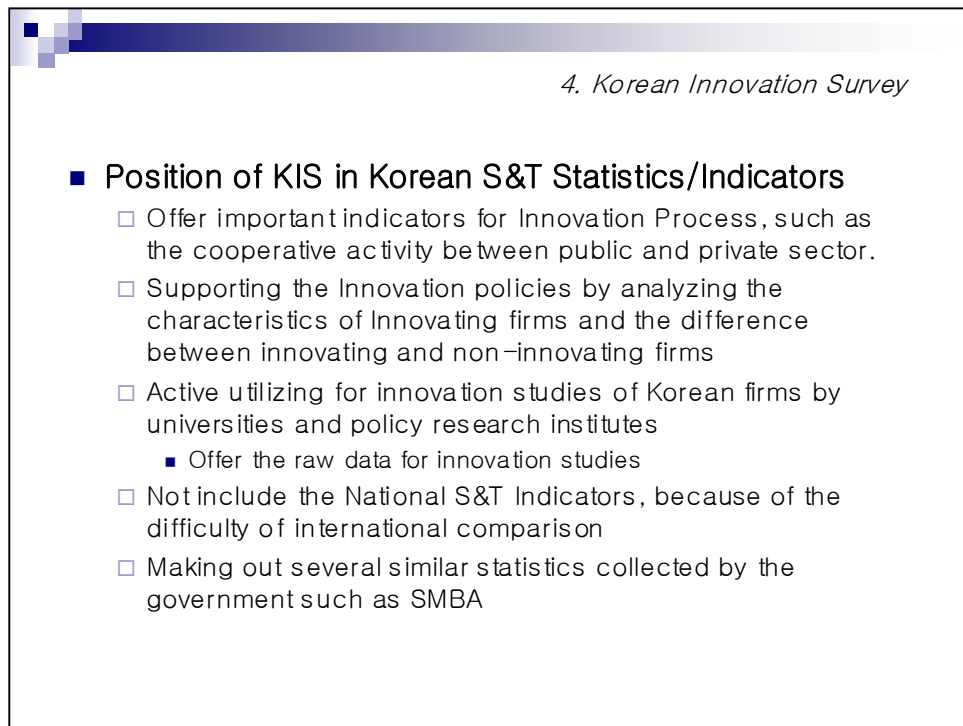
### *4. Korean Innovation Survey*

### ■ History

- 1996, first survey for manufacturing sector only based on CIS 1 of EU
- 1998, second survey for both manufacturing and service sector based on CIS 2 of EU
- 2002, third survey for manufacturing sector based on CIS 3 (3875 companies collected)
- 2003, third survey for service sector (2000 companies)
- 2005, forth survey under collecting for manufacturing sector

Innovation Survey has an important position in Korean S&T indicators; because it is an almost unique source of indicators data for innovation process, such as a cooperative activity between public and private sector (Slide 19). And it can support the innovation policies by analyzing the characteristics of innovating firms and the difference between innovating and non-innovating firms. Micro data of Korean Innovation Survey is released to policy makers and researchers of universities and institutes to study innovation activities. So they are active utilizing for innovation study.

Slide 19



*4. Korean Innovation Survey*

- **Position of KIS in Korean S&T Statistics/Indicators**
  - Offer important indicators for Innovation Process, such as the cooperative activity between public and private sector.
  - Supporting the Innovation policies by analyzing the characteristics of Innovating firms and the difference between innovating and non-innovating firms
  - Active utilizing for innovation studies of Korean firms by universities and policy research institutes
    - Offer the raw data for innovation studies
  - Not include the National S&T Indicators, because of the difficulty of international comparison
  - Making out several similar statistics collected by the government such as SMBA

Next slide is an international comparison result of Innovation Survey data (Slide 20). Even though each country conducted the survey based on the same manual in the concept and collecting methodology, the surveys of each country are different in some points. I summarize the features of each country's survey. Korean survey collected for the firms' innovation activities during 2000-2001, and the final response rate is over 60 percent. The survey terms are shorter than the other countries. Therefore, we tried to adjust the terms to get the comparable proportion of innovative firms, but the estimates are only the maximum value of the rate.

Slide 20

*4. Korean Innovation Survey*

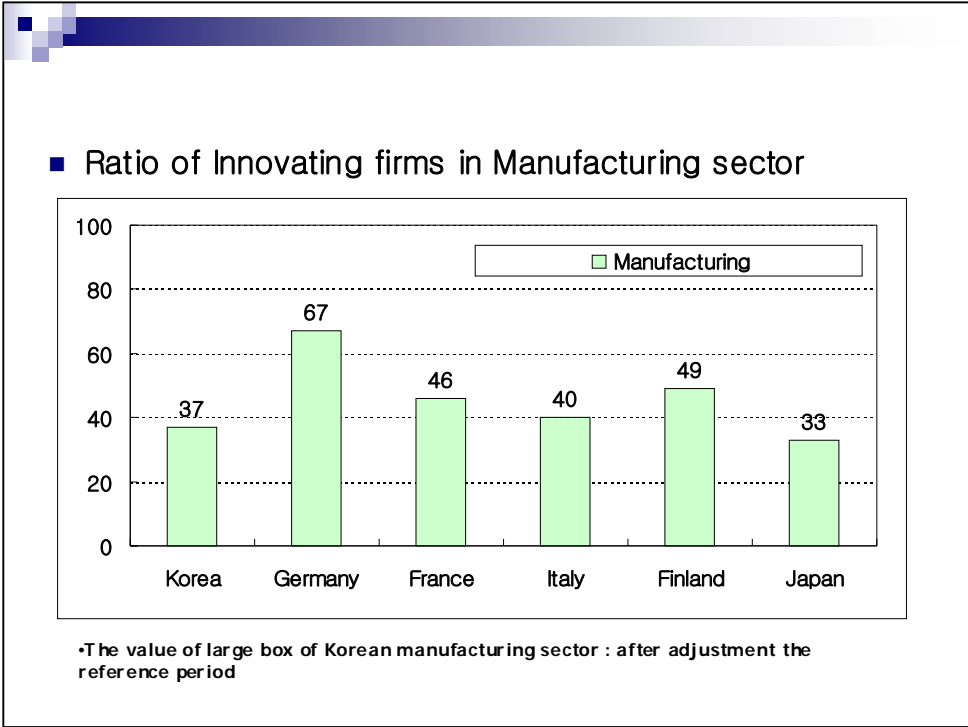
**(1) Results of International comparison**

- **Data summary : manufacturing sector only**

	Korea	Germany	France	Italy	Finland	Japan
Data collecting years	2000–2001	1998–2000	1998–2000	1998–2000	1998–2000	1999–2001
Rate of sampling	12%	40%	12%	20%	35%	27%
Response rate	61%	94%	82%	62%	50%	21%

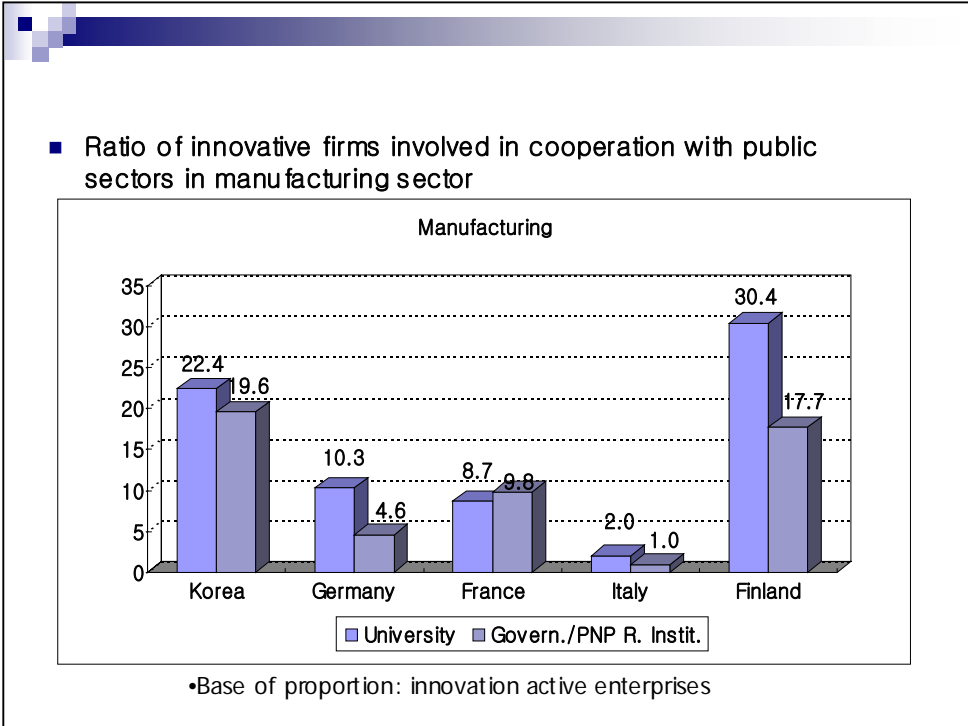
This is the ratio of innovating firms in manufacturing sector (Slide 21). Germany is very high, Finland also high ratio. Japan and Korea are lower than European countries. Next slide (Slide 22) is the result of the ratio by firm size. The larger the firm size, the higher the ratio of innovative firms. Large companies with over 300 employees, about eighty percent, have similar value with Italy and France, and lower than Germany and Finland. Small and medium companies have lowest value compared with EU countries. But Japan has lower value for every firm size.

Slide 21



Next slide (Slide 23) is about the cooperation activity between the public sector in the manufacturing sector for innovation. Finland has a really strong relationship between public and private, and Korea is also a very good situation in cooperative relation compared with Germany, France, or Italy. Compared with by size, the large companies of every countries, including Korea, have a stronger relationship with universities and public institutes than the small and medium ones. But compared with other countries, Korea has a stronger relationship between the public and private sector even for small and medium enterprises. This is a very impressive result for the Korean innovation policy, and we will have to search the reason.

Slide 23



Last I summarize my presentation (Slide 25). There are many S&T indicators collected in Korea, but mainly collecting the indicators in the area of the innovation resources and activities. So we have an imbalance between the indicators and the statistics. Now we have a few trials to build the comprehensive S&T indicators system. And we will improve I hope. Thank you.

Slide 25



## Summary

- There are many S&T Statistics collected in Korea.
  - Mainly collecting the indicators in the area of the Innovation resources and activities.
- Until now, Korea has little effort to developing the system of S&T statistics/indicators
- Now, Korea has a few trial to build the comprehensive S&T indicators system.

## **Discussion on the Korean Presentation**

Niwa: Thank you so much for your splendid presentation. Dr. Um introduced Korean S&T statistics and policy or indicators. And finally you introduced Korean Innovation Survey. And I think we are greatly interested in results of Korean Innovation Survey. So I would like to choose the Korean Innovation Survey as the first topic of discussion. Today I would like to ask Professor Ijichi, and he is an organizer of Japanese Innovation Survey. First I would like to ask Professor Ijichi for some comments. We are very interested in your comments.

Ijichi: Thank you very much for your presentation. In your presentation Korea has more experience than us so you have plenty of information on conducting active innovation. Still I would like to mention about the slide on data results on international companies. Could you show that? For Japan the response is not so many and we conduct non-response analysis. We check that why those companies did not participate in the survey. The main reason was that this survey, our Japanese survey is the first one. So that is why it was difficult or impossible to respond to the survey. The company needs to collect the data for the survey. And the innovation survey covers various kinds of information, so they do not have the preparation. If you look at other countries, it depends on the status of the survey. And in Germany they used a method of a panel survey. This means that most of the companies are familiar with the data collection. Also other countries, especially England and France, the surveys are compulsory. So the companies have to respond. And now in European countries, European Union economic area countries, they have to collect innovation data. So this framework the government has to collect and private companies have to respond. So that is why the ratio is very high. In other EU member countries like Sweden or other countries they conduct individual surveys on a voluntary basis. So the ratio is not so good.

Niwa: In the case of Korea I think that is the first survey, so why has the response been so high? Oh, not first. OK. I am sorry. So thank you very much.

Ijichi: You are establishing a S&T indicator database in Korea. STEPI was collecting the information not only for Korean indicators but also for other Asian countries under the framework of APEC. So what is the relationship between MOST activities and APEC ones?

Um: This database is organized by MOST for the domestic users.

Ijichi: For some reason I found a home page on the APEC DB on STEPI.

Um: These databases include a wide range, not just S&T activities. It also includes data about human resources, of high schools.

Wong: The definition of innovative firm that you use in your survey instrument is “new to the firm”, right? But not “new to the world.” Innovation is “new to the firm”, but not “new to the world” because the CIS has two questions; one is, were they “new to the firm”? The other one is, was it “new to the world”? Yours is “new to the firm”, right?

Um: Yes, “new to the firm.”

Wong: Did you collect data on the other question, which is “new to the market”, “new to the world”?

Um: Yes, we also did.

Wong: So what are the numbers of firms with something “new to the world”?

Um: “New to the world”? About 10 percent.

Gao: In China we are only five percent.

Um: You have many enterprises.

Gao: I have a very small question about your presentation which is the structure of the minister of science and technology. And you have two Vice Ministers. One is for science and technology. And the other is for science and technology innovation. What is the difference between these two?

Um: Previous to changing the organization we had only a Vice Minister of Science and Technology. Now the Vice Minister covers the original MOST works. However, the Vice Minister for Science and Technology Innovation is responsible for supporting visionary concept for S&T. He is responsible for organizing and coordinating the whole S&T plan and budget distribution about all over the S&T Ministries.

Wong: Also under the vice minister you have deputy ministers. Vice Ministers, Deputy Ministers, Deputy Minister for R&D Coordination, and also here, Deputy Minister for Policy Management and Public Relations. Confusing! So, how many Ministers? Are the Vice Ministers politicians, or political nominees, or bureaucrats?

Um: Bureaucrats.

Wong: So in this chart only one? The Deputy Prime Minister.

Nagano: I cannot understand what divides the Vice Minister for Science and Technology and the Vice Minister for Science and Technology Innovation. Do you mean that the Vice Minister for Science and Technology Innovation is somehow related to national council?

Um: Yes.

Hirano: What is the meaning of S&T innovation? That is one question. And the other one is, STEPI is doing the Innovation Survey. But it is doing, the Innovation Survey without any relationship with the government. But my understanding is that STEPI is a governmental organization. So I guess that STEPI cannot do anything without authorization by the government.

Um: I mean that STEPI does not have any approval and a special budget for the survey from the minister.

Hirano: Is it right that you can do anything at your discretion, with your own judgment?

Um: We receive the budget for operation and research in the gross from the government, and do not have special one for the Innovation Survey, so we are carrying out the Innovation Survey independently.

Nagano: Sorry, you are saying you do not get budget from MOST. But from which Ministry, maybe the Cabinet, do you get budget?

Um: Prime Minister. The Prime Minister is our ruling officer.

Hirano: How about the meaning of S&T innovation? Do you mean that there are two kinds of innovation? One is S&T innovation, the other one is non-S&T innovation? Is that what you mean?

Um: I mean “science” and “technology innovation”. The government focuses on innovation, all of the area.

Hirano: So your Innovation Survey covers all, doesn't it?

Um: Technology innovation is our scope.

Ijichi: Original idea of Schumpeter, “innovation” covers not only technological innovation but also non-technological innovation. For example, organizational innovation, and so on.

Um: From this year we collect non-technological innovation activities in Korea.

Niwa: I would like to ask Professor Ijichi for comments of the innovation company. This is page 13, the top figure. Japan is 37, Korea is 33, and Germany 47.

Ijichi: It is very difficult to interpret these indicators' meaning. This chart shows that 33 percent of companies in Japan are doing innovation, and the others do not conduct innovation. But I think that this figure shows that a kind of a part of the nature of our innovation system. A possible interpretation is that in Japan innovation activities are realized by a relatively small number of innovative companies. But other non-innovative companies might have a close contact with innovating companies. But in other countries like France or Italy more companies do independent work, so they are more innovative. So this figure just shows such a situation. But it is a possible interpretation, and we need more research conducted using indicators. And currently Dr Keith Smith, who is also a consultant to OECD, using the CSV data to create new indicators to find a tie or kind of innovation by country. In the case of Japan it might still relate to the problem of language because in Germany this CSV survey dropped out the technical. But still in Germany the technical has a different meaning from other European countries. So this language problem might affect this data.

Gao: Also I would like to give this comment about the time range. The time range for innovation may be different for the different categories in the survey you used. For example, in Korea you may ask a firm, "Do you have innovation activities for last year or the year before last?" Is it two years, or one year, or three years? I do not know.

Wong: The CIS definition of the word "innovation" asks to count the innovations which have happened during the last three years.

Gao: Last three years? So if you use the last three years, or use the last year. I do not know. Of course, in Germany they do an innovation survey every two years so they could not ask them for the last three years. So I think the time arrangement for surveys may be different.

Wong: I think the data from the CIS, too, has not really been validated in the sense of having seen its correlation with other places. For example, Sweden is like Japan. Sweden no longer has the highest R&D to GDP ratio at three percent. But it is also among the lowest among the European countries in terms of this measure, innovating. So I think we could be some countries that slip by us because it is all perception of what you mean by significantly improved or new. And also it is affected by sector. If you are like Sweden, Sweden has a lot of heavy industry. With heavy industry you do not have new product innovation, significant innovation every year. Because it depends on what you mean by significant. It is relative to

the whole product that you are making a new power generator. To qualify as significant that means you have to have a very major change. But if you are making a small product, even a small change is significant, right? So it is what you mean there. So I guess frankly this is not a measure that is really objective. There has been no scholarly work being done to really be innovative. I mean you do not see top innovation having published data. You see this measure in a real way across country. So I think I would give it a grain of salt. Because it may be, for example, in Japan that innovation standard is very high so when people say "I am innovating, I am really doing a lot", but in a poor country they may think that doing something is innovating. But to a Japanese, no, it is not innovating. So it is a question of standards.

Gao: In China's pilot survey the innovation rate may be high. But if you look at more than 60 percent, it is high enough. But if you look firms who have R&D expenditures, it is much lower than that. So it is very strange. So there is the conception about innovation. What is the innovation for the response? He may think that every new product is new innovation. Perhaps these new products are just imported. They do not have any R&D. But if you follow the definition of innovation, it should be innovation. But they do not have R&D activities. So in some instances it is not comparable. I think that.

Niwa: But if in each case we gather some ideas to include in the questionnaire. For example, 1/10 improvement or tenfold improvement, or some example.

Wong: I would like to ask what proportion of the sales is the contribution of innovation.

Ijichi: And also the relation to the R&D expenditures, the innovation survey questionnaire includes that your company is conducting R&D continuously or non-continuously.

Um: In Korea's case, many innovating companies have R&D activities. About 70 percent of innovative firms have conducted R&D activities continuously. The R&D activity is very important in innovation activity of Korean companies.

Niwa: Thank you very much. A very wonderful and interesting presentation and magnificent discussion. Our final speaker is Professor Wong. Please.