調査資料 No.124

「日中韓科学技術政策セミナー2006」
開催報告

（2006 年 1 月 23 日－24 日、於：三田共用会議所、東京）

The Science and Technology Policy Research Seminar 2006

(January 23 and 24, 2006, Mita Kaigisho, Tokyo)

2006 年　3 月
March, 2006

文部科学省　科学技術政策研究所
第 3 調査研究グループ

Third Policy-Oriented Research Group
National Institute of Science and Technology Policy (NISTEP)
Ministry of Education, Culture, Sports, Science and Technology

The Science and Technology Policy Research Seminar 2006

January, 2006

Organized by

Third Policy-Oriented Research Group
National Institute of Science and Technology Policy (NISTEP)

目次

はじめに

東アジア地域はその発展が著しく、北米、欧州に並ぶ世界のイノベーション中心地域の一つとなっております。経済的にも、東アジアの関係性は一層深まっており、また知識経済社会を支える科学技術・学術活動においても、相互交流が深まっております。

成長著しい東アジアの将来を展望し、効率的なイノベーション・システムを構築して行く上で、「科学技術政策研究」はいわば「国家戦略の羅針盤」としての重要な研究領域として、各国においてその重要性に対する認識が高まっており、それを担う研究機関の役割も一層重要なものとなっております。

こうした情勢の中、科学技術政策研究所は、東アジアの主要国である日本、中国、韓国の科学技術政策研究機関の関係者が一同に会し、科学技術政策・イノベーション研究についてのそれぞれの取り組みについて情報交換を行うとともに、それぞれの立場から「科学技術人材」、「理解増進」、「地域イノベーション」及び「科学技術予測」について、専門的な立場から意見交換を行うことを目的に「日中韓科学技術政策セミナー2006」を 2006 年１月 23 日，24 日の両日開催いたしました。

本セミナーでは、当研究所の他、中国の国家科学技術部中国科技促進発展研究中心（NRCSTD)、中国科学院科技政策与管理研究所（IPM)、韓国の科学技術政策研究院（STEPI)、科学技術評価・計画院（KISTEP）の各所長に加え、各機関の将来を担う研究者が参加し、意欲と情熱をもって取り組んでいる各テーマについて、有意義な発表・意見交換が行われました。

本セミナーの開催が、各機関においてフェイス・トゥー・フェイスの関係を築いていく契機となり、本セミナーの継続的な開催をはじめとした各機関の交流拡大はもとより、将来、東アジアが更なる飛躍を遂げていくためにも、意味のある第一歩となることを期待しており、本書はその基礎的資料として、本セミナーの概要、発表資料をとりまとめております。

末筆ながら、多忙なスケジュールの中、本セミナーにご参画、ご貢献いただいた国内外の有識者並びに関係各位に対し、改めて心からの謝意を示させていただきます。

2006 年３月　科学技術政策研究所
所長　　小中　元秀

プログラム

１月２３日　（月）

10:00～10:10　オープニングセッション

10:00～10:05　　開会挨拶　小中元秀科学技術政策研究所長

10:05～10:10　　挨拶　小田公彦　科学技術・学術政策局長

10:10～12:00　セッション１　日中韓における科学技術政策研究

10:10～10:30　　*基本計画レビュー調査にみられる科学技術政策研究所の役割*

（日本：小中元秀　科学技術政策研究所長）

10:30～10:50　　***Scenarios: China's Future S&T Development Strategies***

国家科学技術部科技促進発展研究中心 Yuan Wang所長

10:50～11:10　　***Overview of Research Activity in IPM***

科学院科技政策与管理研究所 Rongping Mu所長

11:10～11:30　　***What STEPI Does?***

科学技術政策研究院 Sungchul Chung所長

11:30～11:50　　***KISTEP-Korea's S&T Planning and Evaluation Innovator***

科学技術評価・計画院 Hee-Yol Yu所長

11:50～12:00　　意見交換（モデレーター：小中元秀所長）

12:00～13:00　　昼食

13:00　セッション２　科学技術政策における人材戦略と理解増進

テーマ１　人材 13:00～14:25

13:00～13:15　　***Japanese Trends for Cultivation of Human Resources in Science and Technology（HRST）***

科学技術政策研究所　第１調査研究グループ　下村智子上席研究官

13:15～13:35　　***The Change of Human Resources in Science and Technology in China***

国家科学技術部科技促進発展研究中心 Yandong Zhao副研究員

13:35～13:55　　***Overview of Development on S&T Talents in China***

科学院科技政策与管理研究所 Lanxiang Zhao研究員

13:55～14:15　　***Nurturing Human Resources in S&T for the 21st Century: Status-quo and Recent Policy Instruments in Korea***

科学技術評価・計画院 Ki-Wan Kim副研究員

14:15～14:25　意見交換（モデレーター：Yuan Wang所長）

テーマ２　理解増進 14:25-15:30

14:25～14:40　***Science Communication and Science Literacy in Japan***
第２調査研究グループ　渡辺政隆上席研究官

14:40～15:00　***The Role Change of Scientist in the Contemporary Popularization of Science***
科学院科技政策与管理研究所　Zhu Xiao-min副研究員

15:00～15:20　***In Search of "Science Culture System": Theory and the Korean Case***
科学技術政策研究院　Sungsoo Song研究員

15:20～15:30　意見交換（モデレーター：Rongping Mu所長）

15:30～15:50　休憩

15:30～17:10　セッション３　科学技術予測と未来戦略

15:30～15:50　*科学技術の中長期発展に係る俯瞰的予測調査　～第８回科学技術予測調査の全体像～*
科学技術政策研究所　動向センター　奥和田久美センター長補佐

15:50～16:00　*急速に発展しつつある科学技術領域調査～第８回予測調査における結果と本年度の取り組み～*
科学技術政策研究所　動向センター　阪彩香研究員

16:00～16:20　***Technology Foresight in China***
国家科学技術部科技促進発展研究中心　Dongyuan Wei博士

16:20～16:40　***Technology Foresight of China : Towards 2020***
科学院科技政策与管理研究所　Rongping Mu所長

16:40～17:00　***Korean Technology Foresight and Future Strategic Technology***
科学技術評価・計画院　Byeongwon Park主任

17:00～17:10　意見交換（モデレーター：Hee-Yol Yu所長）

18:00～　レセプション

１月２３日総合司会
科学技術政策研究所第３調査研究グループ　松澤孝明　総括上席研究官

１月２４日（火）

<u>9:30～11:30　セッション４　東アジアにおける地域イノベーションシステムの現状と課題</u>

9:30～9:50　***Conflicting "Regional Innovation System (RIS)" and its reality***
科学技術政策研究所第３調査研究グループ　松澤孝明 総括上席研究官

9:50～10:00　***Diversity of Region***
科学技術政策研究所第３調査研究グループ　丸山泰廣 特別研究員

10:00～10:20　***The Research of Regional Independent Innovation Capacity in China***
国家科学技術部科技促進発展研究中心　Shuhua Wang副研究員

10:20～10:40　***Central Government's Efforts to Promote Innovation at the Regional Level in China***
科学院科技政策与管理研究所　Yibing Duan副研究員

10:40～11:00　***Innovation Clusters in Changing Global Production Networks of East Asia***
科学技術政策研究院　Jeong Hyop Lee副研究員

11:00～11:20　***Policies and Strategies for Strengthening Regional Innovation Capacity in Korea***
科学技術評価・計画院　Jooyoun Hahn副研究員

11:20～11:30　意見交換（モデレーター：Sungchul Chung所長）

11:30～11:40　休憩

<u>11:40～12:10　クロージングセッション</u>

11:40～12:00　意見交換（モデレーター：小中元秀所長）

１月２４日総合司会
科学技術政策研究所第３調査研究グループ　阿部浩一　上席研究官

Programme

Science and Technology Policy Research Seminar 2006

23 January 2006 （**at the Mita House**）

10:00-10:10 Opening

10:00-10:05 Opening address by Mr. Motohide Konaka, Director-General, NISTEP

10:05-10:10 Keynote address by Dr. Kimihiko Oda, Director-General, Science and Technology Policy Bureau, Ministry of Education, Culture, Sports and Technology (MEXT)

10:10-12:00 Session 1: General session （**Outline of respective institutes' activities)**

10:10-10:30 ***Role of NISTEP in process of formulation of 3rd Science and Technology Basic Plan***
Mr. Motohide Konaka, Director-General, National Institute of Science and Technology Policy, Japan

10:30-10:50 ***Scenarios: China's Future S&T Development Strategies***
Prof. Yuan Wang, Director-General, National Research Centre for S&T for Development, China

10:50-11:10 ***Overview of Research Activity in IPM***
Dr. Rongping Mu, Director-General, Institute of Policy & Management, Chinese Academy of Sciences, China

11:10-11:30 ***What STEPI Does?***
Dr. Sungchul Chung, Science and Technology Policy Institute, Korea

11:30-11:50 ***KISTEP-Korea's S&T Planning and Evaluation Innovator***
Dr. Hee－Yol Yu, Korea Institute of S&T Evaluation and Planning, Korea

11:50-12:00 Discussion on General Session (Moderator: Mr. Motohide Konaka, NISTEP)

12:00-13:00 Lunch break

13:00-15:25 Session 2: Breakout session on human resources and enhancement of understanding on Science and Technology Policy

Theme 1: Human resources (13:00-14:25)

13:00-13:15 **Japan**

13:00-13:15 ***Japanese Trends for Cultivation of Human Resources in Science and Technology（HRST）***

Ms. Tomoko Shimomura, Senior Research Fellow, First Policy-Oriented Research Group, NISTEP

13:15-13:55 **China**

13:15-13:35 ***The Change of Human Resources in Science and Technology in China***

Dr. Yandong Zhao, Vice Researcher, NRCSTD

13:35-13:55 ***Overview of Development on S&T Talents in China***

Prof. Lanxiang Zhao, Researcher, IPM

13:55-14:15 **Korea**

13:55-14:15 ***Nurturing Human Resources in S&T for the 21st Century: Status-quo and Recent Policy Instruments in Korea***

Dr. Ki-Wan Kim, Associate Research Fellow, KISTEP

14:15-14:25 **Discussion on human resources**

(Moderator: Prof. Yuan Wang, Director-General, NRCSTD)

Theme 2: Enhancement of understanding (14:25-15:25)

14:25-14:40 **Japan**

14:25-14:40 ***Science Communication and Science Literacy in Japan***

Mr. Masataka Watanabe, Senior Research Fellow, Second Policy-Oriented Research Group, NISTEP

14:40-15:00 **China**

14:40-15:00 ***The Role Change of Scientist in the Contemporary Popularization of Science***

Dr. Zhu Xiao-min, Vice Researcher, IPM

15:00-15:20 **Korea**

15:00-15:20 ***In Search of "Science Culture System": Theory and the Korean Case***

Dr. Sungsoo Song, STEPI

15:20-15:30 **Discussion on enhancement of understanding**

(Moderator: Dr. Rongping Mu, Director-General, IPM)

15:30-15:50 Coffee Break

15:50-17:30 Session 3: Science and Technology foresight

15:50-16:20 Japan

15:50-16:10 ***The 8th Science and Technology Foresight Program in Japan***
Dr. Kumi Okuwada, Senior Research Fellow, Science and Technology Foresight Center, NISTEP

16:10-16:20 ***Study on Rapidly-Developing Research Area***
Dr. Ayaka Saka, Research Fellow, Science and Technology Foresight Center, NISTEP

16:20-17:00 China

16:20-16:40 ***Technology Foresight in China***
Dr. Dongyuan Wei, NRCSTD

16:40-17:00 ***Technology Foresight of China : Towards 2020***
Dr. Rongping Mu, Director-General, IPM

17:00-17:20 Korea

17:00-17:20 ***Korean Technology Foresight and Future Strategic Technology***
Dr. Byeongwon Park, Head, Foresight & Strategic Planning Team, KISTEP

17:20-17:30 Discussion (Moderator: Dr. Hee-Yol Yu, President, KISTEP)

18:00～20:00 Reception

24 January 2006 （at the Mita House）

9:30-11:30 Session 4: Breakout session on current situation and challenges of regional innovations in East Asia

09:30-10:00 **Japan**

09:30-10:00 *Conflicting "Regional Innovation System (RIS)" and its reality*

Mr. Takaaki Matsuzawa, Director, Third Policy-Oriented Research Group, NISTEP

Diversity of Region

Mr. Yoshihiro Maruyama, Visiting Researcher, Third Policy-Oriented Research Group, NISTEP

10:00-10:40 **China**

10:00-10:20 ***The Research of Regional Independent Innovation Capacity in China***

Dr. Shuhua Wang, Vice Researcher, NRCSTD

10:20-10:40 ***Central Government's Efforts to Promote Innovation at the Regional Level in China***

Dr. Yibing Duan, Vice Researcher, IPM

10:40-11:20 **Korea**

10:40-11:00 ***Innovation Clusters in Changing Global Production Networks of East Asia***

Dr. Jeong Hyop Lee, Associate Research Fellow, STEPI

11:00-11:20 ***Policies and Strategies for Strengthening Regional Innovation Capacity in Korea***

Dr. Jooyoun Hahn, Associate Research Fellow, KISTEP

11:20-11:30 **Discussion (Moderator: Dr. Sungchul Chung, STEPI)**

11:30-11:40 **Break**

11:40-12:10 Wrap-up session

11:40-12:00 Inclusive discussion (Moderator: Mr. Motohide Konaka, NISTEP)

開催結果概要

世界の中で、東アジア地域は経済発展著しい地域であり、北米、欧州に並ぶ科学技術・イノベーション中心地域の一つとして成長しつつある。東アジア各国の関係性は一層深まっており、知識経済社会を支える科学技術・学術活動においても一層の相互交流が期待されており、平成１７年１２月に出された「『科学技術に関する基本政策について』に対する答申」の中でも、国際活動の戦略的推進におけるアジア諸国との協力として、「内外から日本に期待される役割を果たしていくため、アジア諸国との間で科学技術の連携を強化する」と述べられている。

このような背景のもと、東アジアの中核となる日・中・韓の３国の科学技術政策研究機関が一堂に会し、その交流を一層深めるために各機関の取り組み状況及び科学技術政策の抱える共通の問題について意見交換を行うため、科学技術政策研究所(NISTEP）では、１月 23 日と 24 日に東京港区の三田共用会議所において、「日中韓科学技術政策セミナー2006」を開催した。

参加した機関は、各国の科学技術政策研究分野での中核的機関であり、具体的には、NISTEP（日本）のほか、中国から、国家科学技術部科技促進発展研究中心（National Research Center for Science and Technology Development：NRCSTD）及び科学院科技政策与管理研究所（Institute of Policy and Management：IPM)、韓国から、科学技術政策研究院（Science and Technology Policy Institute：STEPI）及び科学技術評価・計画院（Korea Institute of Science and Technology Evaluation and Plannning ：KISTEP）である。

セミナーは２日間にわたり行われた。最初に各機関の所長よりそれぞれの取り組みが紹介され、引き続き以下の４つのテ

ーマにおいて活発な議論がされた。
「科学技術政策における人材戦略と理解増進」では、「科学技術人材」に関するテーマにおいて、日中韓３国にとって、「科学技術人材の養成・確保」は、今後の社会経済の発展にとって重要な政策課題であるが、具体的な政策ニーズや制度面でのあり方について、それぞれ異なる課題を抱えているということが明らかにされた。
また、「理解増進」に関するテーマでは、３国は、置かれている状況は異なるものの、科学技術を文化として国民の間に根づかせる必要性を感じている点では共通していることがわかった。
「科学技術予測と未来戦略」では、デルファイ法の調査設計など予測活動に用いられる手法や科学技術の負の側面の取扱いの問題、予測活動の理解増進の重要性などが議論された。
さらに、「東アジアにおける地域イノベーションの現状と問題点」では、各国とも地域科学技術政策を推進する必要性について共通の認識を有するとともに、国情の違いから、地域間格差の問題や地方政府の役割について意見交換が行われた。

今回の議論を踏まえ、科学技術政策研究所の提案（別添）により、日本、中国、韓国による枠組を今後とも継続していくことが合意され、これを踏まえ、STEPIより、来年はSTEPI設立２０周年であることから、次回のセミナーを韓国で開催したいという提案がなされ、了承された。

平成18年1月24日（火）

セッション4　東アジアにおける地域イノベーションの現状と問題点

① 松澤孝明　**NISTEP** 総括上席研究官

Conflicting "Regional Innovation System (RIS)" and its reality

現在、第 3 調査研究グループで行っている研究活動を紹介するとともに、「地域イノベーションシステム」を考えるにあたっての問題点や、日本における地域科学技術政策の変遷などを説明し、今後の第 3 調査研究グループが進める研究活動の方向性を提示した。

② 丸山泰廣　**NISTEP** 特別研究員

Diversity of Region

2004 年度に構築した「地域科学技術総合指標」を用いて、地域科学技術総合力の高い都道府県と低い都道府県を分類した。あわせて、それらの都道府県における産学官連携活動担当者が、都道府県における産学官連携活動に対してどのような問題意識を持っているかを、2004 年度に実施したアンケート結果をもとに分析した。

③ **Shuhua Wang　NRCSTD** 副研究員

The Research of Regional Independent Innovation Capacity in China

中国における地域イノベーション活動が、東部に集中して展開されている現状を報告するとともに、地域イノベーション活動を支える資源が偏在していることなどの問題点が生じていることを指摘した。このために、戦略的な地域科学技術計画を実行するなどの解決策を提示した。

④ **Yibing Duan　IPM** 副研究員

Central Government's Efforts to Promote Innovation at the Regional Level in China

中国において、地域のイノベーション活動について地域間で様々な格差が生じている現状を報告するとともに、地域イノベーション活動を推進するために各機関で実施する政策について紹介した。

⑤ **Jeong Hyop Lee　STEPI** 副研究員

Innovation Clusters in Changing Global Production Networks of East Asia

世界的な企業ネットワークの中で、東アジアにおける各国のクラスターがどのように変化しているかを、企業間の生産ネットワークの形成過程を通じて分析した。

⑥ **Jooyoun Hahn　KISTEP** 副研究員

Policies and Strategies for Strengthening Regional Innovation Capacity in Korea

韓国における地域科学技術活動の現状を 2004 年に終了した第 1 次包括計画をもとに説明するとともに、今後の韓国における地域科学技術政策について説明した。

（別添）

The Science and Technology Policy Seminar in Future

1. It is the key for innovations and sustainable development to conduct well-designed science and technology policies. Our organisations, IPM, KISTEP, NISTEP, NRCSTD, and STEPI, have been conducting research activities which contribute to science and technology policy.

2. From 23 to 24 January 2006 in Tokyo, it is really first time that all of the science and technology policy research institutions of Japan, China and Korea take one single round table at the same moment to participate in “the Science and Technology Policy Seminar 2006.” We discussed about human resources for science and technology, public understanding and awareness in science and technology, science and technology foresight, regional innovation policies in this Seminar.

3. It is indeed valuable for our science and technology policy institutes which are located in the countries playing core roles for development in eastern Asia region to exchange our opinions and information in very frank manner.

4. It should be also important opportunity for young researchers to present their research activities and exchange their fresh thoughts.

5. NISTEP would like to propose a plan to continue and to strengthen our cooperative relationships.
   - Every year, we shall hold the Science and Technology Policy Seminar.
   - Three countries would alternately provide opportunities of the seminar.
   - We shall make effort to focus suitable agenda in order to deepen our discussions at every annual seminar,

   and,
   - We could arrange a co-operatively organised session in certain international conferences or similar opportunities as well as have an additional open to public, in order to co-operate and communicate with outside of our circle.

各発表者の発表概要

平成18年1月23日（月）

セッション1　日中韓における科学技術政策研究

① 小中元秀　科学技術政策研究所(NISTEP)所長

Role of NISTEP - in process of formulation of 3rd Science and Technology Basic Plan-

NISTEPは2004年度、2005年度の2年間に亘り、科学技術基本計画の達成状況調査と科学技術予測を実施した。その成果は、第2期計画に引き続き4分野に重点化することの根拠の一つとなるなど、CSTP が行う第3期計画の策定に関して大きな貢献をしてきた。さらに、今後は、独自の研究等に加え、科学技術研究システムの定点観測と大学の研究開発の現状調査を実施など科学技術政策の立案に直接貢献する調査を進めていく。

② **Yuan Wang**　国家科学技術部科技促進発展研究中心(NRCSTD)所長

Scenarios: China’s Future S&T Development Strategies

科学技術開発のポイントは、(1)インプットの増加、(2)エネルギー、環境問題の解決、(3)基礎研究・インフラなど公的科学への政府投資増、(4)国家イノベーションシステムの確立である。科技促進発展研究中心は、産業技術研究、地域・農村開発の戦略研究などに業務範囲が拡大し、また、国家科学技術統計・科学技術フォーサイトセンターが設立され、中国科学技術開発戦略アカデミー（the Academy of Science and Technology Development Strategy in China）に再編されることとなった。

③ **Rongping Mu**　科学院科技政策与管理研究所(IPM)所長

Overview of Research Activity in IPM

IPM は科学技術・科学技術政策の研究、科学・工学の管理・開発、科学技術評価の部門がある他、学術専門誌を発行している。国家的な科学技術戦略のうち、地域開発、革新政策、社会と科学技術の関わり、ハイテクの開発政策、技術予測、学術的な政策について携わっている。科学院の 89 全ての研究機関や発展研究中心の評価を行っている。

④ **Sungchul Chung**　科学技術政策研究院（STEPI）所長

What STEPI Does?

STEPI は科学技術分野のシンクタンク機関として、政策立案者に対して、科学技術だけでなく、経済学、統計学、社会科学等の知識を織り込んで提言を行っている。2006 年は(1)経済成長と雇用創出のためのイノベーション政策、(2)企業のイノベーションへの投資の決定因子、(3)政府の産業革新支援の効果、(4)各国の研究開発費分配の比較、(5)研究開発の産業生産性への影響、(6)産業開発の不均衡解決策、(7)キャッチアップ後の国家・地域イノベーションの研究に取り組む。

⑤ **Hee-Yol Yu** 科学技術評価・計画院（KISTEP）所長

KISTEP-Korea's S&T Planning and Evaluation Innovator

KISTEP は韓国の中長期科学技術イノベーション政策や人材活用・育成の基礎計画の作成、科学技術関係統計・指標、技術が社会や文化に与える影響の評価の他、中長期の研究開発投資のプライオリティ付け、国家の大型研究開発プログラムの実行可能性調査等を実施している。また、研究開発の企画立案調整のトレーニングコースや、研究開発の計画・マネジメントに関する博士課程学生への教育プログラムの提供等をしている。中長期的には、KISTEP が科学技術研究評価の世界的なブランドとなることを目指している。

セッション２ 科学技術政策における人材戦略と理解増進

テーマ１　人材

① 下村智子 **NISTEP** 上席研究官

Japanese Trends for Cultivation of Human Resources in Science and Technology（HRST）

知識基盤社会、人口減少社会においては、科学技術人材政策の重要性は益々高まってきている。特に、①科学技術人材が所属する研究組織のマネジメントの状況及び課題と、②科学技術人材を取り巻く社会システムの課題について、ファクト・データ及びアンケート調査結果を報告した。

② **Yandong Zhao** **NRCSTD** 副研究員

The Change of Human Resources in Science and Technology in China

「科学技術関係人材」の総数の推移（1990 年以降）とともに、そのうち、コアとなる「研究開発人材」及び「科学者・技術者」の産学官セクター別・地域別の人数推移等について中国科学技術指標を報告した。

③ **Lanxian Zhao** **IPM** 研究員

Overview of Development on S&T Talents in China

最近の中国における「科学技術人材」の人数の推移やセクター別人数等の現状について概説するとともに、科学技術人材に関連した各種の課題（「質」の向上、第２次産業従事者が少ないこと等）や、主要な科学技術人材育成政策・施策について報告した。

④ **Ki-Wan Kim** **KISTEP** 副研究員

Nurturing Human Resources in S&T for the 21st Century: Status-quo and Recent Policy Instruments in Korea

韓国における科学技術人材の最近の状況として、「量的には増大しているが質的な面での課題が残っていること」や「需要と供給とのミスマッチ問題」等についてファク

ト・データをもとに概説するとともに、これらの課題解決に向けた政策的手段（新たなイノベーションシステムを構築すること、大学改革や産学連携を進めることで創造的人材を育成すること等）について報告した。

テーマ2　理解増進

① 渡辺政隆　**NISTEP** 上席研究官

Science Communication and Science Literacy in Japan

科学技術に対する日本人の意識を概括すると同時に、及びサイエンスコミュニケーション活性化方策に関する提言と事例紹介を行った。

② **Zhu Xiao-min**　**IPM** 副研究員

The Role Change of Scientist in the Contemporary Popularization of Science

科学の普及においては、従来は科学者の役割が強調されていたが、今後は専門のポピュラライザー（ジャーナリスト、ライター、プロデューサー等）の育成も重要である。それと同時に、引き続き科学者の活躍を期待すべく、奨励と評価システムの整備も進めるべきである。

③ **Sungsoo Song**　**STEPI** 研究員

In Search of “Science Culture System”: Theory and the Korean Case

科学の普及及び理解増進に関連する一連の活動を「科学文化」と命名し、さらに科学文化の構築及び普及に関わる要素を含めた科学文化システムなる概念を定義した上で、その分析を行うと同時に、韓国の事例を報告した。

セッション **3**　科学技術予測と未来戦略

① 奥和田久美　**NISTEP** 科学技術動向研究センター長補佐

The 8th Science and Technology Foresight Program in Japan

阪彩香　**NISTEP** 研究員

Study on Rapidly-Developing Research Area

第8回科学技術予測調査（「科学技術の中長期発展に係る俯瞰的予測調査」）の全体像を紹介し、今回は第 3 期科学技術基本計画策定に資するという「クライアントとタイミングに明確な目標」があり、その目標を達成するために「複数の予測手法を組み合わせた予測調査」であったことを説明した。後者のうち、今回新たに導入した論文調査による外挿的予測手法も紹介した。

② **Wei Dongyuan**　**NRCSTD** 研究員

Technology Foresight in China

1990 年代からの中国の科学技術政策と予測調査の関係、あるいは 2000 年からの第 10 期 5 ヵ年計画の中での予測調査のプロセスおよび結果の一部を紹介した。

③ **Rongping MU　IPM** 所長

Technology Foresight of China : Towards 2020

IPM で行なわれているデルファイ法による予測活動の設計手法と成果（特に重要度指数の高い分野など）を紹介した。

④ **Byeongwon PARK　KISTEP** 主任

Korean Technology Foresight and Future Strategic Technology

過去20年間の韓国の科学技術指標の急激な変化と今後の不確定要因について説明がなされた。それらを踏まえたうえで、複数の予測手法を組み合わせて行なわれた第 3 回韓国技術予測が詳しく報告し、技術予測調査から戦略的な将来技術を抽出していくプロセスを紹介した。

平成18年1月24日（火）

セッション4　東アジアにおける地域イノベーションの現状と問題点

① 松澤孝明　**NISTEP** 総括上席研究官

Conflicting “Regional Innovation System (RIS)“ and its reality

現在、第 3 調査研究グループで行っている研究活動を紹介するとともに、「地域イノベーションシステム」を考えるにあたっての問題点や、日本における地域科学技術政策の変遷などを説明し、今後の第 3 調査研究グループが進める研究活動の方向性を提示した。

② 丸山泰廣　**NISTEP** 特別研究員

Diversity of Region

2004 年度に構築した「地域科学技術総合指標」を用いて、地域科学技術総合力の高い都道府県と低い都道府県を分類した。あわせて、それらの都道府県における産学官連携活動担当者が、都道府県における産学官連携活動に対してどのような問題意識を持っているかを、2004 年度に実施したアンケート結果をもとに分析した。

③ **Shuhua Wang　NRCSTD** 副研究員

The Research of Regional Independent Innovation Capacity in China

中国における地域イノベーション活動が、東部に集中して展開されている現状を報告するとともに、地域イノベーション活動を支える資源が偏在していることなどの問題点が生じていることを指摘した。このために、戦略的な地域科学技術計画を実行するなどの解決策を提示した。

④ **Yibing Duan　IPM** 副研究員

Central Government’s Efforts to Promote Innovation at the Regional Level in China

中国において、地域のイノベーション活動について地域間で様々な格差が生じている現状を報告するとともに、地域イノベーション活動を推進するために各機関で実施する政策について紹介した。

⑤ **Jeong Hyop Lee　STEPI** 副研究員

Innovation Clusters in Changing Global Production Networks of East Asia

世界的な企業ネットワークの中で、東アジアにおける各国のクラスターがどのように変化しているかを、企業間の生産ネットワークの形成過程を通じて分析した。

⑥ **Jooyoun Hahn　KISTEP** 副研究員

Policies and Strategies for Strengthening Regional Innovation Capacity in Korea

韓国における地域科学技術活動の現状を 2004 年に終了した第 1 次包括計画をもとに説明するとともに、今後の韓国における地域科学技術政策について説明した。

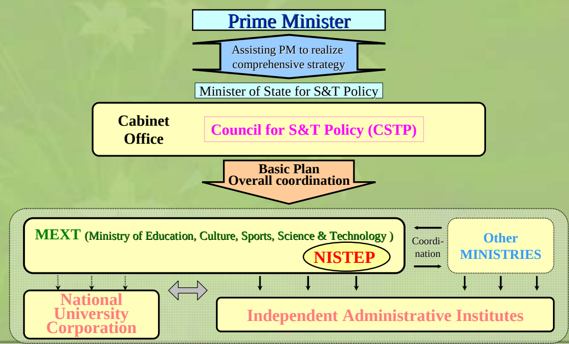
Role of NISTEP

in process of formulation of 3rd Science and Technology Basic Plan

January 23, 2006

KONAKA Motohide
National Institute of Science and Technology Policy (NISTEP)
Ministry of Education, Culture, Sports, Science and Technology (MEXT)

2. Administrative Structure for S&T in JAPAN



1. History of S&T System Restructure

2001.1 Overall Administration Reform
CSTP, MEXT, METI……

2001.4 Independent Administrative institutes

2004.4 National University Corporation

3. Two research projects conducted by NISTEP

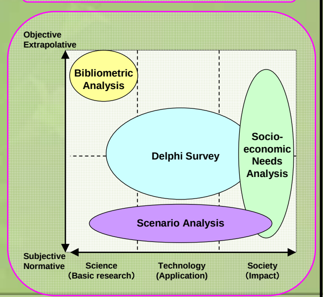
(supported by Special Coordination Funds for Promoting S&T in FY 2003-2004)

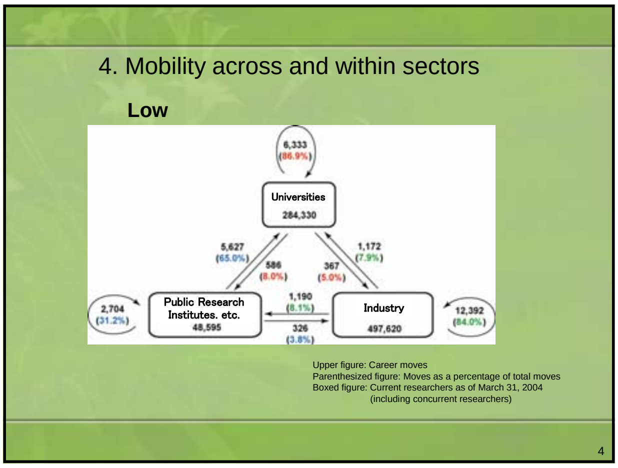
Review of the last 10 years
(during 1st & 2nd S&T Basic Plans)

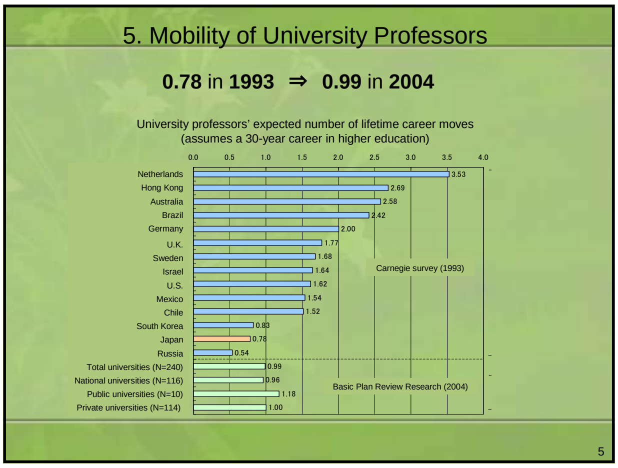
- S&T Indicators
- Evaluation of achievements
- Benchmarking
- Impact study etc.

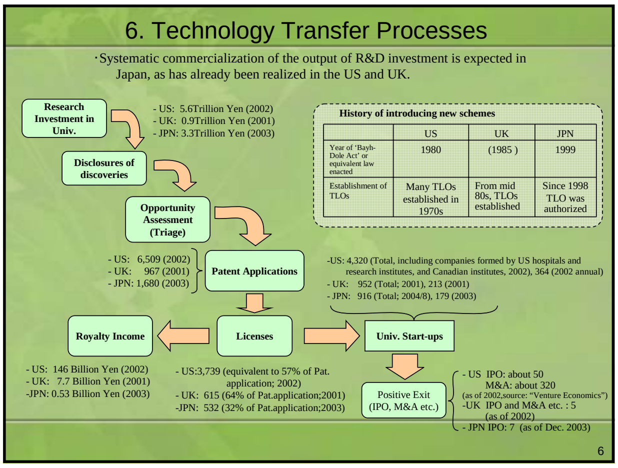
\+

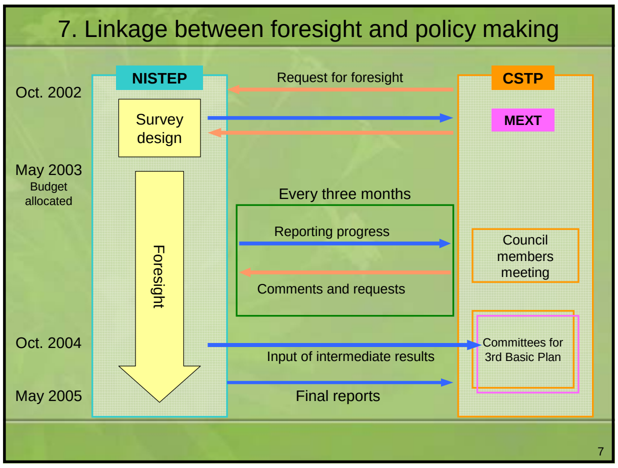
Multi - methodology foresight




4. Mobility across and within sectors
Low
6,333
(86.9%)
Universities
284,330
5,627
(65.0%)
586
(8.0%)
367
(5.0%)
1,172
(7.9%)
2,704
(31.2%)
Public Research
Institutes. etc.
48,595
1,190
(8.1%)
326
(3.8%)
Industry
497,620
12,392
(84.0%)
Upper figure: Career moves
Parenthesized figure: Moves as a percentage of total moves
Boxed figure: Current researchers as of March 31, 2004
(including concurrent researchers)
4


5. Mobility of University Professors
0.78 in 1993 ⇒ 0.99 in 2004
University professors' expected number of lifetime career moves
(assumes a 30-year career in higher education)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
Netherlands 3.53
Hong Kong 2.69
Australia 2.58
Brazil 2.42
Germany 2.00
U.K. 1.77
Sweden 1.68
Israel 1.64
U.S. 1.62
Mexico 1.54
Chile 1.52
South Korea 0.83
Japan 0.78
Russia 0.54
Carnegie survey (1993)
Total universities (N=240) 0.99
National universities (N=116) 0.96
Public universities (N=10) 1.18
Private universities (N=114) 1.00
Basic Plan Review Research (2004)
5


6. Technology Transfer Processes
·Systematic commercialization of the output of R&D investment is expected in Japan, as has already been realized in the US and UK.
Research Investment in Univ.
- US: 5.6Trillion Yen (2002)
- UK: 0.9Trillion Yen (2001)
- JPN: 3.3Trillion Yen (2003)
Disclosures of discoveries
Opportunity Assessment (Triage)
History of introducing new schemes
US
UK
JPN
Year of 'Bayh-Dole Act' or equivalent law enacted
1980
(1985)
1999
Establishment of TLOs
Many TLOs established in 1970s
From mid 80s, TLOs established
Since 1998 TLO was authorized
- US: 6,509 (2002)
- UK: 967 (2001)
- JPN: 1,680 (2003)
Patent Applications
-US: 4,320 (Total, including companies formed by US hospitals and research institutes, and Canadian institutes, 2002), 364 (2002 annual)
- UK: 952 (Total; 2001), 213 (2001)
- JPN: 916 (Total; 2004/8), 179 (2003)
Royalty Income
Licenses
Univ. Start-ups
- US: 146 Billion Yen (2002)
- UK: 7.7 Billion Yen (2001)
-JPN: 0.53 Billion Yen (2003)
- US:3,739 (equivalent to 57% of Pat. application; 2002)
- UK: 615 (64% of Pat.application;2001)
-JPN: 532 (32% of Pat.application;2003)
Positive Exit
(IPO, M&A etc.)
- US IPO: about 50
M&A: about 320
(as of 2002,source: "Venture Economics")
-UK IPO and M&A etc. : 5
(as of 2002)
- JPN IPO: 7 (as of Dec. 2003)
6


7. Linkage between foresight and policy making
NISTEP
CSTP
MEXT
Oct. 2002
Request for foresight
Survey design
May 2003
Budget allocated
Foresight
Every three months
Reporting progress
Comments and requests
Council members meeting
Oct. 2004
Input of intermediate results
Committees for 3rd Basic Plan
May 2005
Final reports
7

8. Outline of Delphi survey

Delphi Survey =

obtaining consensus in future image and long-term strategy among S&T experts with repeated questionnaires

■ **Accumulation of experiences in past Delphi survey**
- 60 - 70% of past topics has been realized
- Some collaboration with foreign activities

■ **New approach based on the experiences**
- Structure of layers of fields-areas-topics
- Asking two different levels of the realization time

13 fields
130 areas
860 topics

Impact for S&T, economy, society

Japanese position in the world

Realization time
technological
social

■ **Respondents of 8th Delphi : around 2200 (Experts in Japan)**

9. Evaluation of future impacts of current prioritized fields

1. Enhancement of Intellectual assets
- a: Contribution to enhancement of Intellectual assets on the interested area itself
- b: Contribution to progress of other areas

2. Economic Effects
- c: Contribution to developments of existing industries
- d: Contribution to creations of new industries and businesses

3. Social Effects
- e: Contribution to securing safety and security
- f: Contribution to improvement of quality of life and social vitality

Measure for evaluation: “Large (10)”, “Largish (7.5)”, “Moderate (5)”, “Small (2.5)”, “Non” (0)

Definition of impacts

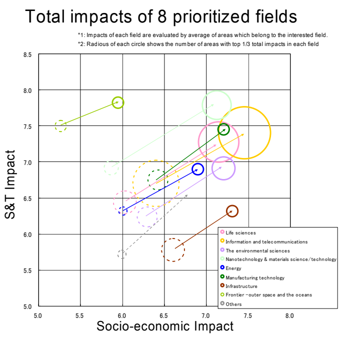
Academic impact → Max (a, b)

Economic Impact → Max (c, d)

Social Impact → Max (e, f)

Socio-economic Impact
→ { Max (c, d) + Max (e, f) } / 2

Total Impact
→ $\{ \text{Max}(a, b)^2 + \text{Max}(c, d)^2 + \text{Max}(e, f)^2 \}^{1/2}$



10. The 3rd Science and Technology Basic Plan (FY 2006-2010)

Contents of the 3rd S&T Basic Plan was approved by the Council of S&T Policy in December 2005.

The Basic Plan will be formulated in March 2006.

11. Main points of the 3rd S&T Basic Plan

- Wide support by society and people and provision of its benefit to society and people.
- Investment : 25 trillion yen for 5 years
- Strategic prioritization of S&T investment
- Strengthening of S&T personnel
- Reformation of S&T system for continuous innovations.

12. Future Works

- Fixed-point survey of activities in realization of 3rd S&T Basic Plan
- Survey Study of University R&D activities in total

12

Scenarios: China's Future S&T Development Strategies

中国未来科技发展战略的基本构想

Wang Yuan, Professor
王元 研究员
National Research Center for Science and Technology for Development ,China
中国科学技术促进发展研究中心

A Brief Historical Retrospect

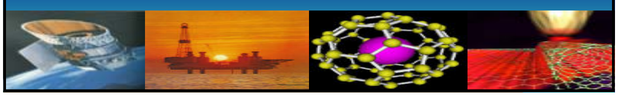
简要的历史回顾

- Seven S&T planning activities since the founding of the People's Republic of China and associated major changes
  新中国建国以来前"七次规划"及其重点的变化
- Changes in the relationship between planning and S&T planning system and in functionalities
  规划与科技计划体制关系和功能的变化

Contents

内容提要

A Brief Historical Retrospect
➢简要的历史回顾
New background and strategic choice
➢新背景与战略的选择
Medium and Long-term Development Planning for China's S&T : basic framework and process
➢中国科技中长期发展规划的基本框架与过程组织
Major strategic and policy points on China's S&T development planning
➢中国科学和技术发展规划的战略与政策要点



- **The Long-term S&T Development for 1956-1967**
  《1956-1967年科学技术发展远景规划》，确定了"重点发展，迎头赶上"的指导方针
- **The S&T planning for 1963-1972**
  《1963-1972年十年科学技术规划》，确定了"自力更生，迎头赶上"的指导方针
- **The National Outlines for S&T Development Planning: 1978-1985**
  《1978-1985年全国科学技术发展规划纲要》提出了"全面安排，突出重点"的指导方针

- **In the S&T Development Plan prepared for 1986-2000**
- 《1986-2000年科技发展规划》提出了“科学技术必须面向经济建设，经济建设必须依靠科学技术”的基本方针
- **The S&T Development Plan for 1991-2000**
- 《 1991-2000年十年规划和“八五”计划纲要》，继续坚持“面向、依靠” 的指导方针
- **The National S&T Development Plan for the 9th five-year period, and the Long Term Target Outlines for 2010**
- 《科技发展“九五”计划和到2010年远景目标纲要》，指导方针调整为“面向、依靠、攀高峰”
- **The S&T and Education Development Plan under the National Economic and Social Development Plan for the 10th five-year period**
- 《“十五”科技教育发展专项规划》确定了“创新、产业化”的指导方针

New background and strategic choice
新背景与战略的选择

- The new perspectives brought by the fast S&T development

  科学技术迅速发展
- Irreversible S&T globalization

  科技全球化趋势
- Changes in the market economy

  市场经济体制转变
- Targets to build a well-to-do society on a full fledged basis

  中国全面建设小康社会的目标要求

- Changes in China’s planning system

  中国计划体系的变化
- Changes in China’s S&T planning system

  中国科技计划体系的变化
- Changes in S&T planning targets and government functionality

  中国科技计划对象和政府职能的变化

Medium and Long-term Development Planning for China’s S&T: basic framework and process
中国科技中长期发展规划的基本框架与过程组织

- 20 strategic study topics

  战略研究－20个战略研究专题
- Methodology and Organization

  规划方法与过程的组织

- General S&T development strategies
  科技发展总体战略
- S&T system reform and the construction of national innovation system
  科技体制改革和国家创新体系建设
- S&T issues in the manufacturing industry
  制造业发展科技问题
- S&T issues in agricultural development
  农业发展科技问题
- S&T issues in energy, resource and marine development
  能源、资源与海洋发展科技问题

- S&T issues in urban development and urbanization
  城市发展与城镇化科技问题
- S&T issues in national defense
  国防科技问题
- Strategic high technology and associated industrialization
  战略高技术与高新技术产业化
- Basic scientific issues
  基础科学问题
- Construction of S&T condition platforms and infrastructures
  科技条件平台与基础设施建设

- S&T issues in transportation and traffic control
  交通发展科技问题
- S&T issues in modern service industry
  现代服务业发展科技问题
- S&T issues in population and health
  人口与健康科技问题
- S&T issues in public security
  公共安全科技问题
- S&T issues in ecological construction, environmental protection, and cyclic economy
  生态建设、环境保护与循环经济科技问题

- Construction of S&T personnel contingent
  科技人才队伍建设
- S&T input and associated management modes
  科技投入及其管理模式
- S&T development related legislation and policy
  科技发展法制和政策
- Regional S&T development
  区域科技发展
- Popular science and innovation culture
  科学普及与创新文化建设

- People who are involved in the study are not limited to the experts coming from natural science or engineering communities, but also include social scientists

  参与研究的不仅有自然科学界和工程技术界的专家，还有大量的社会科学界的专家
- The strategic study emphasizes the openness and public participation in the planning process

  战略研究整个阶段强调了规划的公开性和公众的参与

---

❶**People-oriented**

坚持以人为本

❷**Independent innovations**

加强自主创新

❸ **Leapfrogging development in priority fields**

实现重点跨越

❹ **Supporting and guiding a coordinated economic and social development**

支撑和引领经济社会持续协调发展

Major strategic and policy points on China's S&T development planning

中国科技发展规划的战略与政策要点

- Guidelines

  指导方针
- Readjusting strategic thinking

  战略思路的调整
- Basic arrangements at the strategic levels

  战略层次的基本安排

---

❶**Development tracks:** from tracking after and imitating to independent innovations

发展路径：向加强自主创新转变

❷**Innovation modes:** from individual technology oriented R&D to integrated innovations for key products and emerging industries

创新方式：向加强集成创新转变

❸ **Innovation system:** from research institutes oriented reform to the construction of a national innovation system

创新体制：向整体推进创新体系建设转变

❹ **Development deployment:** from research and development to S&T innovation and science diffusions

发展部署：向创新与科普并重转变

❺ **International cooperation:** from general S&T exchanges to an all-round and active utilization of global S&T resources

国际合作：向主动利用全球资源转变

- Set up a series of special projects for key strategic high tech products or engineering developments
  实施一批重大高技术战略产品和工程专项
- Define a range of key fields and key technologies, in an attempt to raise its sustainable development capacity
  确定一批重点领域，发展一批重大技术，提高可持续发展能力
- Strengthen its basic science and cutting edge technology researches
  加强基础科学和前沿高技术研究
- Strengthen the construction of public S&T infrastructures and national innovation system
  加强国家公共科技基础设施和国家创新体系建设

Thanks

Institute of Policy & Management, Chinese Academy of Sciences

Overview of Research Activity in IPM

Professor Dr. Phil. Mu Rongping
Institute of Policy and Management (IPM)
Chinese Academy of Sciences (CAS)

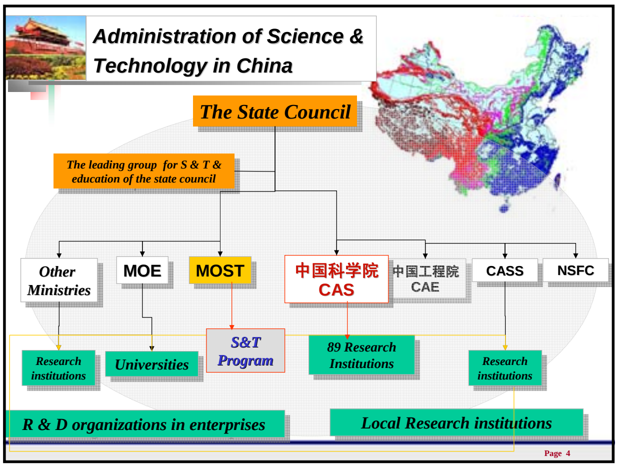
http://www.casipm.ac.cn

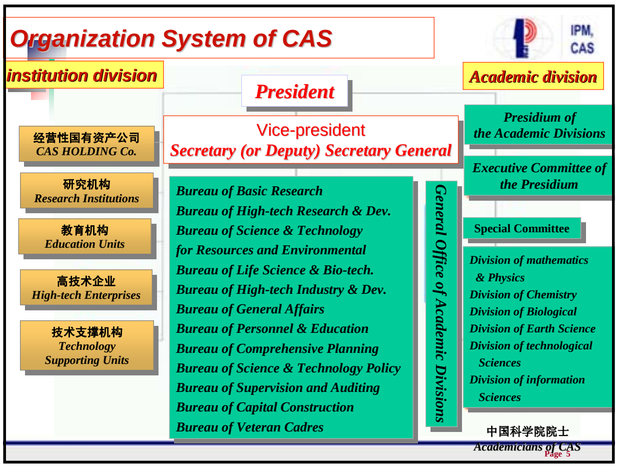
Outline

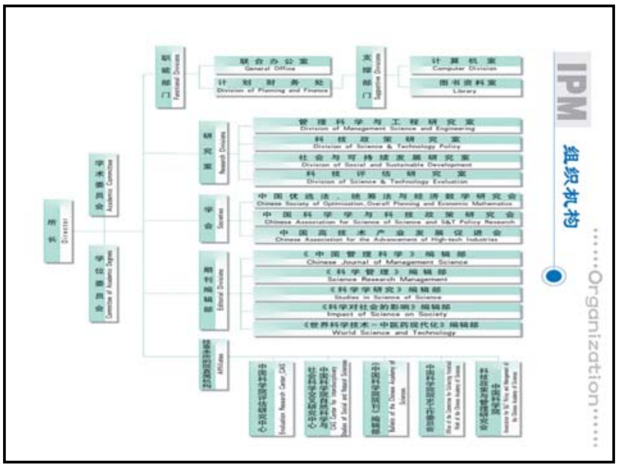
I. CAS and IPM
II. Research Activity in IPM
III. Future Plan

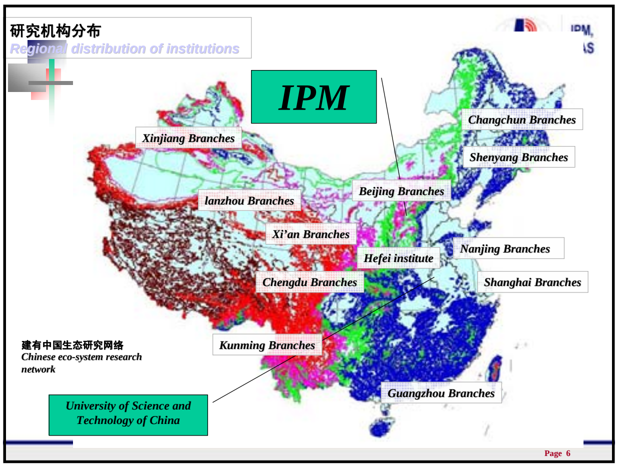
I. CAS and IPM

Administration of Science & Technology in China




Organization System of CAS
IPM, CAS
institution division
President
Academic division
经营性国有资产公司
CAS HOLDING Co.
研究机构
Research Institutions
教育机构
Education Units
高技术企业
High-tech Enterprises
技术支撑机构
Technology
Supporting Units
Vice-president
Secretary (or Deputy) Secretary General
Presidium of
the Academic Divisions
Executive Committee of
the Presidium
Special Committee
Bureau of Basic Research
Bureau of High-tech Research & Dev.
Bureau of Science & Technology
for Resources and Environmental
Bureau of Life Science & Bio-tech.
Bureau of High-tech Industry & Dev.
Bureau of General Affairs
Bureau of Personnel & Education
Bureau of Comprehensive Planning
Bureau of Science & Technology Policy
Bureau of Supervision and Auditing
Bureau of Capital Construction
Bureau of Veteran Cadres
General Office of Academic Divisions
Division of mathematics
& Physics
Division of Chemistry
Division of Biological
Division of Earth Science
Division of technological
Sciences
Division of information
Sciences
中国科学院院士
Academicians of CAS
Page 5


IPM
组织机构
Organization

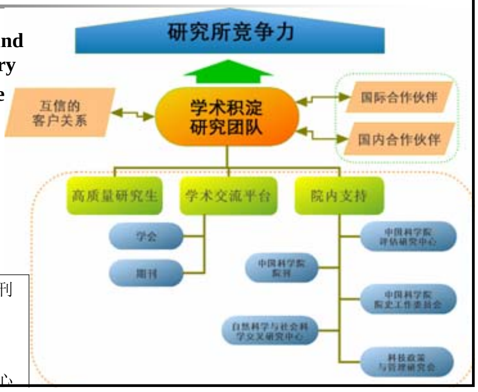

研究机构分布
Regional distribution of institutions
IPM, CAS
IPM
Xinjiang Branches
Changchun Branches
Shenyang Branches
Beijing Branches
lanzhou Branches
Xi'an Branches
Hefei institute
Nanjing Branches
Chengdu Branches
Shanghai Branches
Kunming Branches
Guangzhou Branches
建有中国生态研究网络
Chinese eco-system research network
University of Science and Technology of China
Page 6


Mission of IPM
研究所使命
IPM, CAS
中国科学院
发展与改革
战略、政策
和管理研究
研究所使命
Mission of IPM
国家战略研究
发展和改革
政策研究
管理理论与应
用研究
可持续发展战略
科教兴国战略
人才强国战略
科技政策
创新政策
创业政策
能源环境政策
公共管理
科技管理
区域管理
项目管理
相关学科
基础理论与方法研究
人 才 培 养

The Competitiveness of IPM

IPM, CAS

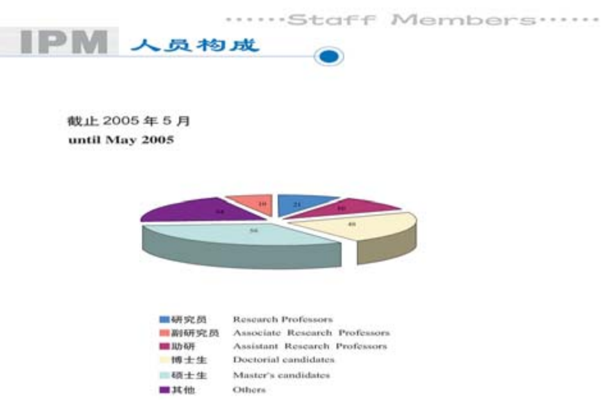
S&T Background
Interdisciplinary
Comprehensive
Independency
CAS Support



3个管理类核心期刊
3个国家一级学会
2个院级研究中心
1个IPM-KU联合中心

所庆20周年大会会场

IPM, CAS



研究生毕业典礼

IPM, CAS

三大报告

出版期刊

中央电视台对话节目现场

II. Research Activity in IPM

1.Strategy Studies

2.Policy Studies

3.Management Science

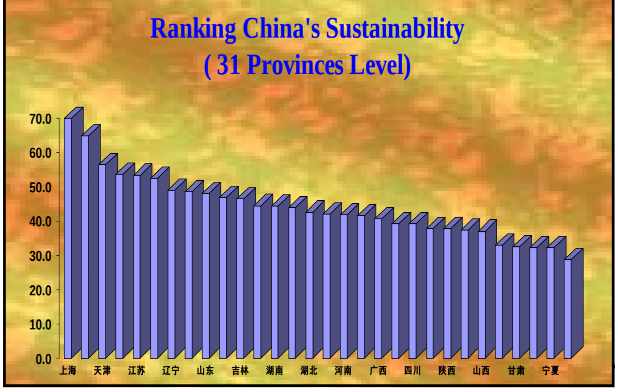
4.Strategic Studies for Development and Reform of CAS

1. Development Strategy

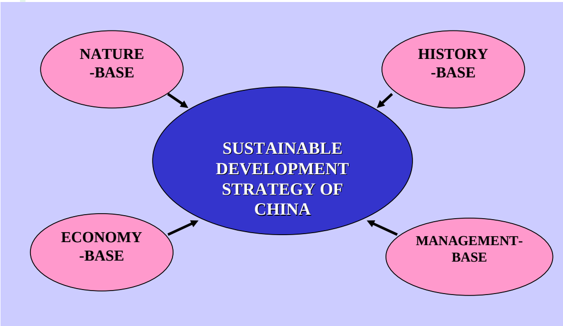
(1) Theory & Strategy for Sustainable Development
(2) National Strategy for S&T Development
(3) Strategy and Planning for Regional Development
(4) Development Strategy & Public Policy Option

(1) CHINA'S Sustainable Development

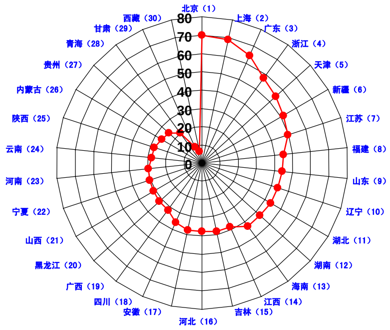
Annual Report on China's Sustainable Development Strategy published since 1999



STRATEGIC CONSIDERATION OF SUSTAINABLE DEVELOPMENT



RANKING REGIONAL LIFE-QUALITY OF CHINA



IPM, CAS

(2) Strategy for Science & Technology Development

IPM, CAS

(3) Strategy and Planning for Regional Development

Strategy & Planning for Regional Development

IPM, CAS

- Planning for Building Nan’ning into a Demonstrative City for S&T progress
- Regional Planning for Tourism of Cities;
- Theoretical & Empirical Studies on S&T Planning
- Strategic Planning for Science City of China (Hefei)

IPM, CAS

(4) Development Strategy & Public Policy Options

Development Strategy & Public Policy Option

- Governmental function reform and governance improvement (institution barrier, partnership)
- China's global strategy of peaceful development in the new world regime (incl. national security, energy, environment, culture, etc)
- Industrial Policies for Recycling-based Economy Development
- Integrated River Basin Management & Water Governance
- Public Safety and Crisis/conflict Management

IPM, CAS

(1) Science & Technology Policy

2. Science & Technology Policy

(1) Science and Technology Policy

(2) Innovation Policy

(3) Science & Technology and Society

(4) Development Policy for Hi-tech and related Industries

(5) Technology Foresight & Disciplinary Policy.

National M&L Term Plan for S & T Dev.

Strategic Studies:

- General Strategy for S&T Development
- Strategic Hi-tech and Industrialization of Hi-tech
- S&T Talents
- Laws and Policy for S&T Development
- Innovation Culture and Science Popularization
- Expert Panel for Planning Strategy

Supportive Policies

- To promote the capacity-building for innovation of Enterprises
- To promote the S&T system reform

Basic Research Policy

IPM, CAS

- To Amend Items Concerning Basic Research in the Law of S&T Progress of China
- To Evaluate the Capability of Basic Research in China
- To Reform the Funding System of NSFC

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IPM, CAS

(2) Innovation Policy

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Innovation Policy

IPM, CAS

- Plan for National Infrastructure of Innovation
- National Innovation System and Capability Building for Indigenous Innovation
- Policy and Strategy for Development of Technology Centers in Large Firms.
- Innovation and Startups
- Supportive Policy for the capability-building of Innovation in Enterprises

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IPM, CAS

(3) Science, Technology & Society (STS)

Page 32

Science, Technology & Society (STS)

- Social stratification and implementation of science
- Ethics in Science and Technology
- Science and governance
- Public understanding of science
- Institutionalization of Science in Modern China
- History of CAS

IPM, CAS

(4) Development Policy for Hi-tech and Related Industries

Innovation Culture & Science Popularization

- Provide a new model of science communication which shows the diversity and specialization trend of subjects of popularization of science.
- Definite the different roles of science popularization and science education in the promotion of the civic science literacy.
- Suggest that the cooperation between science community, school education and mass media has far-reaching implication to the science communication in current society.

Policy for Hi-tech and Related Industries

- Public and Private Partnership in Developing Country: Case Studies of Transgenic Rice and SARS Vaccine in China
- Human Cloning: International Regulations Activities and Implication to China
- The Path of Public Acceptance of Cloning Cow
- Evaluation on the International Competitiveness of Hi-tech Industries such as the Computer Manufacturing Industry, the Electronic and Telecommunication Technology Industries, Bio-tech Industries, Energy Industries.

  Annual Report on Hi-tech Development published since 2000

(5) Technology Foresight & Policy for Disciplinary

III. Management Science & Engineering

(1) Management of Commercial Bank
(2) Emergency Management
(3) Complex System and Complexity
(4) Industrial Engineering
(5) Project Management

(1) Management of Commercial Bank

A. Operational management of commercial banks
B. Risk management of commercial bank

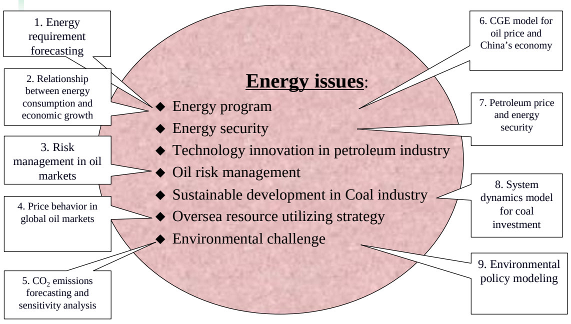
(2) Emergency Management

Principle, mechanism, system, model/methods

(3) Complex System

--Energy Policy
--Programming for sustainable development
--Risk management
--Disaster management

Modeling for Energy Policy



IV. S & T Management and Evaluation

(1) S&T Evaluation

(2) Management of Projects and R&D Organization

(3) Technology Management

IPM, CAS

Others: World Heritage Protection

Cultivating the groundwork to promote the development and prosperity of Da Ge, based on the protection of social environment of Dong Sing Art.

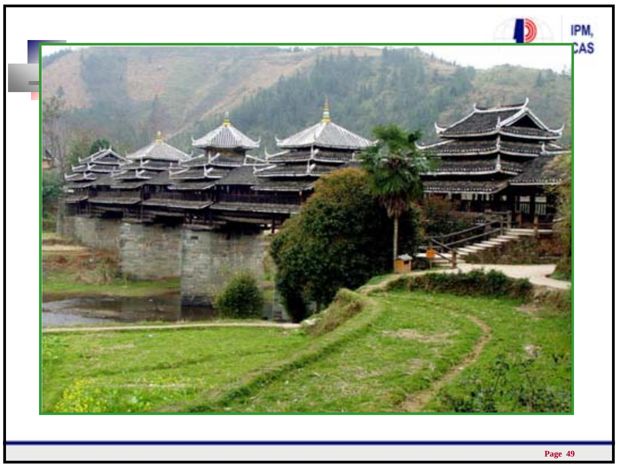
A feasible pattern for Nonmaterial cultural protection and development will be found and popularized to facilitate effective protection and development of Nonmaterial cultural legacy in China.

IPM, CAS

IPM, CAS

IPM, CAS

IPM, CAS


IPM,
CAS
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IPM,
CAS
Page 50


Institute of Policy & Management,
Chinese Academy of Sciences
Thank you!
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What STEPI Does?

- An Outline of STEPI's Activities -

Sungchul Chung
President

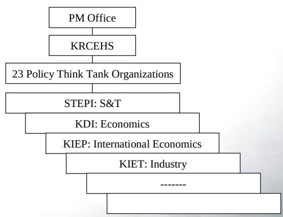
STEPI: Chronology

- ❑ Creation of the "Center for Science and Technology Policy" (CSTP) as an affiliate of KAIST(1987)
  - ❖ Support the Ministry of Science and Technology by conducting S&T policy research and evaluation of the National R&D Programs
- ❑ Renamed as the "Science and Technology Policy Institute (STEPI)"(1992)
  - ❖ National R&D planning and management was added to STEPI's function
- ❑ The functions related to the planning and managing the National R&D Programs were transferred to KISTEP(1999)
- ❑ The Science and Technology Policy Institute(STEPI) was reorganized and restructured as a Government policy think-tank organization under the Korea Research Council for Economics, Humanities and Social Sciences(KRCEHS) which is overseen by the Prime Minister's Office(1999)

Contents

STEPI: Legal Status and Mandates

- ❑ Legal Status
  - ❖ A special corporate chartered by the Act for the Creation, Operation and Promotion of the Government Research Institutes
  - ❖ An institute operating under the supervision of the Korea Research, Council for Economics, Humanities and Social Sciences(Prime Minister's Office)



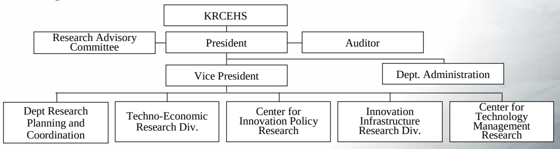
STEPI: Legal Status and Mandates

- Mandates

"Provide a perspective for policy-makers based on multidisciplinary research and analysis, incorporating not only scientific and technological knowledge but also such diverse disciplines as economics, statistics, management….."

STEPI: Functions and Organization

- Functions
  STEPI, as a center for S, T & I policy research
  - Conducts research and analysis on the issues pertaining to science, technology and innovation
  - Provides government agencies with policy ideas and suggestions for the promotion S, T & I
  - Identifies policy issues to effectively deal with future challenges
  - Creates and disseminates S&T policy materials, data and information
- Organization

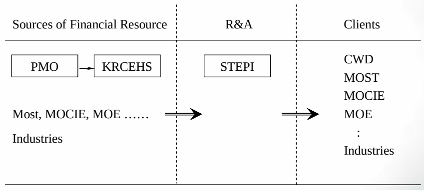


STEPI: Human Resources

- Staff size
  - Research staff: 59 (47 PhDs)
  - Administrative staff : 18
  - Support staff: 30 (including temporary RAs)
- Backgrounds of Researchers
  - Economics: 18
  - Science and Engineering: 14
  - Management (public+business): 15
  - Political science: 4
  - Others: 8

STEPI: Research Activities

- STEPI's clients



STEPI: Research Activities

❑ Division of Techno-Economic Research
- Interface between S&T and Economy
- Economic Analysis of S&T Issues
- Economic Effects of R&D Investment
- S&T and Economic Development
- International S&T Policy

❑ Center for Innovation Policy
- Strategies and Long-term Vision for National S&T Policy
- Priority and Direction in National R&D Investment
- Policy Programs to Promote Innovation
- Science-Innovation Interface

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STEPI: Research Activities

❑ Center for Techno-Management Research
- R&D Planning
- R&D Management
- R&D Evaluation
- Technology Transfer and Dissemination
- Policy for Government-funded Research Institutes(GRI)
- University Research System
- Basic Research Policy

❑ Division of Innovation Infrastructure Research
- S&T Statistics and Indicators
- S&T Human Resources
- S&T Policy to Resolve Issues of Social Concern
- S&T Policy Government
- Regional Development and RIS

9

STEPI: Recent Research Subjects (2006)

- ✓ Innovation policy for economic growth and job creation
- ✓ Determinants of firms' innovation investments in manufacturing sector
- ✓ Assessment of the effectiveness of the government support programs for industrial innovation
- ✓ Comparative analysis of the R&D resource allocation systems of selected countries
- ✓ The impacts of R&D on industrial productivity
- ✓ Technological diffusion system for balanced industrial development
- ✓ Future oriented studies: NIS, RIS
- ✓ Statistics and indicators: Innovation survey

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STEPI: Other Activities

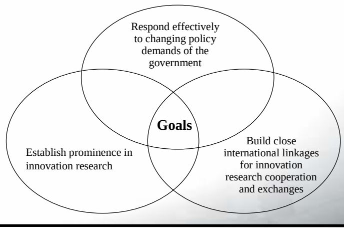
❑ Domestic Activities
- Science &Technology Policy Forum
- Cyber Research Communities

❑ International Activities
- STEPI International Symposium
- Technology and Policy (TAP) Training Program
- APEC R&D Management Training (ART) Program
- International organizations: OECD, APEC, etc.

11

STEPI: Visions and Goals

STEPI aspires to be a world center of excellence in innovation policy research. Our vision is to accelerate Korea’s move toward an advanced knowledge society by presenting strategic policy options for the promotion of scientific research and innovation.



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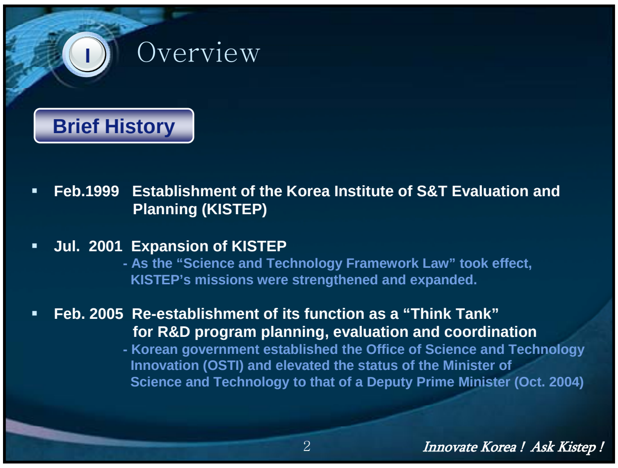
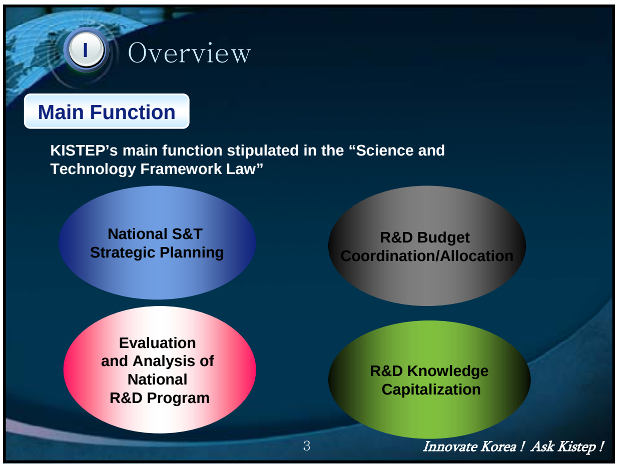
NISTEP Seminar
23-24 Jan. 2006
Tokyo, Japan
Innovate Korea ! Ask Kistep !
KISTEP – Korea's S&T Planning and Evaluation Innovator
Dr. Hee-Yol Yu
President
Korea Institute of S&T Evaluation and Planning
(KISTEP)


I
Overview
Brief History
▪ Feb.1999 Establishment of the Korea Institute of S&T Evaluation and Planning (KISTEP)
▪ Jul. 2001 Expansion of KISTEP
- As the "Science and Technology Framework Law" took effect, KISTEP's missions were strengthened and expanded.
▪ Feb. 2005 Re-establishment of its function as a "Think Tank" for R&D program planning, evaluation and coordination
- Korean government established the Office of Science and Technology Innovation (OSTI) and elevated the status of the Minister of Science and Technology to that of a Deputy Prime Minister (Oct. 2004)
2
Innovate Korea ! Ask Kistep !

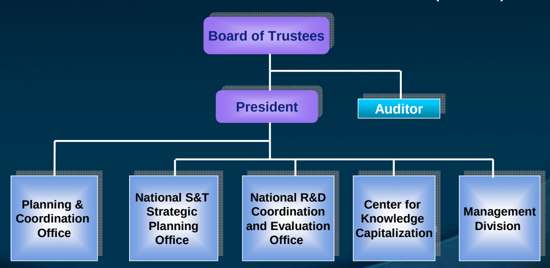

Contents
I Overview
II Main Activities
III Mid & Long-term Development Plan
1
Innovate Korea ! Ask Kistep !


I
Overview
Main Function
KISTEP's main function stipulated in the "Science and Technology Framework Law"
National S&T Strategic Planning
R&D Budget Coordination/Allocation
Evaluation and Analysis of National R&D Program
R&D Knowledge Capitalization
3
Innovate Korea ! Ask Kistep !

I Overview

Organization

(Jan. 2006)



I Overview

Relationship to the Government

National S&T Council (NSTC)
- The highest decision-making body for R&D policies in Korea
- Confirms and approves major policies and master plans for the Nation's S&T Development

Secretariat support

Office of S&T Innovation (OSTI) / MOST
- Coordinates the nation's S&T related policies
- Evaluates all government-funded R&D programs
- Sets priorities for national R&D programs and conducts pre-coordination for the next year's R&D budget

Provides expertise and administrative support

Korea Institute of S&T Evaluation and Planning (KISTEP)
- Supports OSTI in R&D planning and evaluation
- Expert "think tank" for national S&T policies

II Main Activities

1. National S&T Strategic Planning (I)

■ Establishes mid & long term S&T innovation policy
- ○ Formulates basic plan for nurturing and utilizing human resources in S&T
- ○ Establishes comprehensive plan to promote basic research
- ○ Establishes the 「2nd regional S&T development plan」
- ○ Conducts policy research for more efficient R&D investment

II Main Activities

1. National S&T Strategic Planning (II)

■ Research on S&T indicators
- ○ Conducts annual survey on R&D activities in S&T
- ○ Establishes the time-series database system for major S&T indicators and provides on-line service
- ○ Develops S&T innovative capability indicators

■ Formulates national standard S&T classifications
- ○ Reflects emerging and converging technologies

Ⅱ Main Activities

1. National S&T Strategic Planning (III)

- Identifies the nation's future strategic technologies and conducts planning studies
  - ○ Conducts the Korean Foresight Study ('05-'30)
    - Identifying 761 future technology areas
  - ○ Performs technology level evaluations for the 「Future Technology 21」 project
- Technology assessment on socio-cultural impacts
  - ○ Ex-ante technology assessments for RFID and NANO technology

Ⅱ Main Activities

2. R&D Budget Coordination & Allocation (I)

- Establishes the mid-term R&D investment plan and sets up basic investment directions for national R&D
  - ○ Identifies priorities in R&D investment through the evaluation of S&T competency
  - ○ Designs an effective way of investment reflecting the nation's current status and future strategies
- Develops an efficient budget coordination system for optimal allocation of R&D resources
  - ○ Designs a system to reflect evaluation results for program improvement and budget coordination
  - ○ Prepares review guidelines for the next-year's national R&D budget

Ⅱ Main Activities

2. R&D Budget Coordination & Allocation (II)

- Plans and coordinates large scale national R&D programs
  - ○ Monitors programs' strategies and concrete plans
  - ○ Conducts overall evaluation of R&D performance and program management
  - ○ Coordinates the program and allocates the budget based on evaluation results
- Performs feasibility studies for national R&D programs
  - ○ Performs feasibility studies for large scale national R&D programs costing more than 50 million US dollars, focusing on cost/benefit analysis, technological feasibility, and policy relevance.

Ⅱ Main Activities

3. Evaluation and Analysis of National R&D Programs (I)

- Surveys and analyzes national R&D programs
  - ○ Conducts surveys on national R&D programs at the project level (7.8 billion $ in 2005, 8.9 billion $ in 2006)
  - ○ Publishes annual analysis report on national R&D programs
- Evaluates national R&D programs
  - ○ Introduces a new evaluation system for national R&D programs
    - Self evaluation by R&D program implementing ministries (Approx. 6.2 billion $ among the total 7.8 billion $ to be evaluated in 2006.)
    - Meta evaluation by NSTC (KISTEP's expertise support)
    - In-depth evaluations for selected programs in issue

Ⅱ Main Activities

3. Evaluation and Analysis of National R&D Programs (II)

■ Evaluates Government-supported Research Institutes (GRIs)

○ **Establishes and manages the evaluation process of GRIs based on the Science and Technology Framework Law**

■ Supports establishing an efficient management system for the national R&D program

○ **Performs assessments of R&D management capabilities of research institutes and universities**

- Grants public authentification to those having excellent mgt system

○ **Develops the efficient monitoring/management system for the inter-ministerial large scale R&D programs (Next generation growth engine programs, Frontier programs, etc)**

Ⅱ Main Activities

3. Evaluation and Analysis of National R&D Programs (III)

■ Supports new role-setting and planning of GRIs

○ **Supports re-establishment of the functions of GRIs thru strategic planning**

○ **Sets up the strategic directions for basic programs of GRIs**

■ Operates the national licensing system for "Certified R&D evaluators"

○ **Introduces a new system of "Certified R&D evaluators" to enhance the efficiency of R&D program by nurturing research institutions' R&D planning and evaluating capacity.**

○ **Manages the national examination for "Certified R&D evaluators"**

Ⅱ Main Activities

4. R&D Knowledge Capitalization (I)

■ Establishes a comprehensive national R&D information system for efficient S&T planning and policy

○ **Builds and manages national R&D integrated information systems**

○ **Provides integrated services for the planning of new R&D programs and R&D policy**

■ Organizes training courses for R&D planning, coordination and evaluation

○ **Operates various training courses tailored for researchers, research managers, R&D project leaders, etc.**

○ **Provides R&D planning and management consulting to GRIs**

○ **Develops joint education programs with universities for Ph. D students in the field of R&D Planning and Management**

○ **Consults on the R&D planning and evaluation activities in developing countries (ex: Vietnam)**

Ⅱ Main Activities

4. R&D Knowledge Capitalization (II)

■ Promotes international collaboration

○ **Hosts and organizes government-level S&T Forums**

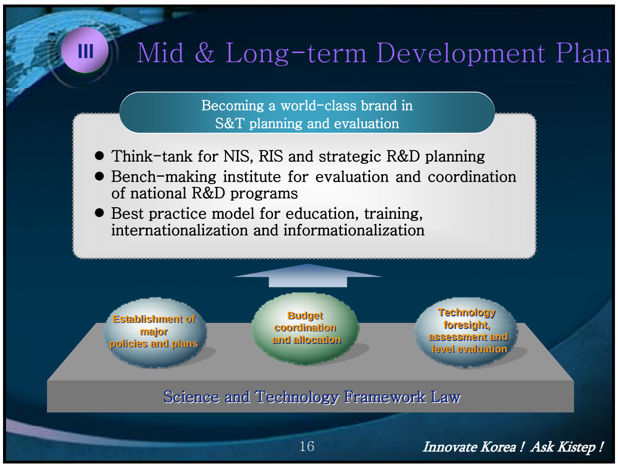
- Korea-Japan, Korea-Brazil, Korea-Argentina S&T Forum, etc.

- Seoul-Washington R&D Evaluation (WREN) Symposium

○ **Builds cooperative networks with international R&D evaluation Institutes (WREN, European REN, NISTEP, CASIPM, NRCSTD, etc)**

○ **Supports participation of experts in OECD S&T activities**

- Publishes the OECD S&T newsletter


III
Mid & Long-term Development Plan
Becoming a world-class brand in S&T planning and evaluation
Think-tank for NIS, RIS and strategic R&D planning
Bench-making institute for evaluation and coordination of national R&D programs
Best practice model for education, training, internationalization and informationalization
Establishment of major policies and plans
Budget coordination and allocation
Technology foresight, assessment and level evaluation
Science and Technology Framework Law
16
Innovate Korea ! Ask Kistep !


Innovate Korea ! Ask Kistep !
Thank You !
kistep
韓國科學技術企劃評價院

Japanese Trends for Cultivation of Human Resources in Science and Technology (HRST)

Tomoko SHIMOMURA

National Institute of Science and Technology Policy

1

Outline

2

1. Perspectives in HRST Surveys

[**Background**]

★Development of **knowledge-based society**

◎Depopulating Society

◎Intensifying global competition

Greater importance of **policy aimed at cultivating and securing HRST**

[**Goal**]

★Right-person-in-the-right-place

★Exertion of their abilities

★Self-reliance

Further reform

[**Reform Directions**]

★**Improve research organization management**

(i) Director's leadership in research organizations

(ii) Merit-based recruiting systems

(iii) Reform of evaluation systems

★**Construct social systems to promote mobility**

・Advantages and disadvantages of career moves

・A system eliminating disadvantages with career moves

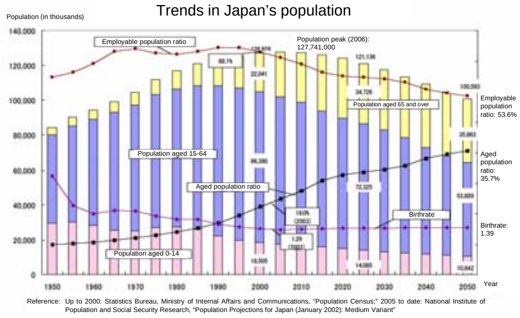
・Diversification of career paths

3

2. Background (i) Depopulating Society

★According to an estimate by MHLW, Japan will face a declining population in 2007.

Trends in Japan's population



Reference: Up to 2000: Statistics Bureau, Ministry of Internal Affairs and Communications, "Population Census;" 2005 to date: National Institute of Population and Social Security Research, "Population Projections for Japan (January 2002): Medium Variant"

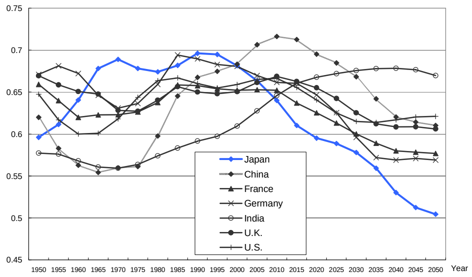
Source: Committee on Social Security Review, reference materials in Reference 4 for the first conference

4

2. Background (i) Depopulating Society

★decreasing of productive-age population ratio

Employable population ratio in major countries



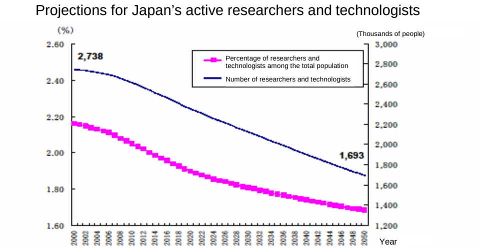
Source: Excerpted from the National Institute of Science & Technology Policy and Mitsubishi Research Institute, Inc.'s "Study for Evaluating the Achievements of the S&T Basic Plans in Japan - Analysis of S&T related human resources training program of the S&T Basic Plans"
Data: Compiled from the projections in the medium variant in the United Nations' "World Population Prospects 2002"

5

2. Background (i) Depopulating Society

★According to an estimate by MEXT, the number of Japan's HRST are declining in proportion to the national population.

Projections for Japan's active researchers and technologists



Source: White Paper on Science and Technology (2003)

Note: The projections were made by the Ministry of Education, Culture, Sports, Science and Technology, assuming that the ratio of "researchers in natural sciences," "technologists" and "university faculty" to the total population of the same age group (in five-year increments) will remain unchanged in future years.

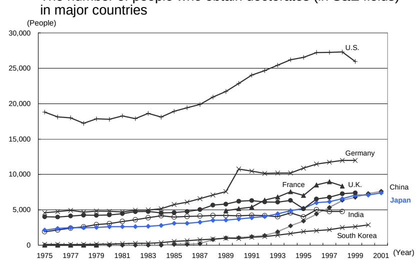
Source: Excerpted from the reference material for the "Key policies in the Third Science and Technology Basic Plan" (Ministry of Education, Culture, Sports, Science and Technology, April 2005)

6

2. Background (i) Depopulating Society

★The annual number of Japanese who obtain doctorates is increasing, but is still below the American and German figures.

The number of people who obtain doctorates (in S&E fields) in major countries



Source: Compiled from NSF's 2002 and 2004 versions of "Science and Engineering Indicators"
Note 1: The science and engineering fields include "social & behavioral sciences," "biology & agriculture," "engineering," "physics & geophysics," "mathematics," and "computer science."
Note 2: The data for Japan include research doctors.
Note 3: The data include doctorates obtained by foreigners.

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2. Background (ii) Intensifying Global Competition

★Japan's competitiveness had fallen to 23rd place in 2004

17th in economic performance
37th in government efficiency
37th in business efficiency
2nd in infrastructure

Japan's competitiveness <total rankings>

	1990	2000	2004
1	Japan	United States	United States
2	Switzerland	Singapore	Singapore
3	United States	Luxembourg	Canada
4	Germany	Netherlands	Australia
5	Canada	Ireland	Iceland
6	Sweden	Finland	Hong Kong
7	Finland	Switzerland	Denmark
8	Denmark	Canada	Finland
9	Norway	Hong Kong	Luxembourg
10	Netherlands	Iceland	Iceland
		No. 21; Japan	No. 23; Japan

(Notes) 1. This table was compiled from "World Competitiveness Yearbook" of IMD (International Institute for Management Development) and other materials.
2. There is no data continuity in the strict sense, due to changes in evaluation criteria.
Source: Competitiveness WG, the special board of inquiry for examining "Japan's 21st Century Vision," basic references in Reference 3 for the first meeting.

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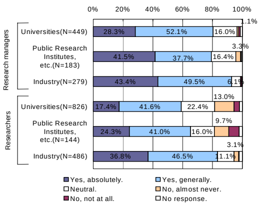
3. Reform Directions (1) Improve Organizational Management

(i) Director's leadership in research organizations
(a) Leadership

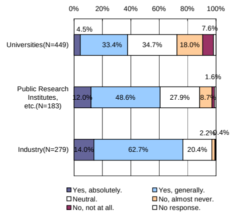
- ●Research managers and individuals recognize the need for management under the director's leadership in research organizations.
- ●The directors of private and public research organizations exercise their management leadership, but those of universities do not good enough.

Do you think it is true that management under the direction of a director is generally essential for vitalizing a research organization and improving its research efficiency?



Source: Compiled from 2003 and 2004 questionnaire surveys

Is management under the direction of a director common in your organization?



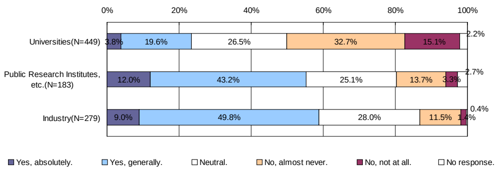
Source: Compiled from 2003 questionnaire surveys

3. Reform Directions (1) Improve Organizational Management

(i) Director's leadership in research organizations
(b) Empowerment

- ●To operate appropriate management, while the directors of private and public research organizations have authority over personnel and financial issues, those of universities do not.

Does a director have authority over personnel and financial issues for flexible operation? (Research managers)



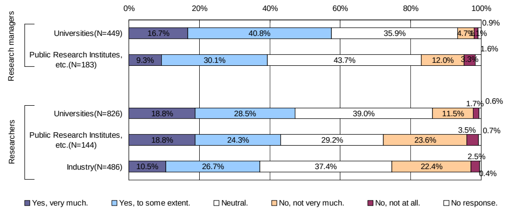
Source: Compiled from 2003 questionnaire surveys

3. Reform Directions (1) Improve Organizational Management

(ii) Merit-based recruiting systems
(a) apply-and-review basis recruit

- ●More research managers and individuals take positive views of apply-and-review basis recruit.

Do you think that all research positions should be filled through apply-and-review basis recruit?



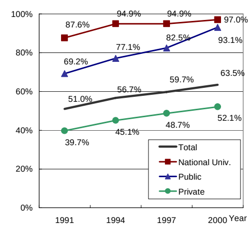
Source: Compiled from 2003 and 2004 questionnaire surveys

3. Reform Directions (1) Improve Organizational Management

(ii) Merit-based recruiting systems
(b) Implementation ～ Fairness and transparency

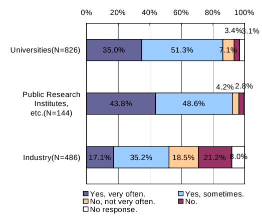
- ● More organizations are implementing apply-and-review basis recruit.
- ● Many researchers feel apply-and-review basis recruit unfair.

Trends in rates of apply-and-review basis recruit at universities



Source: Compiled from the handouts of the Subdivision on Universities, the Central Council for Education
Note: The open recruitment rate refers to the percentage ratio of open recruitment positions to total recruitment positions.

Do you feel that apply-and-review basis recruit for researchers is disingenuous (i.e., most of the positions are already promised to specific candidates before being offered)?

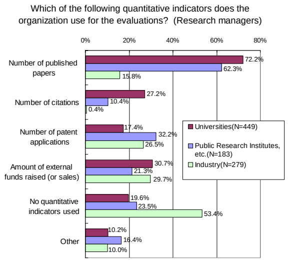


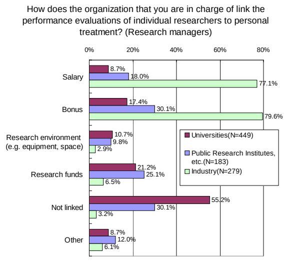
Source: Compiled from 2004 questionnaire surveys

3. Reform Directions (1) Improve Organizational Management

(iii) Reform of evaluation systems

- ●While most universities and public research organizations use the number of published papers as a quantitative indicator, about half of the private institutions use no quantitative indicators.
- ●While roughly 80% of private research managers feel that the evaluations are linked to salary, many university research managers feel that evaluations are not reflected in compensation.





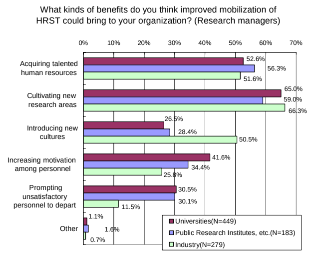
Source: Compiled from 2003 questionnaire surveys

13

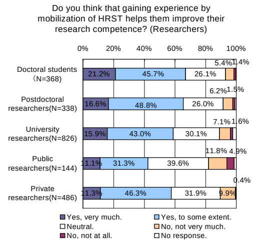
3. Reform Directions (2) Construct Systems to promote Mobility

(a) Mobilization of HRST

1. Expand new research fields
2. Acquire excellent researchers
3. Cultivate researchers



Source: Compiled from 2003 questionnaire surveys



Source: Compiled from 2004 questionnaire surveys

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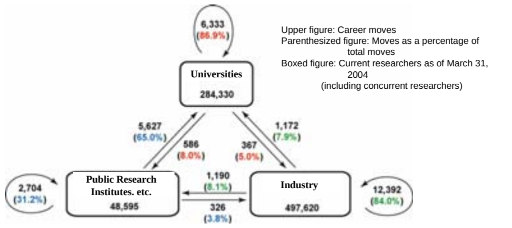
3. Reform Directions (2) Construct Systems to promote Mobility

(b) Mobilization of HRST

Low

Mobility across and within sectors (FY 2003)



Source: Compiled from the Ministry of Internal Affairs and Communications' "Report on the Survey of Research and Development" (2004)

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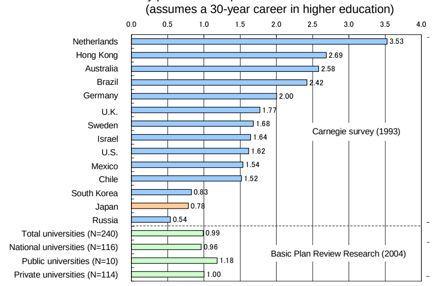
3. Reform Directions (2) Construct Systems to promote Mobility

(c) Mobilization of university professors' expected number of lifetime career moves

0.78 in **1993** ⇒ **0.99** in **2004**

University professors' expected number of lifetime career moves (assumes a 30-year career in higher education)



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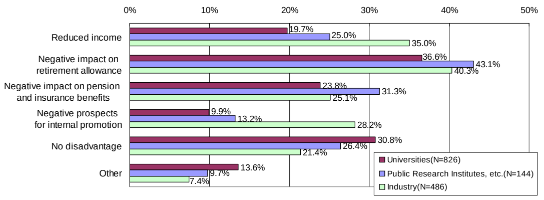
3. Reform Directions (2) Construct Systems to promote Mobility

(d) Disadvantages of mobilization

Retirement allowance

What kind of disadvantages in your working conditions would you expect if you were to move to another research organization ? Choose two major disadvantages. (Researchers)



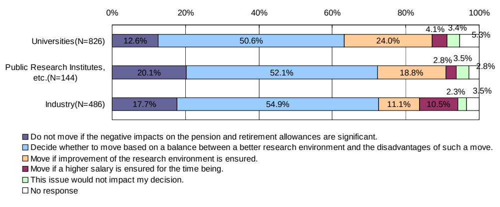
Source: Compiled from 2004 questionnaire surveys

3. Reform Directions (2) Construct Systems to promote Mobility

(e) Conditions

Pension and retirement allowance VS Sufficient R&D environment

If you realized that moving to another research organization would have a negative impact on your pension and retirement allowance, what would your decision be? Choose a statement that best describes your decision. (Researchers)



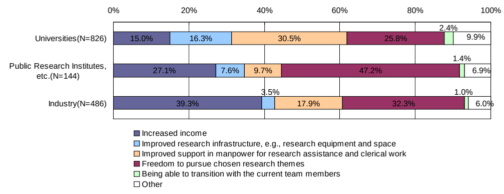
Source: Compiled from 2004 questionnaire surveys

3. Reform Directions (2) Construct Systems to promote Mobility

(f) Policy for Mobilization of HRST

- **R&D support system**
- **Freedom to choose research topics**
- **Income**

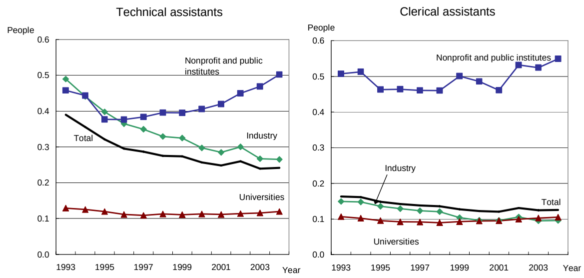
What is the minimum requirement for you to move to another research organization? Choose the most important requirement. (Researchers)



Source: Compiled from 2004 questionnaire surveys

3. Reform Directions (2) Construct Systems to promote Mobility

(Reference) Trends in research assistant numbers



Source: Compiled from the Ministry of Internal Affairs and Communications' "Report on the Survey of Research and Development"

4. Conclusion

Creation of a competitive environment

(1) Appropriate Management and Evaluation Systems
(2) Mobilization of HRST

［GOAL］
★Right-person-in-the-right-place
★Exertion of their abilities
★Self-reliance

［Our Research］
1. Leadership Management
2. Fairness and Transparency of Evaluation ～ apply-and-review basis recruit
3. Supply and Demand of Researchers and Engineers
4. Self-reliance of Young Researchers ～ carrier of post-doctorates holders

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Thank you !

Special thanks to Dr. Jibu

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The Change of Human Resources in Science and Technology in China

Zhao Yandong
National Research Center for S&T for Development, China
2006.1

Stock of HRST in China

- Stock of HRST in China
  - people who have completed higher education in S&T fields
  - people who are engaged in S&T activities without matched higher education diplomas or degrees
- Rapid growth of HRST stock since 1990s
  - Background: a "great leap" of higher education
  - average annual growth of 10.1% in 1990-2000, 6.4% in 2001-2003
  - The annual growth rate of the population with degrees or diplomas from tertiary education institutions in China far exceeds that of GDP

Human Resources in S&T

- What is HRST?
  - people who are practically engaged in or have potentials to be engaged in the production, development, transmission, and application of systematic scientific and technological knowledge.
- Levels of HRST
  - R&D personnel
  - S&T personnel
  - national stocks of HRST

Change of China's HRST Stock (1990, 2000-2003)

	1990	2000	2001	2002	2003
Number of persons with higher education background (million person)	1.616	4.402	4.838	5.622	6.606
The Stock of HRST (million person)	1.220	3.200	3.380	3.660	3.850
Number of HRST per thousand total population (person)	10.8	25.2	26.5	28.5	29.8

Data source: *China science and technology indicators 2004*

S&T Personnel and its distribution by sectors

- **S&T Personnel in China**
  - people who are directly engaged in S&T activities and S&T activity related management or who provide direct service for such activities
  - In 2003, there were a total of 3.28 million S&T personnel in China
- **In recent years……**
  - the number of S&T personnel in business enterprises has increased tremendously;
  - the number of S&T personnel in research institutions is decreasing gradually every year
  - S&T power in universities has been reinforced.
  - Enterprises is now playing a dominate role in S&T activities

R&D Personnel

- **R&D activities**
  - systematic and creative work carried out in the fields of S&T for purposes of augmenting the total amount of knowledge and creating new application with these knowledge.
- **R&D personnel**
  - people who are directly engaged in R&D activities and personnel who provide management or direct service for R&D activities.

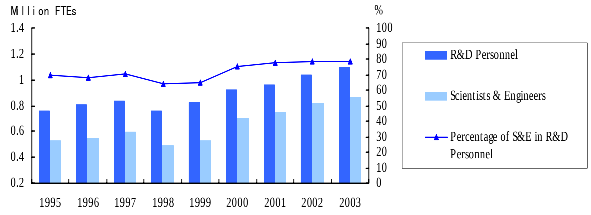
Distribution of S&T personnel by Sector (2003)

	S&T personnel		Scientist & Engineers	
	(million persons)	(%)	(million persons)	(%)
Total Number of S&T personnel across the Country	3.284	100	2.255	100
wherein : Research Institutions	0.406	12.4	0.266	11.8
Higher Education	0.411	12.5	0.404	17.9
Enterprises	2.467	75.1	1.585	70.3

Data source: *China science and technology indicators 2004*

Growth of R&D Personnel in China

The Growth Trend of the Total Number of China's R&D Personnel and S&E (1995~2003)



Data source: *China science and technology indicators 2004*

Change of R&D Personnel by Sector of Performance

- **Principal Sectors of R&D activities in China**
  - Government research institutions
  - Universities
  - Business enterprises
- **Since 1999's reform, there is …**
  - A tremendous increase in enterprises' R&D personnel,
  - A steady rise of R&D personnel in higher education sector, and
  - A constant decline of R&D personnel in government research institutions

Change of R&D Personnel by Activity Type

- **Three types of R&D activities and distribution in 2003**
  - basic research, 8.2%
  - applied research, 23.8%
  - experimental development, 68.0%
- **Change of R&D personnel by activity type**
  - a rapid growth in experimental development personnel, a stable increase in applied research personnel, and a general stagnation of basic research personnel

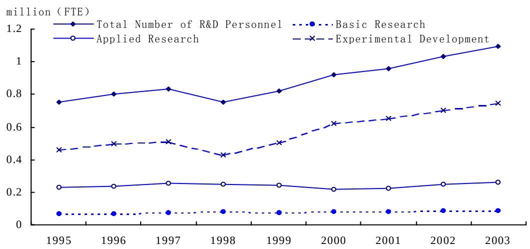
The National Distribution of R&D Personnel by Sector of Performance (2000-2003)

	Total		Research Institutions		Higher Education		Enterprises		Other*	
	Thousand FTEs	%	Thousand FTEs	%	Thousand FTEs	%	Thousand FTEs	%	Thousand FTEs	%
2000	922	100.0	227	24.6	163	17.7	4.1	50.0	71	7.7
2001	957	100.0	205	21.4	171	17.9	532	55.6	48	5.0
2002	1,035	100.0	206	19.9	181	17.5	601	58.1	46	4.5
2003	1,095	100.0	204	18.6	189	17.3	656	59.9	46	4.2

*: Other refers to government-subordinated public service units that carry out scientific and technological activities but cannot be categorized as research institutions.

Data source: *China science and technology indicators 2004*

Distribution of China's R&D Personnel by Activity Type (1995-2003)



Data source: *China science and technology indicators 2004*

Regional Distribution of R&D Personnel

- **Immense regional gap in the development of R&D human resources**
  - The Eastern Region is an economically developed region where R&D personnel are mainly concentrated.
    - *In year 2003, 59.1% of R&D personnel and 60.2% of the Scientists & Engineers in R&D activities were concentrated here*
  - The regional distribution of R&D personnel are basically proportionate to that of total economic output
- **The increase of R&D personnel in China are also mainly concentrated in the Eastern Region**

The Cultivation of HRST

- **Higher education in China**
  - the development of higher education contributes to the promotion of the supply of China's HRST
  - since 1999 when college enrollment was expanded for five consecutive years, China the biggest country in the world in terms of higher education
- **In recent years……**
  - The scale of higher education is consistently expanding
  - The number of postgraduates keeps increasing
  - The proportion of students in natural sciences and technologies is on the decrease
    - *Yet still account for 53.5% of the total entrants of higher education*

The Change of the R&D Personnel in the three Regions (2000-2003)

Year	R&D Personnel in the Eastern Region		R&D Personnel in the Central Region		R&D Personnel in the Western Region	
		Scientists & Engineers		Scientist s & Engineers		Scientist s & Engineers
2000	498	387	215	159	209	149
2001	518	416	215	166	188	137
2002	607	491	236	188	209	153
2003	630	507	234	184	201	150

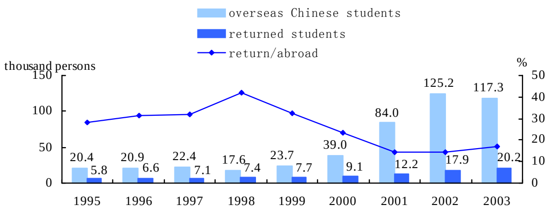
Unit: thousand FTEs

Data source: *China science and technology indicators 2004*

Overseas Chinese Students

- **A rapid increase of overseas students since reform and opening up**
  - In 2003, the number of overseas Chinese students was 117, 000
- **Returned students in recent years manifest an upward trend**
  - 20,000 returnees in 2003

Overseas Chinese students and returnees (1994-2003)



Data source: *China science and technology indicators 2004*

Thanks

HRST Policies

- **The emerging new framework of public finance support system to HRST**
  - Reform of research institutes system
- **Construction of Key R&D Base**
  - As a effective way of HRST talent development
- **Middle-aged and young researchers became the focus of policy support**
- **Internationalization of HRST**

Overview of Development on S&T Talents in China

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I. Introduction

The Role of S&T Talents

- Today, S&T talent has become the primary strategic resources of a country. It is the concentrated manifestation of the advanced productivity, a leading factor for social progress and the focus of economic competition.
- The objectives for the national socio-economic growth in the future 10 to 20 years, and those for building a moderately well-off society in particular, present huge demand for the development of China's contingent of S&T talent.

Contents

I. Introduction

The Concept of S&T talents

- Talent refers to scientists and engineers (S&Es) as well as those involved in R&D activities measured by Full Time Equivalents (FTEs).

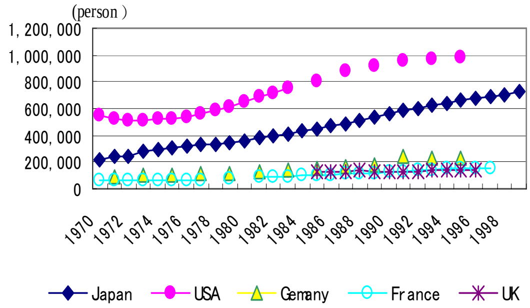
I. Introduction

This presentation focuses on following aspects:

- **Development of S&T Talent in China**
- **Major issues about S&T talents in China**
- **Major policies for talents in China**

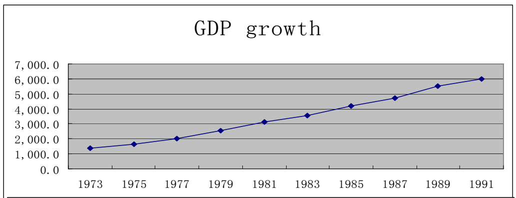
II. Development of S&T Talent in China

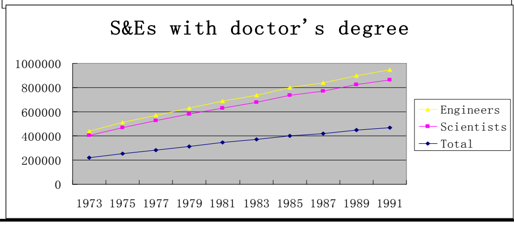
S&Es Scale in some Selected Countries



II. Development of S&T Talents in China

The quantity of S&Es grows with the growth of GDP in USA

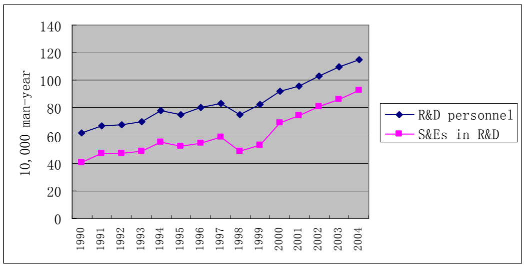




II. Development of S&T Talent in China

1. The Quantity

The Quantity of S&Es increases gradually in China



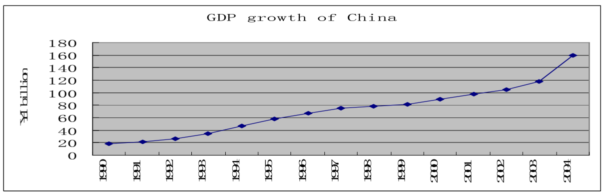
source：２００5中国科技统计年鉴

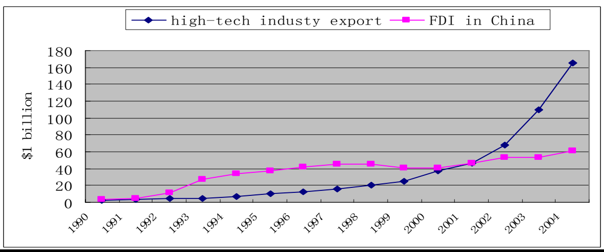
II. Development of S&T Talent in China

Unit: 1,000 man-years

	2004	Compared with 1990
R&D personnel	1,152.6	1.87 times
S&Es in R&D	926.3	2.27 times

The quantity of S&T talents in China ranks the second in the world

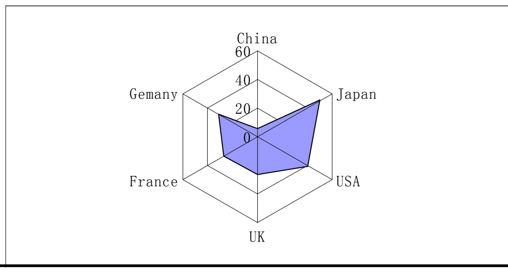




II. Development of S&T Talent in China

2. The Density

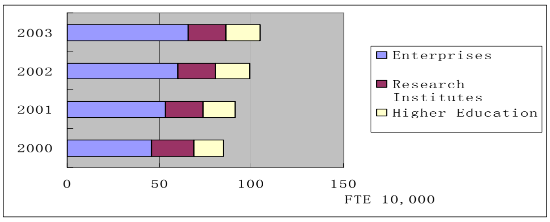
the number of S&Es in R&D per capita is relative small, much smaller than other countries such as Japan, the US, UK, Germany and France.



II. Development of S&T Talent in China

3. 1 Structure

Distribution of R&D personnel by performing sector in China

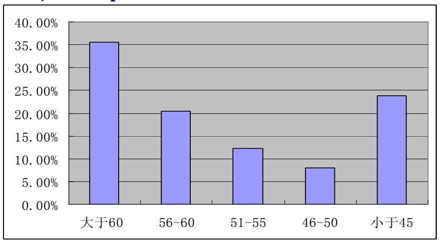


- The amount of R&D personnel in enterprises is increasing rapidly, while that in R&D institutions showed the trend of persistent lowering.

II. Development of S&T Talent in China

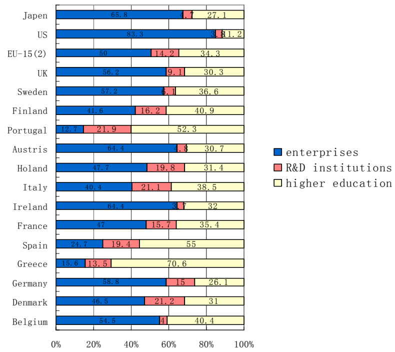
3. 2 Structure

The age structure of professors (supervisor for PhD students) has improved.



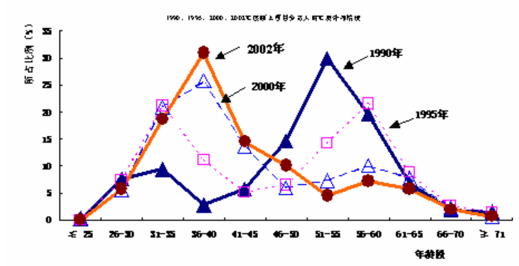
The proportion of the Professors under the age of 45 has gone up to 24 percent

Distribution of R&D personnel by performing sector in selected countries（1999）



日本和美国企业雇佣的研究人员比例较高，美国达83.3%，日本达65.5%。政府研究机构雇佣的研究人员相对企业和大学要少。从欧盟的平均数来看，大学雇佣了大约1/3的研究人员，企业雇佣的研究人员占半数。各国差别大。韩国1995-2000年企业、大学和研究机构分别占50-59%，37%，10%

The Age Distribution of PIs of NSFC Projects



We can see this change from the structure of basic research team:

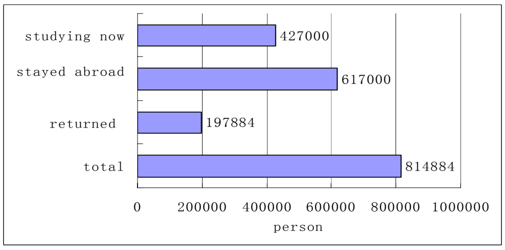
- **In 1995, PI of NSFC projects at age of 51-60, account for 36%**
- **In 2002，principals in NSFC projects at age of 36-40, account for 30.9%**

III. Major Issues about S&T Talent in China

1. The brain-drain in China
2. The quality of S&T talents
3. The density of S&T talents
4. The structure of S&T talents

   (industry, Geographical, age)

The overall situation of studying abroad



From 1978 to 2004, the total number of 814,884 Chinese students and scholars studied abroad，197,884 returned(increase at the rate of 13% annually). As for 617,000 who haven't returned yet, 427,000 are still studying, doing research or visiting as scholars.

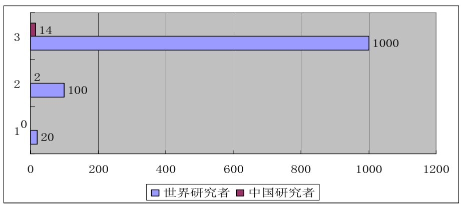
III. Major Issues about S&T Talent in China

Brain-drain become major problem in China since 1980's

- From 1978, the government sent lots of students and scholars study abroad.
- During 1980-2002, the ration of the recipients of S&E PhD who came back to that stayed abroad is about 1 to 3, while the ration is usually 2 to 1 during the take-off period of newly industrialized countries.

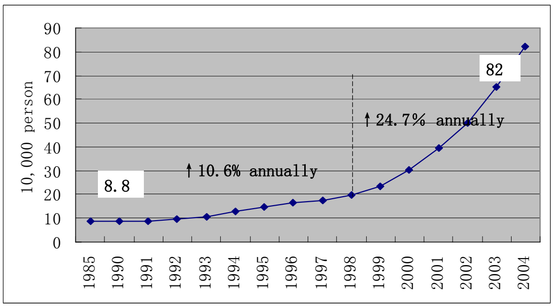
III. Major Issues about S&T Talent in China

The quality of S&T talents in China is still not comparable with developed countries. According to the times of bibliographic citation of SCI papers from 1993 to 2003, No Chinese authors rank in the top 20, only 2 in the top 100 authors, 14 in the top 1000 authors

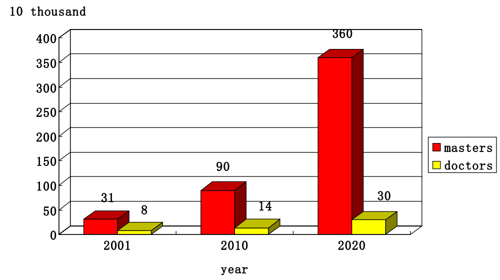


III. Major Issues about S&T Talent in China

The number of candidates for PhD & Master degree（1985-2004）

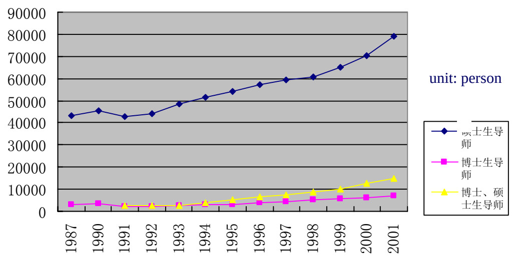


- **Quality of S&T talents becomes increasingly important as Quantity of S&T talents has increased dramatically since 1998.**



The future scale of PhD & Master towards 2020

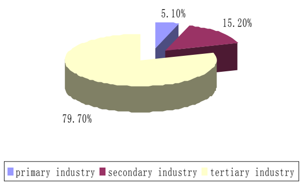
Quantity change of the supervisors for PhD/Master students



There is big gap between the scale of teachers and the scale of graduates, which may result in the fall of quality.

III. Major Issues about S&T Talent in China

The structure of total amount of professional and technical personnel among industries.



The tertiary industry accounts for 79.7% of professional & tech. personnel, while secondary industry accounts for 15.2%.

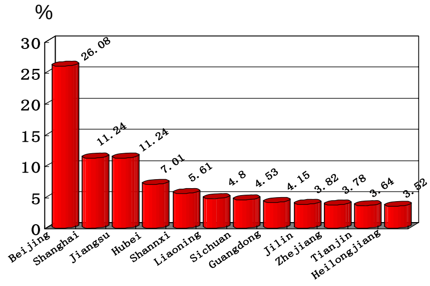
II. Development of S&T Talent in China

Structure –Balance of S&T

How to balance between Science and technology in allocating the innovation resources ?

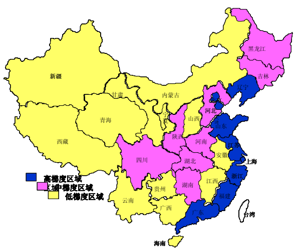
- China accounts for about 2% of total invention patents granted according to the statistics of WIPO.
- China accounts for about 5% of total SCI papers in the world. (the GDP share of China)
- There is a big gap between the share of SCI papers and the share of invention patents granted, which implies the problems of S&T talents' allocation.
- **The key is how to encourage more talents to work for enterprises**

The distribution of PhDs enrolled in different provinces in 2002



Regional allocation of S&E in China

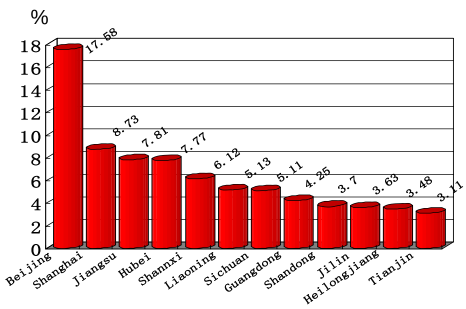
Geographical Structure



In Eastern, middle and western part of China, the ration of S&E involved in scientific activities is as following:

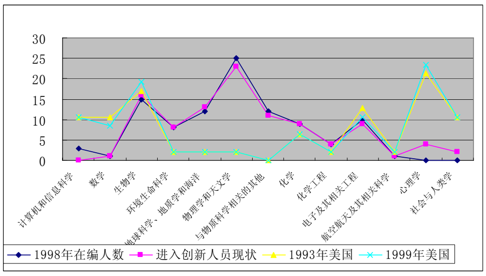
3.31 ： 1.47 ： 1

The distribution of Masters enrolled in different provinces in 2002



II. Development of S&T Talent in China

Structure of talents by disciplines in CAS



Talents in CAS mainly allocate in traditional disciplinary instead of newly emerging disciplinary or interdisciplinary areas such as IT, life science.

The main measures taken in the personnel policy

- To improve academic environment and working condition
- To increase living quality
- To increase political and social status, promotion advantage, more opportunities.
- To pay more attention to dependents family members, and guarantee them the freedom of coming and going.
- To provide more opportunities and important positions for the young talents

IV. Major Policies for S&T Talent in China

1. To draw and encourage oversea students and scholars back to China by setting up different talent program
2. To increase S&T input so as to provide more opportunity for young scientists
3. To Increase the quality of high education
4. To encourage more talents to work for enterprises

Program for Distinguished Young Talents since 1990s

计划名称	青年人才或创新群体
人事部等"百千万人才工程"（1995-2001 年，4 批第一、第二层次人选）	1397 人
教育部"跨世纪优秀人才培养计划"（1993-2000 年）	499 人
教育部"高校青年教师奖"（1999-2001 年）	314 人
教育部"长江学者奖励计划"（1998-2002 年）	492 名特聘教授，43 名讲座教授
中科院"百人计划"（1994-2002 年）	572 人
国家自然科学基金委员会"国家杰出青年科学基金"（1994-2002 年）	435 人
国家自然科学基金委员会"海外青年学者合作研究基金"和"香港、澳门青年学者合作研究基金"（1998-2002 年）	284 人
国家自然科学基金委员会"创新研究群体科学基金"（2000-2002 年）	55 个创新群体
国家自然科学基金委员会"青年科学基金"（1987-2002 年）	8630 人（负责人）

IV. Major Policies for S&T Talent in China

- **MOE launches the training program for outstanding talents toward the 21st Century since 1993.**

— To target the outstanding overseas young teachers back China.

— 922people are supported with an amount of ￥180 million .

- **MOE launches the Changjiang Scholars Program since 1998.**

— leading scholars under 45 years old with oversea study background in certain disciplines.

— 4 months a year in China.

Conclusions

1. The quantity of S&T talents in China will experience a rapid expanding period as Chinese economy keep growing with high speed in the next 10 years.
2. The quality becomes the key issue of policy for future talent development as the quantity increases in large scale.
3. The employment of oversea students/scholars can solve the problems resulted from shortage of talents to some extent. However, the final solution to the problems is to train and develop outstanding S&T talents in practice of innovation.
4. The structure problems have been gradually solved to some extent. However, how to attract and encourage increasingly more outstanding talents to work for and in enterprises is still one of key issues in policy-making for innovation

- **Joint research Founds for Overseas Young Scholars (NSFC, 1998）**

  To attract outstanding scholars under the age of 45 years old who cannot back to china for the time being.

- **Special funds for Chinese Scholar abroad to work or lecture in China （ NSFC, 1999）**

  To realize the research model of two base (one at home and one abroad)

- **One hundred talents program (CAS, 1994）**

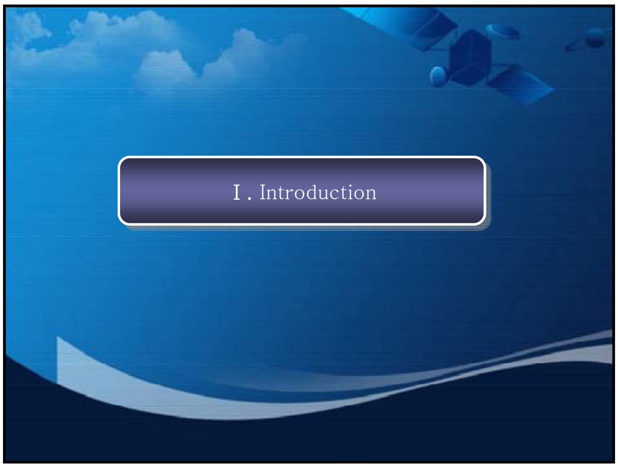
— Outstanding scholars under the age of 45 years old

— Award ￥2 million in 3years.

— By the end of 2002，956 professors have been appointed, 95％ of them have the experience of abroad study

Thank you!


Nurturing HRST for the 21st Century
Status-quo and Recent Policy Instruments in Korea
January 23-24, 2006
Dr. Ki-Wan Kim
Korea Institute of S&T Evaluation & Planning


I . Introduction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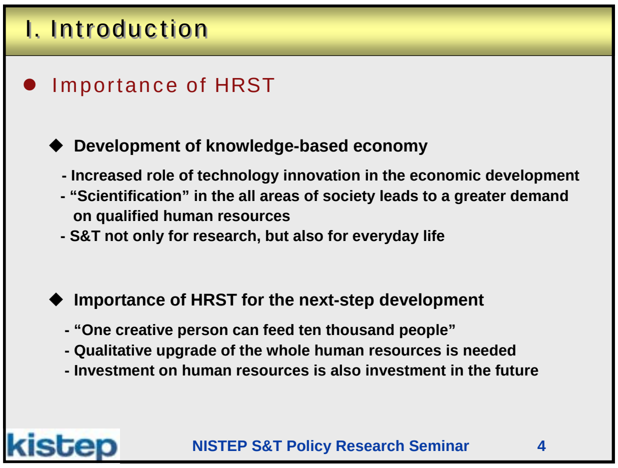

I. Introduction
● Importance of HRST
◆ Development of knowledge-based economy
- Increased role of technology innovation in the economic development
- “Scientification” in the all areas of society leads to a greater demand on qualified human resources
- S&T not only for research, but also for everyday life
◆ Importance of HRST for the next-step development
- “One creative person can feed ten thousand people”
- Qualitative upgrade of the whole human resources is needed
- Investment on human resources is also investment in the future
kistep
NISTEP S&T Policy Research Seminar
4

I. Introduction

- HRST policy in Korea

◆ **HRST is one of the major parts of R&D policy in Korea**

- Policy relevance has been identified from the beginning of R&D policy in Korea
- MOST and MOE are major public actors in HRST policy, but recently pluralization of HRST policy has taken place

◆ **Changes in policy emphasis**

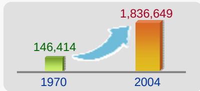
- In 70s and 80s, greater emphasis on nurturing technicians and engineers for the direct application in industry
- In 90s, policy efforts have been put on basic science ("Brain Korea 21", Fostering Research Universities etc.)
- Now, both basic researchers and engineers & technicians are regarded as important for the balanced development of S&T
- New policies of the present government to nurture and utilize HRST more effectively and to reinforce academia-industry linkage

II. HRST in Korea : Status-quo

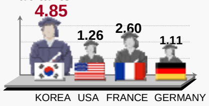
- Quantitative growth and qualitative discontents

Quantitative Growth

- Drastic growth in the number of college graduates (world-highest)



- College graduates in per 1,000 inhabitants



Low Competitiveness

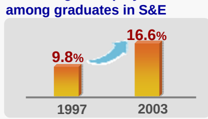
- International competitiveness of Korea's universities is insufficient
- Qualitative level of scientific papers are low (2003)
  - Number of papers : 14th
  - Citation rate : 34th
- Low citation rate on registered patents (2001)
  - KAIST 2.4 , POSTECH 2.7
  - USA (average) 3.7
- Technology transfer
  - License incomes (2001-2002)
  - Whole univ. in Korea (40 bill. Won)
  - Stanford univ. (49 bill. Won)

II. HRST in Korea : Status-quo

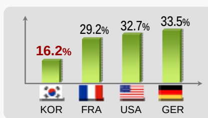
II. HRST in Korea : Status-quo

Mismatch of Core Researchers by Quality and Areas

- Increasing unemployment rate among graduates in S&E

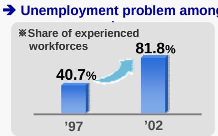


- Proportion of S&T jobs (2002)



Shortage of Engineers for Industrial Demand

- Oversupply of S&E graduates, but shortage of industrial engineers and technicians (esp. for SMEs)
- Insufficient job-specific education and avoidance of production industries
- Companies prefer experienced workforce in recruitment
  ➔ Unemployment problem among



II. HRST in Korea : Status-quo

● Problems of universities in Korea

Curriculums do not correspond to demands

- Adequateness of univ. education to the socio-economic demand : 59th (IMD, 2004)
- Insufficient experiment and practical education
  - High costs for job-training in industry

Insufficient major education in S&E

- Requirement for major course in S&E has decreased

  ex) Major in IT
  : 84 credits (prior to 2002)
  → 70 credits (after 2003)
- Weakened students' study in major due to bad employment situation

III. Policy Instrument (1)

– Creating a New National Innovation System –

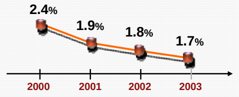
II. HRST in Korea : Status-quo

Insufficient profile-building of universities & colleges

- Similar faculties and curriculums
- Less emphasis on the academia-industry cooperation activities
- Emphasis on "Research University"
  - All universities want to be research university.

Academia-industry cooperation

- Mismatch between research in universities and technological requirement in industry
- Companies prefer to in-house technology development
  → R&D investment in universities decreases in relative term



III. Policy Instrument (1) - Creating a New National Innovation System

● Backgrounds

◆ **Fast economic development during last 40 years**

- Export-oriented industrialization strategy
- Very strong initiative of the government
- Transition from labor-intensive to capital-intensive industry
- Plenty human resources eager to new knowledge and tasks

◆ **New Challenges in the era of knowledge-based economy**

- Limitation of the "catch-up" mode of development
- Transformation towards innovation-driven growth model
- Need to build and restructure national innovation system
- Not only industries, but also universities and government are important actors in this process

III. Policy Instrument (1)
- Creating a New National Innovation System

● Challenges imposed on Korea

◆ The 21st century's knowledge-based economy

→ Severe global competition based on S&T strength

◆ Technology innovation functions as an future growth engine

➡ Calls for swift transition to an innovation-led growth model

III. Policy Instrument (1)
- Creating a New National Innovation System

● Strength and weakness of Korea's NIS

Strong Points

- Accumulation of technology innovation experiences through large-scale national programs
  - e.g. TDX, 4M DRAM, KTX, etc.
- Establishment of world-level information infrastructure
- Good innovation potential through quantitative expansion
  - 10,000 private research institutes,
  - Graduates in S&T areas per 1,000 inhabitants : 2.2 (Japan: 1.2)
- Innovation in process technology through technology import & improvement resulting in developing world-level technology in selected areas
  - Memory semiconductor, CDMA, TFT- LCD etc.

III. Policy Instrument (1)
- Creating a New National Innovation System

Weak Points

- Lack of capability for producing creative, world-level output
  -Technology level of the next-generation products: 67.3% of the advanced nations
- Insufficient diffusion and commercialization system of innovation
- Inactive cooperative networks among industry, academia, and public research institutes
  - Private enterprises use 97% of research expenditure for conducting their own research
- Unbalance in demand and supply of S&T human resources and weak basis for fostering creative human resources in S&T

III. Policy Instrument (1)
- Creating a New National Innovation System

● Innovation-driven growth & NIS

Innovation-led growth

- Foster leading industries
- Create new technology-based industries
- Cultivate knowledge-based service industries

Technology innovation contributes to innovation in all sectors of society as well as economic growth, and thus brings out systemic changes on the national level.

➡ Calls for establishing a new NIS

III. Policy Instrument (1)
- Creating a New National Innovation System

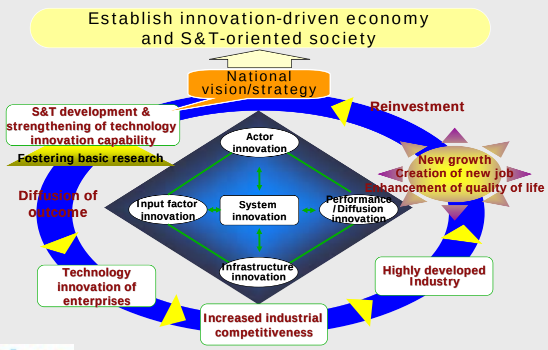
● Basic goals & strategies

Catch-up mode of NIS	5 Areas of innovation		Creative mode of NIS
Imitative-& modifying -based system	Strengthen innovation capabilities of industry, academia & public research institutes	"Actor" innovation	Value creation -based system
	Produce and commercialize creative outputs from R&D	"Performance /diffusion" innovation	
Stand-alone & closed system	Strengthen collaboration with leading research organizations and companies	"System" innovation	Networked & open system
	Coordinate policies, budget, and programs efficiently and effectively		
Input-oriented & supply-side mode	Secure efficient R&D investment and supply of high-quality S&T manpower	"Input factor" innovation	Performance -centered & demand-oriented system
	Create innovation-driven eco-system, including S&T culture	"Infrastructure" innovation	

* Strengthen the foundation of macro-economy based on the qualitative development of micro-economy through S&T, industry, and human resources

III. Policy Instrument (1)
- Creating a New National Innovation System

● Policy system



III. Policy Instrument (1)
- Creating a New National Innovation System

● Restructuring of national S&T administration

◆ Change of policy environments

- Emphasis on innovation-oriented S&T activities
- More effective government reaction and efficient resource allocation

◆ Major changes

- Reposition the MOST to the vice prime minister-level ministry
- Create the Office of Science, Technology and Innovation (OSTI) in MOST
- Strengthen evaluation and coordination efforts of national R&D programs
- Coordinate STI-related micro-economic policies on the national level

IV. Policy Instrument (2)
- Strategic Plan for "Strong Korea with Creative Talent"

- Backgrounds

◆ **Importance of S&T Human Resources for NIS**

- "Few core researchers and engineers can provide economic growth and jobs for tens of thousand people"
- Not only researchers for basic science, but also well-trained industrial engineers and technicians are needed

➡ Strategies for Nurturing S&T Human Resources for the Realization of "Strong Korea"

◆ **Process**

- Initiative of Presidential Council on Science & Technology
- Participation of various actors in academia, government and industry
- Presentation of a master plan in March 2005
- Set up a concrete "Implementation Roadmap" on the trans-ministerial level (coordinated by OSTI)

IV. Policy Instrument (2)
- Strategic Plan for "Strong Korea with Creative Talent"

- Vision and strategy

IV. Policy Instrument (2)
- Strategic Plan for "Strong Korea with Creative Talent"

(1) Software innovation in universities

◆ **Promote differentiated development of universities and colleges according to their strengths and characteristics**

◆ **Promote competition among universities and among researchers at universities**
- Strengthen performance evaluation of universities and professors

◆ **Reform curriculums in order to cope with the need on the demand side**
- Curriculums for interdisciplinary and fusion researchers, Dissemination of demand-oriented courses etc.

IV. Policy Instrument (2)
- Strategic Plan for "Strong Korea with Creative Talent"

(2) Enhance universities' R&D capability

◆ **Foster world-level Research Universities**
- Build and support Research Universities that can compete with top-level universities in foreign countries

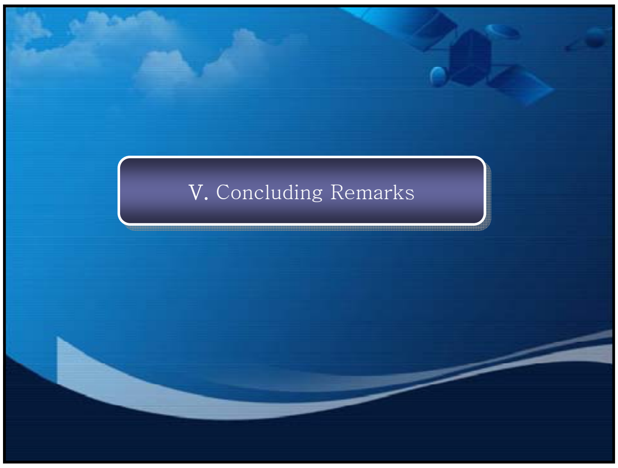
◆ **Build basis for the internationalization of research and education**

◆ **Support graduate students to continue high-quality education and research activities**
- Financial and infrastructural support for graduate students in S&E (fellowship, dormitories for graduate students etc.)

IV. Policy Instrument (2)
- Strategic Plan for "Strong Korea with Creative Talent"

(3) Promote industry-academia link

- ◆ Build basis for effective industry-academia collaboration
  - Improve laws and regulation blocking effective collaboration
- ◆ Develop HRST nurturing system according to the type of company and HE institutions
  - Global companies / Innovation-driven medium-sized companies / general SMEs
- ◆ Strengthen re- and continuous training of HRST
- ◆ Facilitate transfer and commercialization of the outcomes of research



IV. Policy Instrument (2)
- Strategic Plan for "Strong Korea with Creative Talent"

● Expected outcomes

- ◆ Enhanced competitiveness of S&E colleges in Korea
  - Foster world-class research universities
  - Enhance the quality of research (SCI indicators etc.)
- ◆ Establish a demand-oriented nurturing system of HRST
  - Improve the adequateness of college education for the industrial demand
- ◆ Contribute to the development of regional economy
  - Build cooperation networks between regional universities & colleges and regional industry
- ◆ Improve employment situation of young people in S&E
  - Create more S&T-related jobs

V. Concluding Remarks

State-of-the-art

- Korea is trying to restructure and strengthen its national innovation system through various policy measures and HRST is one of the major issues.
- Diminishing disparities between supply of and demand on HRST will be the key issue for the renewal of effective NIS in the future.
- Especially, the creative and path-breaking efforts of the OSTI, MOST will play a pivotal role in the establishment of effective and well-functioning NIS.

Implications

- Regarding HRST, Korea, Japan and China have similarities and differences at the same time. (ex: importance of HRST and policy efforts, different demands and different institutional contexts)
- Various collaborative research will benefit all the countries in the region by providing discussion forum and actual information of each country.


Thank You!
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23 January 2006

Science Communication and Science Literacy in Japan

渡辺　政隆
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People's feeling about S&T

People think that…

- S&T knowledge is important.
- We can understand it if someone explains simply.
- There is few information that we can understand easily.

People's attitude is very passive!!

The Situation of Public Understanding of Science & Technology in Japan

- The general awareness and literacy of S&T among adults is not very high, especially among young people.
- The leading sources of information on S&T are generally the TV and newspaper.
- Internet usage is increasing, needless to say cellular phone.

Is the simpler the better?

© Sidney Harris

Public Understanding of Science

↓ ← Deficiency Model

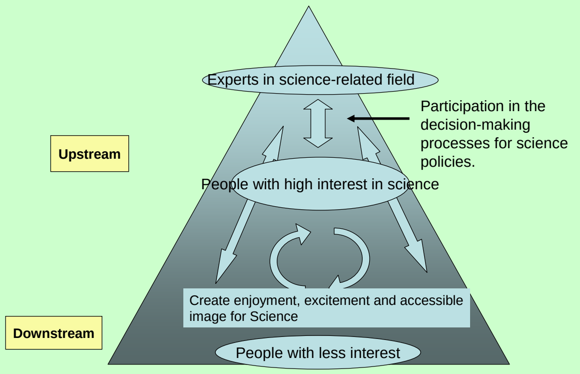
Science Communication

Science Communication is not the one-way communication from the scientists to the public, but the activity whereby science will penetrate into the society by enforcing the communication in consideration of the understanding of both sides.

Science Communication:

Who, How, and Where ?

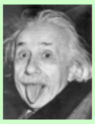
Science Communication pyramid



Scientists?

Not so many scientists have necessary communication skills!

Role Model of Scientists



Subject: Albert Einstein
Year: 1974
Sculptor: Robert Berks
Location: Potomac Park, Washington DC

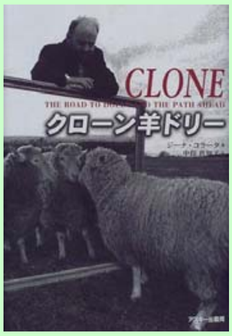
TV Commercial Film since Sep. '97 to Jan. '98

Press Release of Clone Sheep Dolly Feb. '97

This film creator was stimulated by Dolly!

Media?

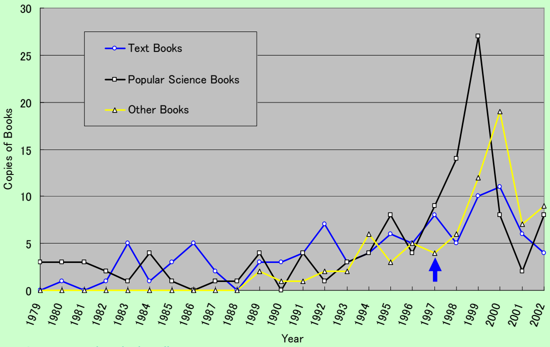
The media has a great influence!



Clone sheep Dolly

Born in 1996
News released in February 1997

Copies of new books that include "DNA" in their title or subtitle

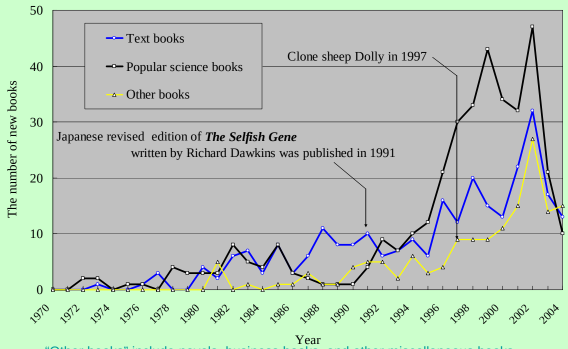


Source: National Diet Library Data Base
"Other Books" include novels, comics, photography and other miscellaneous books

Number of Science & Technology Researchers and Members of Science & Technology Writers Associations

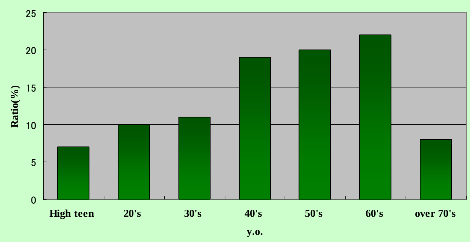
Nation	Total number of researchers	Number of members of S&T writers associations	Number of S&T journalist schools	Name of Associations
JAPAN	675,898	380 (2004)	0 (2005)	Japanese Association of Science & Technology Journalists (150 members) Medical Journalists Association of Japan (regular member 230; guest member 113)
US	1,261,227	2,500 (2003)	45	National Association of Science Writers (S&T Journalsts:60%; Public Information Officers:40%;33% are freelance writers)
UK	157,662	900 (2004)	28 (full time school: 4)	Association of British Science Writers (All kind of S&T Journalists, Public Information Officers, Students)

Copies of new books that include the word "gene" in their title or subtitle



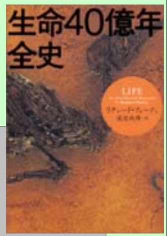
"Other books" include novels, business books, and other miscellaneous books.
Data from the data base "Webcat Plus" in National Institute of Informatics.

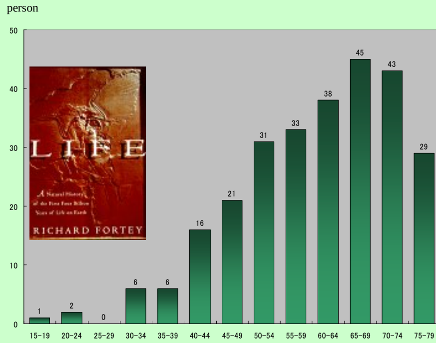
Relative numbers by age of readers of natural science & environmental books among people who like reading books



Source: Mainichi Shimbun poll about reading book conducted in 2003

Readers' age distribution of *LIFE* written by Fortey based on returned reader cards





IDOBATA DIALOGUE
(井戸端会議　Well-side Chats)

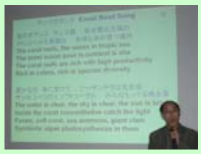
It's a small world!

→ Information would spread by word of mouth, and before long become common knowledge.

Where and How ?

At casual place
&
in easy way

Science Café 科　学　茶　房　by NISTEP



Let's sing science songs!

We need

Effective training systems
&
Novel ideas !!

Our goal is not to let people love S&T,
but to let them have interest in S&T.
Because …….

The opposite of love is not hate,

it's indifference.

by Mother Teresa

The Role Change of Scientist in the Contemporary Popularization of Science

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- Institute of Policy and Management
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Content--my topic of today

Content--introduction

0. General introduction of PS in China

0-1. A simple history of PS in China

- (1)At the beginning of PRC(1949) there was a Bureau of PS (科普局)in central government
- (2)In 1950, the National Association of Popularization of S&T(全国科普) was established
- (3)In 1958, the China Association for Science and Technology (CAST，中国科协) was established
- ----2 main functions:
- academic communication in SC + PS in society
- ----3 objects: leaders, students, peasants

0. General introduction of PS in China

0-1. A simple history of PS in China

- (4) Science 1996, 3 times of National Convention of PS have been held
- (5) 2002, the first Law of PS was enacted
- (6)2004, in the Long Term Planning of S&T, PS became one of 20 Topics in first time in history (19th Topic: Popularization of Science and Innovation Culture)
- (7)2004, 2049 Project by CAST
- (8)2006,Outline of Action Program for Civil Scientific Literacy(2006-2010-2020)

1. Traditional notions

- Britain, the 1985 Royal Society report on Public Understanding of Science
- ----- the Bodmer Report ,1985
- “It is clearly a part of each scientist’s professional responsibility to promote the public understanding of science.”

0. General introduction of PS in China

0-2. Several hot topics of PS in China now

- (1)the aim of PS
- (2)the definition of PS
- (3)the relation between PS and formal education
- (4) the relation between PS and mass media
- (5) the relation between PS, PUS and SC
- (6)the market mechanism of PS (industrialization of PS)
- **(7)the trend of specialization of PS (role change of scientist in PS)----my topic today**

1. Traditional notions

- US, the president of AAAS M. R. C. Greenwood called on in 1999 that
- American scientists should take part-time job at all kinds of schools
- and promote the science education and the public understanding of science.

1. Traditional notions

- China, chairman of the CAST, Zhou Guangzhao in 2000 said that
- S&T researchers were the main forces for popular science work in China
- popularization of science was an unshirkable duty for scientists

2. Traditional communication model

- **Four elements:**
- **i s → i → c c→ i r**
- **information sender →**
- **information →**
- **communication channel →**
- **information receiver**
- 信息传播者→信息→传播渠道→信息接受者

1. Traditional notions

- It is true that in the history of science, scientists always play an important and central role in the PS.
- Thanks to their endeavors, more and more people turned to accept, support, and even like science.
- "We never know how many scientists working at the scientific frontiers got their initial inspiration through a book, an article, or a story written by Asimov, we neither know how many ordinary people support the science at the same reason ."
- ——Carl Sagan,1992

2. Traditional communication model

- There is a tacit premise
- **information producer = information sender**
- 信息生产者=信息传播者
- This is common in the general news report, and also in early history of PS:
- representative figures are Bruno, Galieo, Michael Faraday , Royal Society of Britain, and Carl Sagan.

3. New model for scientific communication

- **New changes in contemporary PS:**
- Popular science work is becoming the concern of government and the whole society
- Information society-- television and internet, the mass media shows a prominent role in PS
- Change in style and content:
- **PS needs specialization**

4. New points of the role of scientist in PS

- First,
- literary works of popularization of science, should be admitted as jobs of new creations.
- **information① ≠ information②**
- “科学知识生产者” ≠ “科学知识传播者”

3. New model for scientific communication

- **Six elements:**
- **s i p → i ① →s i s → i ② → c c→ i r**
- **scientific information producer → information ① →scientific information sender → information② →communication channel → information receiver**
- 科学知识生产者→信息①→科学知识传播者→信息②→传播渠道→科学知识接受者

4. New points of the role of scientist in PS

- Second,
- Independent evaluation system is needed. PS should not be belittled under the standards of academic findings of scientific research
- Differences: communication targets
- communication styles
- communication contents
- evaluation standards

4. New points of the role of scientist in PS

- Third,
- scientists ≠ the main and professional role of PS today
- Mass media workers are more and more like to be professionals, which include
- popular science writers
- scientific journalists and editors
- organizers of popular science work

4. New points of the role of scientist in PS

- However,
- It's not to say that scientists have no responsibility of PS today
- In democratic & scientific society, scientific community has to pay greater attention to PS than before
- Good relationship & cooperation between scientists and mass media is important
- Science community should encourage particular members to do both the research work and the popular science work as their pioneers

4. New points of the role of scientist in PS

- Fourth,
- It should not be a part of each scientist's professional responsibility to promote PS
- It's unreasonable and impractical to ask every scientist to take that unshirkable duty of popularization of science.
- We should pay more attention to the training of talents and professional staffs for PS.

5. Conclusions

- First, there is a trend of diversity and specialization in the contemporary PS
- Second, mass media is playing a professional role in the contemporary PS
- Third, scientific community has to face this reality and adapt to the new trend of the PS

The Role Change of Scientist in the Contemporary Popularization of Science

- **THANK YOU!**

- Xiao-min Zhu
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- Jan. 23, 2006 Tokyo

In Search of "Science Culture System": Theory and the Korean Case

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Science and Technology Policy Institute (STEPI)

1. Introduction

The development of science and technology (hereafter S&T) has kept abreast of various interactions with society. These interactions make not only S&T more powerful, but also the boundary of S&T more extended. In this process, the attitude of the public to S&T has changed. S&T was regarded as the symbol of progress in the 1920s, but in the 1960s the disfunctions of S&T began to be criticized. Recently, controversies on S&T are coming to light even before the paths of S&T are entirely visualized.

In this context, academic and practical efforts have been made to enhance public understanding of S&T. This paper deals with theoretical trends and policy issues concerning science and the public. The first half of this paper examines theoretical perspectives before and after public understanding of science (PUS). In the remaining sections, I will introduce the concept of "science culture system" and analyze the case of Korea.

2. From "Popularization of Science" to "Public Understanding of Science"

The traditional perspective concerning science and public is based on the concept of "popularization of science." Because the public doesn't know about science, scientific experts should enlighten the public. In other words, scientific experts convey scientific knowledge to the public in a one-directional way.

Brian Wynne (1991) called this perspective "deficit model" and pointed out its three premises. Firstly, science is single, universal, and self-evident. Secondly, the public is "cognitively deficit" about science. Thirdly, the more scientific knowledge is provided to the public, the more their behavior becomes more rational.

This perspective has undergone a sort of crisis according to the change of circumstances around science and the public from the 1960s on.

Most of all, social problems of S&T have been settled as important public agenda. There have been various controversies on S&T, including nuclear power plants, nuclear waste storage facilities, the destruction of the ozone layer, genetically modified organisms (GMO), and fluoridation of drinking water (Nelkin, 1992). These controversies sometimes ended up as technical ones among scientists, but in many cases were extended to social ones that stakeholders and the public participated in.

In the academic aspects, new trends of science and technology studies (STS) symbolized as "social constructivism" have emerged and diffused (Jasanoff, et al., 1995). Social constructivism emphasizes conflict and negotiation among relevant social groups in S&T changes. It leads to comparatively decreasing the role of the S&T community and increasing the possibilities that the public can take part in the construction of S&T.

Under such circumstances new perspectives concerning science and the public have been actively pursued since the 1980s. In 1985, Royal Society in UK published an important report titled <Public Understanding of Science>. After that, many scholars, such as Brian Wynne, Alan Irwin, John Durant began to study PUS intensively. They emphasize "contextual model" contrary to "deficit model" and produced many case studies on understanding and behavior of the public about S&T in social contexts.

PUS starts from how the public understands S&T. In other word, PUS considers very importantly not that which knowledge the public has but that what the public wants to know. PUS premises "scientific understanding of the public"(Irwin, 1995: ix).

The characteristics of PUS can be summarized as follows. Firstly, the public is interpreted as heterogeneous group"s" in PUS. The public is composed of various entities whose identity is different according to sex, age, occupation, region, race, class and personal history. Therefore, the public has a different moment to have interest in science and a different frame of reference to acquire scientific knowledge compared to scientific experts.

Secondly, as the public is not a homogeneous entity, the concept of science is not single. In one sense, science means general scientific knowledge, in another sense, institutional aspects or social forms of scientific activities in particular sphere. In the aspects of knowledge, PUS evaluates tacit knowledge, lay knowledge, and even ignorance in addition to formal knowledge.

The third point is about the relationships between public and science. PUS emphasizes the public understands science through "reconstruction" of science. The public compares science with other knowledge and evaluates the reliability of science in a peculiar context based on personal experience. For example, in the public debate on S&T, as social learning and evaluation of expertise is performed, status and effectiveness of expertise is continuously redefined.

3. Beyond "Public Understanding of Science"?

In recent years, various concepts are attempted to complement PUS. They include heterogeneous PUS, public understanding of research (PUR), public participation in science (PPS), and so on.

Heterogeneous PUS criticizes existing PUS in that public is considered excessively to be rational, the expert is conceptualized to be homogeneous, and the public and science is interpreted as separated entities (Michael, 2002; Kim, 2002). In contrast, heterogeneous PUS attempts to grasp the relationships between public and science as heterogeneous networks. It focuses on the continuous development of actor-network constructed with some of the public and some of experts on a particular issue. In this process, both public and experts are differentiated to various entities, and new forms of public or experts come out, then another actor-network is constructed.

PUR is recently searched by National Science Foundation (NSF) in USA (Field and Powell, 2001; Brooks, et al., 2001). While NSF has managed the informal science education (ISE) program since 1984, it conceives that the public is greatly interested in ongoing research activities relevant to their everyday life than the contents of established science. The characteristics of PUR are summarized in <Table 1>.

<Table 1> The characteristics of PUR (Public Understanding of Research)

	Informal Science Education	Public Understanding of Research
Scope	- contents of established science - post-constructed research process - great scientists in history - results of scientific research	- information about ongoing research - realistic picture of research process - scientists doing research presently - discussion on the application of research
Method	- one-time opportunity to learn - particular media according to subjects - conveying information to public - emphasizing S&T development itself	- continuous updating of information - combination of various media - continual feedback with public - focusing social issues of S&T

Source: Field and Powell (2001: 423-424).

PPS is to extend the ideal of participatory democracy to the S&T sphere (Lee, 2000). The basis for PPS can be found in that everyday life of the public is much affected by S&T and most research and development (R&D) programs are dependent on taxes from the public. In PPS, the public is redefined as who has "citizenship" about S&T not simply who consumes the products of S&T. There has been various attempts to promote S&T citizenship, such as technology assessment (TA), consensus conference, and science shop. PPS is evaluated as a very affirmative way for the public to understand S&T and for scientific experts to understand the public through their interactions and social learning (Durant, 1999).

5. Conceptualizing "Science Culture System"

As discussed so far, the dominant perspective concerning science and the public has changed from popularization of science to PUS, and recently various concepts are proposed to deepen the discussion on PUS. However, it is not an easy task to systemize and apply the PUS perspective on a practical level, not a theoretical level. This kind of difficulty arise from that imposed meaning of PUS is different according to the social conditions of each country, in practical activities the popularization of science and the PUS can be overlapped, various actors including public agencies play important roles in addition to the public and scientists, and the activities of relevant social groups are institutionalized in a particular way.

Based on this judgment, I will conceptualize "science culture system" (hereafter SCS) and analyze its characteristics. SCS consists of the words "science culture" and "system". Science culture is a neutral concept for various activities mediating science and public, whereas popularization of science and PUS are based on a specific position. System approach emphasizes organic connection of elements, and the whole is more than the sum of each part. SCS can be defined as "a system including constituents which affect to production, diffusion, and application of science culture and the relationship of such constituents."

To draw analytical categories on SCS, I refer to two system approaches. One is technological system approach developed in science and technology studies, especially history and sociology of technology (Hughes, 1987; Hughes, 1994). The other is national innovation system (NIS) theory developed in innovation studies (Lundvall, 1992; Song, 2002).

Analytical categories on SCS can be classified as purposes, actors, infrastructure, and organizing mechanism.

Constituents are starting points in every system approach. They include both human ones and nonhuman ones. As such, SCS can be operated by human resources on one hand, by physical and institutional resources on the other hand. I will divide constituents of SCS into "actors" and "infrastructure." In these categories, main concerns are which actors have been well shaped and whether infrastructure is sufficiently established or not.

Every system is operated toward particular purposes. This point is stressed in technological system approach by Hughes. And, these purposes of system are not fixed, but changed through historical periods. The purposes of SCS are not only to provide environments for existing S&T activities but also to present new directions of S&T change.

Organizing mechanism is a category that NIS theory has emphasized. Even if two countries have similar resources in SCS, the effectiveness of SCS can be different according to how such resources are organized. In this category, main concerns are which actors play major roles in SCS and whether all processes of SCS are appropriately organized or not.

6. Characteristics of Science Culture System in Korea

In this section, I will analyze the characteristics of SCS in Korea as a kind of exploratory study according to four categories.

1) Purposes

In many cases, the purposes of SCS are expressed indirectly through slogans or programs. "Movement for the scientification of all nation" in the 1970s was carried out to enlighten the Korean people in S&T focused on its practical aspects. In the 1980s, activities for the scientification of youth were developed aimed at the promotion of interest in S&T and entrance into S&T fields. From 1991 to 1996, "public understanding of S&T program" was initiated that intended to strengthen the support of S&T and related policy by enhancing science literacy of the public and corresponding to social issues of S&T. Since 1997, while the words of "science culture" or "S&T culture" are usually adopted, "diffusion of S&T culture program" has been performed which had various purposes, such as the promotion of entrance into the S&T field, corresponding to social issues of S&T, and enjoyment of S&T as cultural entertainment.

The purposes of SCS in Korea since the 1970s can be summarized like <Table 2>. SCS in Korea has covered such purposes as ① enlightenment of public in S&T, ② promotion of entrance into S&T fields, ③ strengthening the support of S&T and related policy, ④ corresponding to social issues of S&T, and ⑤ enjoying S&T as cultural entertainments. Among these purposes, whereas ①, ②, ③ have been continuously emphasized in Korea, ④ and ⑤ began to be proposed from the 1990s and stressed recently. Therefore, the purposes of SCS in Korea are mainly confined to support the development of S&T and comparatively neglects social quality of life.

<Table 2> The Purposes of Science Culture System in Korea

Purposes	Enlightenment of public in S&T	Promotion of entrance into S&T fields	Strengthening the support of S&T (policy)	Corresponding to social issues of S&T	Enjoying S&T as cultural entertainment
1970s	○○○	○○	○		
1980s	○○	○○○	○○		
1991 ~ 1996	○○	○○	○○○	○	
since 1997	○○	○○○	○○	○○	○

Note: The number of_○_means a comparative significance.

2) Actors

The actors of SCS in Korea have been shaped mainly in the public sector. Ministry of Science and Technology (MOST) has the department of S&T culture and Korea Science Foundation (KSF) under MOST manages various programs about S&T culture. Korea Agency for Digital Opportunity & Promotion (KADO) under Ministry of Information and Communication (MIC) focuses on "information culture" and Korea Nuclear Energy Foundation (KNEF) under Ministry of Commerce, Industry, and Energy (MOCIE) is in charge of "nuclear energy culture." Like this, each of the governmental ministries in Korea has its own public agencies concerning S&T culture. In Korea, the longitudinal networks of governmental ministries and public agencies are not sufficiently developed contrary to horizontal networks.

On the other hand, science culture activities in the private sector are at a rudimentary stage. The S&T community is well organized with academic societies or federations but the degree of contribution to science culture activities is comparatively low. S&T scholars and experts in Korea have a strong tendency to regard their activities, except for research and education, as "wrong course" or "waste of time." In Korean industries a few large corporations operate science museums, and there is little enterprise specialized in S&T culture, except for science publications. There are a few NGOs relevant to S&T, which began to emerge after the 1990s and have played a relatively active role.

3) Infrastructure

The physical infrastructure of SCS in Korea is very weak. In Korea, there are 59 science museums including 7 national museums, 34 public museums, and 18 private museums. The number of population per each science museum is about 850 thousand, falling within 10~20% of advanced countries. The weight of S&T in mass media, such as television and publications, is also very low. As of June 2003, three major Korean broadcasting stations operated only 5 programs pertinent to S&T out of entire 752 unit programs. The number of new S&T books published in 2004 was 3,405, 9.6% of all books, and in the case of pure science, numerical value decreased to 514 and 1.5% respectively.

The institutional infrastructure of SCS in Korea is less developed. For example, investment for science culture by the Korean government has continuously increased but the ratio of the entire R&D expenditure does not even amount to 2% (See <Table 3>). Because laws concerning science culture are not sufficiently prepared, there are limitations to systematic development of science culture activities. For example, science museums in Korea have much less tax incentives and more regulations than general museums or art museums.

<Table 3> Investment in Science Culture by the Korean Government

Unit: hundred million won, %

Year	2003	2004	2005	2006	2007
R&D Expenditure of Korean Government(A)	55,768	60,995	67,230	83,231	97,997
Investment for Science Culture(B)	462	671	1,097	1,831	2,939
Ratio(B/A)	0.83	1.10	1.63	2.2	3.0

Source: Ministry of Science and Technology.

4) Organizing Mechanism

Until now, science culture activities in Korea have been at the stage of quantitative enlargement. In this process, executive capabilities for S&T culture programs are considerably secured but systematic planning and assessment capabilities are underdeveloped. At this point, there has been continual criticism, such that S&T culture programs are dissipative and end up being a "one-time event." The organizing mechanism of SCS in Korea does not have a virtual circle in which contents developed in a certain program are systematically complemented and additionally utilized in another program.

The planning and execution of science culture activities in Korea are strongly influenced by government and related agencies. This mechanism is very effective at the early stage when relevant science culture activities began to be shaped, but can be an obstacle to further stages when science culture activities have grown to some degree. As actors of SCS become more diversified, various needs of science culture are suggested, but government and related agencies cannot sufficiently reflect such needs. Although government and related agencies recognize the importance of the private sector, if the organizing mechanism follows old routines, then practical roles of the private sector will be limited.

7. Concluding Remarks

In December 2003, the Korean government worked out "The Five-Year Plan for the Promotion of S&T Culture," which covered not only existing programs but also novel tasks. The plan is strongly pushed ahead by the "Science Korea Movement," which started in April 2004. This movement has focused on the establishment of "science classroom for everyday life" and "youth science clubs (YSC)," and is recently accelerated by the designation and promotion of "science culture cities."

However, the perspectives from the "audience" have not yet rooted in science culture activities in Korea (cf. Lewenstein, 1992). Whereas the tendency to objectify the public is prevalent, attempts to consider the public importantly are somewhat increasing. In the near future, science culture activities in Korea should be carried out in the direction of promoting public participation in S&T and to correspond actively to social issues of S&T.

At the same time, science culture activities in Korea should pay attention to secure "best practices." It is very important to concentrate on a few cases from a long-term perspective instead that an immature program is diffused nation-wide all at once. Science culture programs should insure steady effectiveness based on actors who have both intention and capabilities. The Korean government should improve the physical and institutional infrastructure for these kinds of programs.

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The 8th Science and Technology Foresight Program in Japan

23,24 January 2006

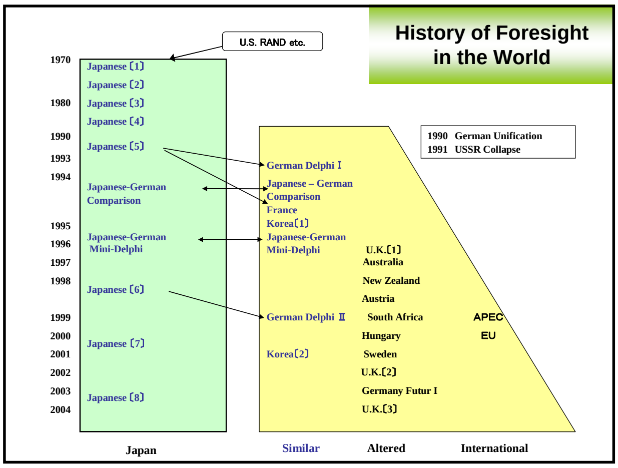
Kumi Okuwada Ph.D.
Science and Technology Foresight Center, NISTEP

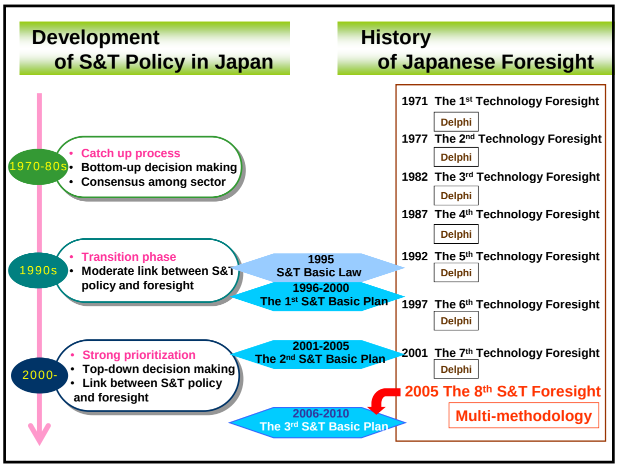
What are "new" in the 8th program ?

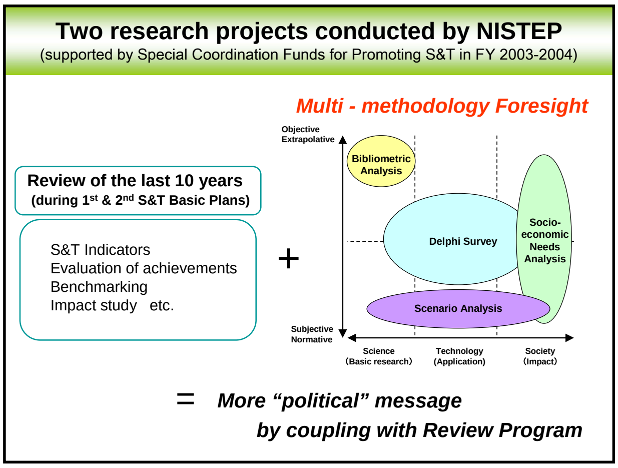
1. *Clear Target on Client and Timing*
   - *Strong linkage with policy making process*
   - *Political Message by coupling with Review Program*
   - *Contribution to discussion for 3rd Basic Plan*
2. *Multi-methodology Foresight*
   - *Improvement in Delphi and complementary three analysis*
   - *Not only Technology, but also Science and Social*
   - *Wider variety of participants*
   - *Post-foresight program*

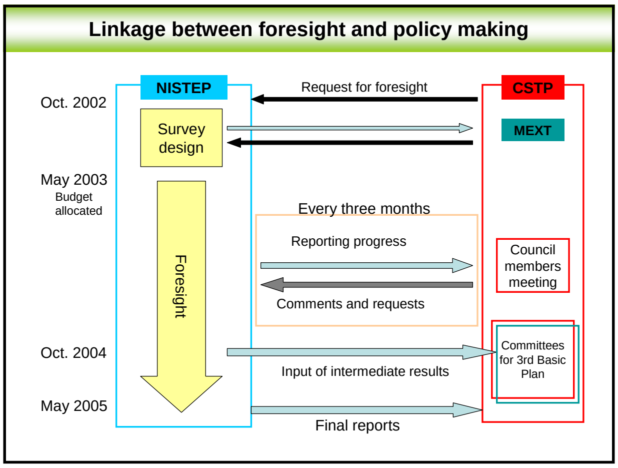
NISTEP conducted a new science and technology foresight program as a two-year research project.

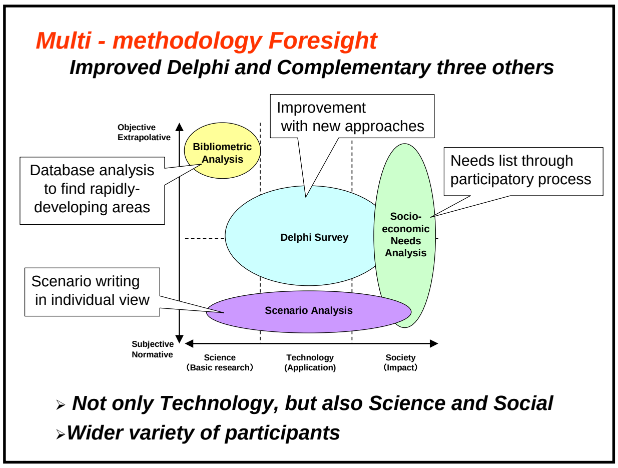
This 8th foresight program had many features that were largely different from the past 1st – 7th ones.




Development
of S&T Policy in Japan
History
of Japanese Foresight
1970-80s
Catch up process
Bottom-up decision making
Consensus among sector
1990s
Transition phase
Moderate link between S&T policy and foresight
2000-
Strong prioritization
Top-down decision making
Link between S&T policy and foresight
1995
S&T Basic Law
1996-2000
The 1st S&T Basic Plan
2001-2005
The 2nd S&T Basic Plan
2006-2010
The 3rd S&T Basic Plan
1971 The 1st Technology Foresight
Delphi
1977 The 2nd Technology Foresight
Delphi
1982 The 3rd Technology Foresight
Delphi
1987 The 4th Technology Foresight
Delphi
1992 The 5th Technology Foresight
Delphi
1997 The 6th Technology Foresight
Delphi
2001 The 7th Technology Foresight
Delphi
2005 The 8th S&T Foresight
Multi-methodology


Two research projects conducted by NISTEP
(supported by Special Coordination Funds for Promoting S&T in FY 2003-2004)
Multi - methodology Foresight
Review of the last 10 years
(during 1st & 2nd S&T Basic Plans)
S&T Indicators
Evaluation of achievements
Benchmarking
Impact study etc.
+
Objective
Extrapolative
Subjective
Normative
Bibliometric Analysis
Delphi Survey
Socio-economic Needs Analysis
Scenario Analysis
Science
(Basic research)
Technology
(Application)
Society
(Impact)
= More "political" message
by coupling with Review Program


Linkage between foresight and policy making
Oct. 2002
May 2003
Budget
allocated
Oct. 2004
May 2005
NISTEP
Survey design
Foresight
Request for foresight
CSTP
MEXT
Every three months
Reporting progress
Comments and requests
Council members meeting
Committees for 3rd Basic Plan
Input of intermediate results
Final reports


Multi - methodology Foresight
Improved Delphi and Complementary three others
Improvement
with new approaches
Database analysis
to find rapidly-
developing areas
Needs list through
participatory process
Scenario writing
in individual view
Objective
Extrapolative
Subjective
Normative
Bibliometric Analysis
Delphi Survey
Socio-economic Needs Analysis
Scenario Analysis
Science
(Basic research)
Technology
(Application)
Society
(Impact)
Not only Technology, but also Science and Social
Wider variety of participants

Delphi survey

Delphi Survey =

obtaining consensus in future image and long-term strategy among S&T experts with repeated questionnaires

- **Accumulation of experiences in past Delphi survey**
  - 60 - 70% of past topics has been realized
  - Some collaboration with foreign activities
- **Improvement by new approaches based on the experiences**
- **Respondents of 8th Delphi : around 2200 (Experts in Japan)**

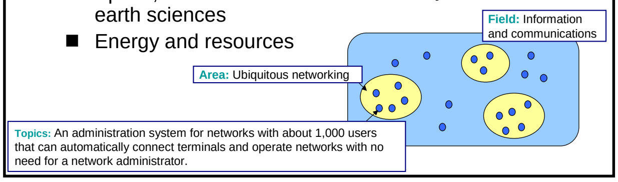
13 fields
130 areas
860 topics

Impact for S&T, economy, society
Japanese position in the world

Realization time
technological
social

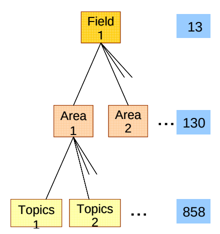
Survey 13 fields including 130 areas and 858 topics

- Information and communications
- Electronics
- Life sciences
- Health, medical care and welfare
- Agriculture, forestry, fisheries and food
- Space, marine and earth sciences
- Energy and resources
- Environment
- Nanotechnology and materials
- Manufacturing
- Industrial infrastructure
- Social infrastructure
- Science and technology for society



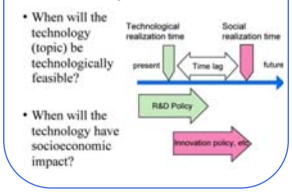
New Approaches in Delphi Survey

1.Structure of layers of Fields-Areas-Topics

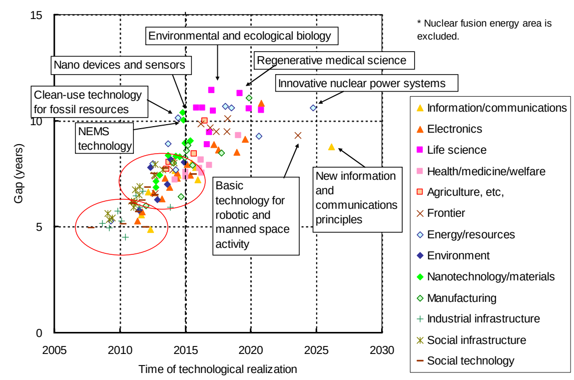


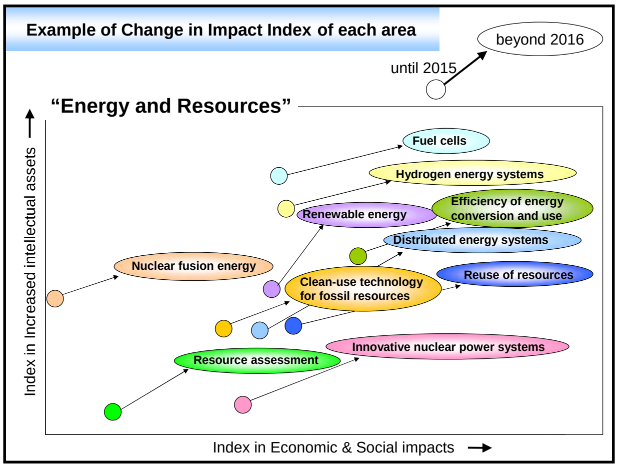
2.Two different stages of the realization time of each topic

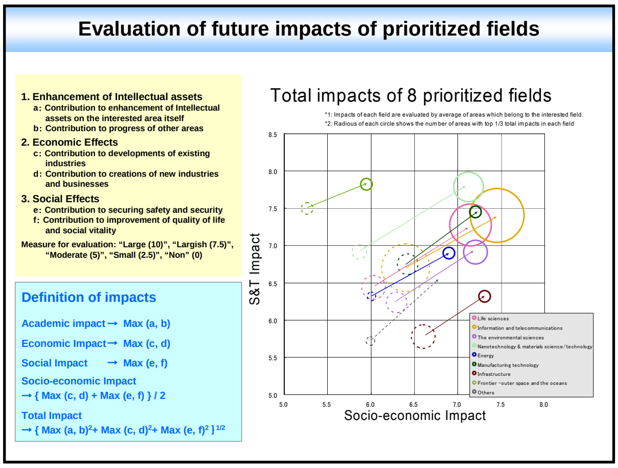
- Technological realization
  - Time
  - Promoting measures
- Social realization
  - Time
  - Promoting measures

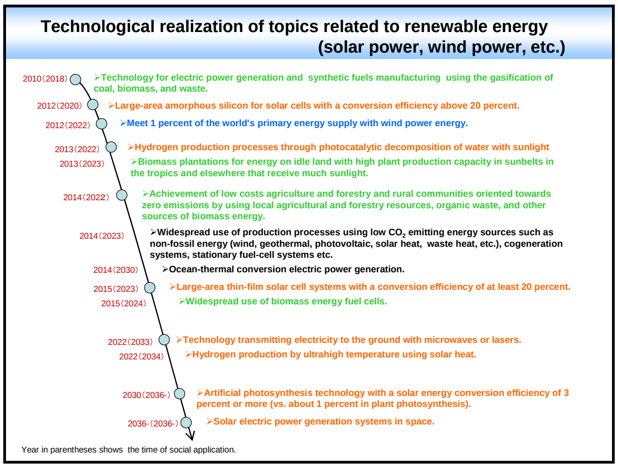


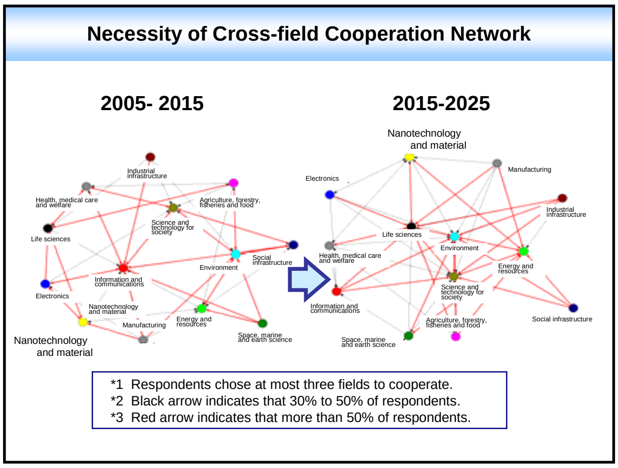
Time lag to Social realization




Example of Change in Impact Index of each area
beyond 2016
until 2015
"Energy and Resources"
Fuel cells
Hydrogen energy systems
Efficiency of energy conversion and use
Renewable energy
Distributed energy systems
Nuclear fusion energy
Clean-use technology for fossil resources
Reuse of resources
Innovative nuclear power systems
Resource assessment
Index in Increased intellectual assets
Index in Economic & Social impacts


Evaluation of future impacts of prioritized fields
1. Enhancement of Intellectual assets
a: Contribution to enhancement of Intellectual assets on the interested area itself
b: Contribution to progress of other areas
2. Economic Effects
c: Contribution to developments of existing industries
d: Contribution to creations of new industries and businesses
3. Social Effects
e: Contribution to securing safety and security
f: Contribution to improvement of quality of life and social vitality
Measure for evaluation: "Large (10)", "Largish (7.5)", "Moderate (5)", "Small (2.5)", "Non" (0)
Definition of impacts
Academic impact → Max (a, b)
Economic Impact → Max (c, d)
Social Impact → Max (e, f)
Socio-economic Impact
→ { Max (c, d) + Max (e, f) } / 2
Total Impact
→ { Max (a, b)²+ Max (c, d)²+ Max (e, f)² } 1/2
Total impacts of 8 prioritized fields
S&T Impact
Socio-economic Impact
Life sciences
Information and telecommunications
The environmental sciences
Nanotechnology & materials science/technology
Energy
Manufacturing technology
Infrastructure
Frontier -outer space and the oceans
Others


Technological realization of topics related to renewable energy
(solar power, wind power, etc.)
2010(2018) ➢Technology for electric power generation and synthetic fuels manufacturing using the gasification of coal, biomass, and waste.
2012(2020) ➢Large-area amorphous silicon for solar cells with a conversion efficiency above 20 percent.
2012(2022) ➢Meet 1 percent of the world's primary energy supply with wind power energy.
2013(2022) ➢Hydrogen production processes through photocatalytic decomposition of water with sunlight
2013(2023) ➢Biomass plantations for energy on idle land with high plant production capacity in sunbelts in the tropics and elsewhere that receive much sunlight.
2014(2022) ➢Achievement of low costs agriculture and forestry and rural communities oriented towards zero emissions by using local agricultural and forestry resources, organic waste, and other sources of biomass energy.
2014(2023) ➢Widespread use of production processes using low CO2 emitting energy sources such as non-fossil energy (wind, geothermal, photovoltaic, solar heat, waste heat, etc.), cogeneration systems, stationary fuel-cell systems etc.
2014(2030) ➢Ocean-thermal conversion electric power generation.
2015(2023) ➢Large-area thin-film solar cell systems with a conversion efficiency of at least 20 percent.
2015(2024) ➢Widespread use of biomass energy fuel cells.
2022(2033) ➢Technology transmitting electricity to the ground with microwaves or lasers.
2022(2034) ➢Hydrogen production by ultrahigh temperature using solar heat.
2030(2036-) ➢Artificial photosynthesis technology with a solar energy conversion efficiency of 3 percent or more (vs. about 1 percent in plant photosynthesis).
2036-(2036-) ➢Solar electric power generation systems in space.
Year in parentheses shows the time of social application.


Necessity of Cross-field Cooperation Network
2005- 2015
2015-2025
Industrial infrastructure
Health, medical care and welfare
Agriculture, forestry, fisheries and food
Science and technology for society
Life sciences
Social infrastructure
Environment
Information and communications
Electronics
Nanotechnology and material
Manufacturing
Energy and resources
Space, marine and earth science
Nanotechnology and material
*1 Respondents chose at most three fields to cooperate.
*2 Black arrow indicates that 30% to 50% of respondents.
*3 Red arrow indicates that more than 50% of respondents.

Categorization of the most important 100 topics

Category	8th (2005)	7th (2001)	6th (1997)	5th (1992)
Environment	17	26	25	28
Information	13	21	24	10
Life Science	19	26	17	37
Natural Disaster	23	8	11	9
New Energy	8	10	11	6
Others	21	9	12	10

7 topics related to human resources
4 topics related to nanotechnology

Scenario Analysis

- written by experts with deep insight.
- normative and subjective.
- schematic future image with time scale.

Themes:
47 themes
Writers:
2 experts selected by co-nomination to each theme
Scenarios:
85 scenarios

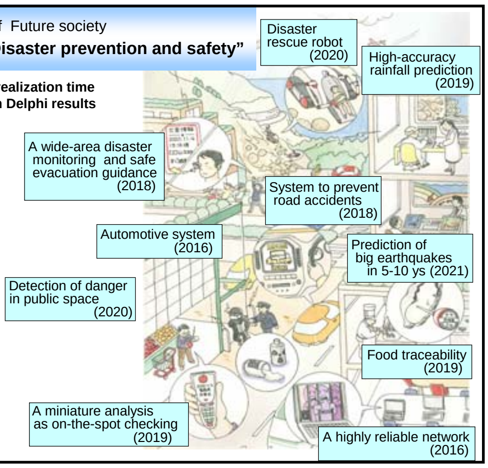
Analyze the present state
↓
Write a scenario
↓
Actions (Strategy & tactics)

<Examples>

Progress of studies in mathematics and mathematical education	Dr. Peter FRANKL Dr. Heisuke HIRONAKA
New healthcare that meets individual needs	Dr. Ken-ichi ARAI Dr. Hiroshi TANAKA
Life support robotics	Dr. Kazuhiro KOSUGE Dr. Norihiro HAGITA
Materials design through computer simulation	Dr. Masao DOI Dr. Akira MIYAMOTO

Example Image of Future society
in a view of "Disaster prevention and safety"

(year) : Social realization time in Delphi results

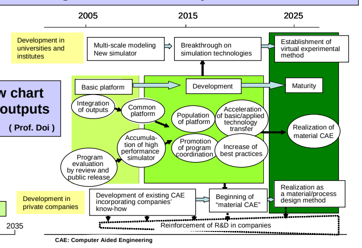


Example : Theme 31 Material design based on computer simulation

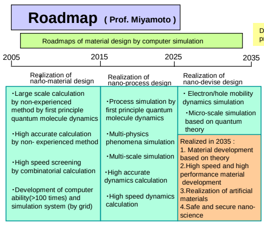
Scenario writers :
Prof. Masao Doi
Tokyo University
Prof. Akira Miyamoto
Tohoku University

Related themes :
Reconstruction of S&T evolution models
Software engineering
Design and manufacturing technology that cannot be easily imitated etc.

Flow chart of outputs (Prof. Doi)



Roadmap (Prof. Miyamoto)



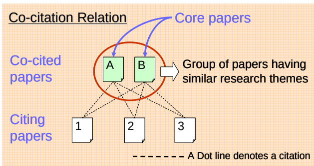
Action plans (Prof. Doi)
- to establish review and public release system of simulation program.
- to start communications to integrate outputs of projects.

Action plans (Prof. Miyamoto)
- to establish research course/department in major universities.
- to establish "core" center of Japan.
- to promote large scale national projects.

*This is a summary with the writer's consents.

Bibliometric Analysis of rapidly-developing research areas

Database analysis
- Research Front database in Essential Science Indicators (Thomson Scientific)
- Grouping of papers by co-citation relation



Highly cited papers → (1st step) → Research Fronts (RFs) → (2nd step) → Research Areas (RAs)

Commercial database
Research Front database in Essential Science Indicators (ESI) provided by Thomson Scientific

Our new approach
Aggregation of research fronts through co-citation relation

Socio-economic needs obtained

I. Japan continues as a leader in scientific and technological achievement.
II. Build hopes and dreams by seeking the challenge of uncharted science and technology territory.
III. Actively contribute to solving global problems.
IV. Japan maintains its international economic competitiveness by pioneering new industrial fields.
V. Build new frameworks aiming for a sustainable social system (including urban-rural links and the preservation of primary industries).
VI. Respond to changes in social structure (respond to the declining population due to the low birthrate and the aging society).
VII. Society is peaceful, safe, and provides peace of mind (prevent traffic accidents, crime, and terrorism).
VIII. Resistant to disasters
IX. Able to live a healthy life
X. Individual potential expands, enabling people to experience the richness of life.
XI. Everyone is fulfilled at home and as part of society; people fulfill their various roles and support one another.
XII. Children and adults learn purposefully, developing true scholastic ability.

Socio-economic Needs Analysis

Trends data | Review precedent activities in other countries, related reports, white papers

Needs list
- Envision a future in a decade from the standpoint of citizens

Participatory process
- Web questionnaires of citizens
- Panels of citizens, business people, intellectuals

Socio-economic Needs Items

<Science & Technology>
- Combination of humanities and sciences
- S&T for society

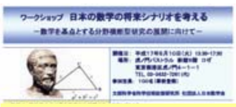
<Challenges >
- Incorporate changes in circumstances (finance, environment ,demographic change)
- Learn from experiences in other countries

Technology seeds
- Generic technology
- Prioritized area

Systems
- System, budget
- Science communication
- Establishment of organizations

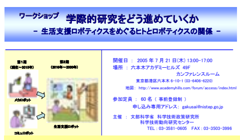
Human resources
- Education, training
- Fostering system

Post-foresight program
Example: Workshops



Future scenarios of mathematical studies in Japan
- Toward the development of cross-field researches based on mathematics -

- Date: May 10, 2005
- Guest Speakers:
  Dr. Hironaka (Mathematical Sciences Association)
  Dr. Frankl (Arithmetic Olympiad Foundation)
  Prof. Morita (Tohoku Univ.)
  Prof. Tsuda (Hokkaido Univ.)
  Dr. Yoshida (Chuo Aoyama Pricewaterhouse Coopers)
  Dr. Takaragi (Hitachi Co.,Ltd.)
  Prof. Takagi (Tokyo Univ.)
  Prof. Giga (Tokyo Univ.)



How should interdisciplinary research be promoted?
- Relation between human being and robotics surrounding lifestyle support robotics -

- Date: July 21, 2005
- Guest Speakers:
  Prof. Kosuge (Tohoku Univ.)
  Dr. Hagita (ATR)
  Dr. Mizuta (IBM Japan)
  Prof. Asama (Tokyo Univ.)
  Dr. Tani (Riken)
  Dr. Kato (Keio Univ.)
  Prof. Nojima (Seijo Univ.)

Concluding Remarks

- *Strong and direct linkage between foresight and policy making*
  - *Supporting more evidence-based policy making*
- *Multi-methodology foresight*
  - *Compilation of various aspects of information*
- *Post-foresight*
  - *Positive inputs through comprehensive discussions*

Study on Rapidly-Developing Research Area

JAN 23, 2006

Ayaka SAKA, PhD
Research Fellow
Science and Technology Foresight Center
National Institute of Science and Technology Policy
Japan

Outline of this talk

1. Purpose of our study
2. Outline of our method
3. Current results
4. Conclusions

2

Purpose

- **Providing objective and comprehensive information of rapidly-developing research areas (RAs) to policy makers**
  - Identify rapidly developing areas among Key research areas.
  - Analyze the presence of Japan in these research areas.
- How can we figure out rapidly-developing RAs?
  ex. Nanotechnology, Bioinformatics, ･･･
- To achieve this, following aspects are required
  - Comprehensive view of RAs
  - State of the art knowledge of RAs

3

Our method

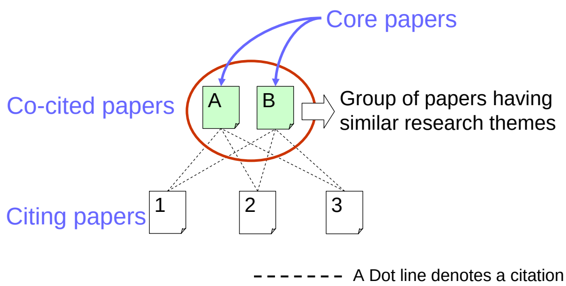
- Integration of "Comprehensive view" and "State of the art knowledge"
  - Database analysis

    - Research Front database in Essential Science Indicators (Thomson Scientific)
    - Grouping of papers by co-citation relation
  - Expertise of cutting edge RAs

    - Detailed analysis of RAs by staffs of STFC
    - Comments from experts (STFC: Expert network, …)

4

Co-citation relation



Ref. Small H G. *Co-citation in the scientific literature; a new measure of the relationship between two documents.* Journal of the American Society for Information Science 24:265-9, 1973.

5

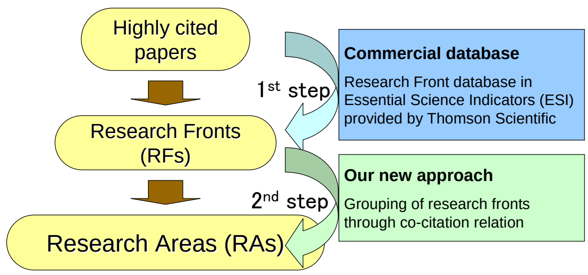
Highly cited papers

- Top 1% of papers in each field and each year
- Year covered by this study: 1997～2002
- 44809 papers (22 disciplines in ESI)

Agricultural Sciences	Mathematics
Biology & Biochemistry	Microbiology
Chemistry	Molecular Biology & Genetics
Clinical Medicine	Multidisciplinary
Computer Science	Neuroscience & Behavior
Economics & Business	Pharmacology & Toxicology
Engineering	Physics
Environment/Ecology	Plant & Animal Science
Geosciences	Psychiatry/Psychology
Immunology	Social Sciences, general
Materials Science	Space Science

6

Grouping of papers through co-citation relation



7

Database structure

	# of RAs	# of core papers	% in whole core papers	# of RFs	% in whole RFs
Total # of highly cited papers (1997-2002)	-	44809	–	–	–
Whole RFs	-	21183	100.0%	5221	100.0%
Whole RAs	**679**	16934	79.9%	3906	74.8%

- Identification of Hot RFs
  - Avg. citation's growth rate
  - Slope of regression line

8

Database structure

	# of RAs	# of core papers	% in whole core papers	# of RFs	% in whole RFs
Total # of highly cited papers (1997-2002)	-	(44809)	—	—	—
Whole RFs	-	21183	100.0%	5221	100.0%
Whole RAs	679	16934	79.9%	3906	74.8%
RAs involved one Hot RF	359	13467	63.6%	3022	57.9%
RAs involved more than 2 Hot RFs	153	10201	48.2%	2192	42.0%
RAs involved more than 4 Hot RFs	51	6744	31.8%	1350	25.9%

9

List of core papers (Example)

Name of research area	# of RFs
? ? ?	30

ID of RF	Keywords	# of core papers	Sum of citations
5780	PROTEIN COMPLEXES; SYSTEMATIC ANALYSIS; SYSTEMATIC IDENTIFICATION; FUNCTIONAL ORGANIZATION; YEAST PROTEOME	2	151

Title	Journal	Volume	Citations	First author
Functional organization of the yeast proteome by systematic analysis of protein complexes	NATURE	415: (6868) 141-147 JAN 10 2002	128	Gavin, AC
Systematic identification of protein complexes in Saccharomyces cerevisiae by mass spectrometry	NATURE	415: (6868) 180-183 JAN 10 2002	98	Ho, Y

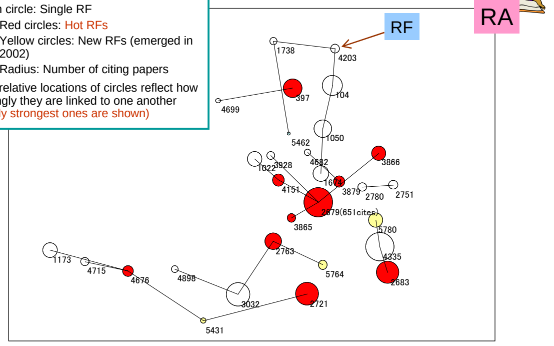
ID of RF	Keywords	# of core papers	Sum of citations
5764	INVASIVE OVARIAN CANCER; IDENTIFY OVARIAN CANCER; PROTEOMIC ANALYSIS; PROTEOMIC PATTERNS; TWO-DIMENSIONAL POLYACRYLAMIDE GEL ELECTROPHORESIS	3	61

Title	Journal	Volume	Citations	First author
Use of proteomic patterns in serum to identify ovarian cancer	LANCET	359: (9306) 572-577 FEB 16 2002	54	Petricoin, EF
Proteomic analysis and identification of new biomarkers and therapeutic targets for invasive ovarian cancer	PROTEOMICS	2: (1) 76-84 JAN 2002	13	Jones, MB
Laser capture microdissection and two-dimensional polyacrylamide gel electrophoresis – Evaluation of tissue preparation and sample limitations	AMER J PATHOL	160: (3) 815-822 MAR 2002	6	Craven, RA

10

??? (Example)

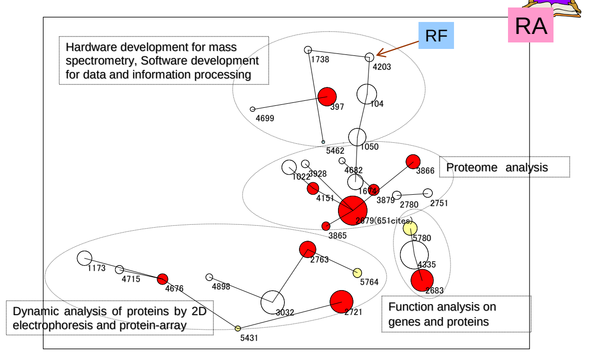
- Each circle: Single RF
  - Red circles: Hot RFs
  - Yellow circles: New RFs (emerged in 2002)
  - Radius: Number of citing papers
- The relative locations of circles reflect how strongly they are linked to one another
  (Only strongest ones are shown)



# of RFs	# of core papers	Citations	Unique citations	Mean publication year	# of Japanese papers	Japanese paper ratio(%)
30 (10)	147	8549	5154	2000.05	3	2

11

Proteomics (Example)

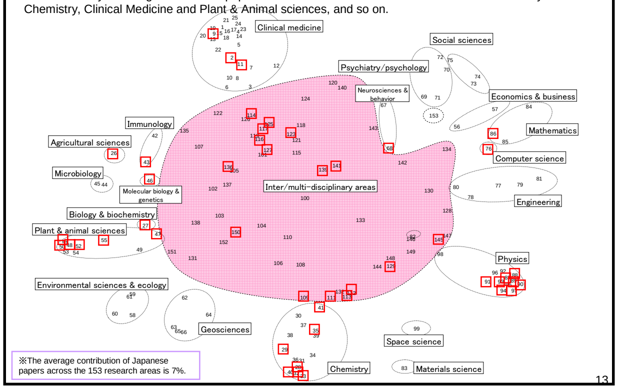


# of RFs	# of core papers	Citations	Unique citations	Mean publication year	# of Japanese papers	Japanese paper ratio(%)
30 (10)	147	8549	5154	2000.05	3	2

12

Map of 153 Rapidly Developing Research Areas

- Roughly 30%, or 54, of the areas have been classified as inter/multi-disciplinary areas. These areas are materialized by the integration of core papers which come from several scientific fields such as Physics and Chemistry, Clinical Medicine and Plant & Animal sciences, and so on.



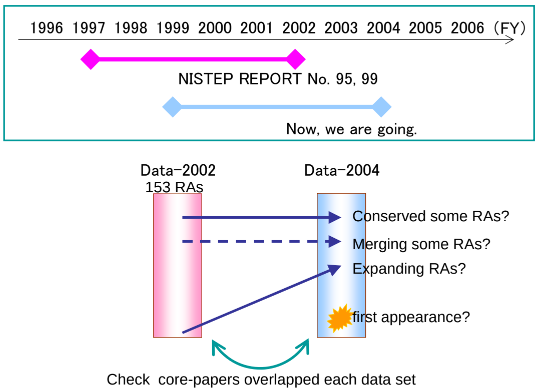
13

Conclusion (Methodology)

- We established a new methodology to identify RAs.
  - Grouping
    - Automatic generation of RAs
    - Exploration of inter- and multi- disciplinary areas
  - Mapping
    - Visualization of inter RAs relation
  - Limitation
    - Efficient for scientific research oriented areas

15

Study on Rapidly-Developing Research Area in 2006



14

Conclusion (Findings)

Importance of inter/multi-disciplinary areas is emphasized in the third science and technology basic plan.

Our findings clearly show

- Inter/multi-disciplinary areas are of great importance as demonstrated by the fact that roughly 30% of the 153 developing areas fall within this category.

- Japan could use inter/multi-disciplinary areas to strengthen its presence in the research fields that are underperforming such as clinical medicine.

16

Technology Foresight in China

WEI DongYuan

Dept. of Foresight & Development Research National Research Center for S & T for Development Ministry of Science and Technology, P. R. China

Technology Foresight in China

- **One.** *Background*
- **Two.** *Overview*
- **Three.** *Background, Disposition and Review of Technology Foresight in China*

One. Background

Technology Foresight for World different country

Current Status of Technology foresight

- **Developed countries, attach great importance to research of technological foresight**
- **Significance of technology foresight**

Two. Overview

Technology Foresight in China

1. Background technology foresight in China

- **Overseas actuality**
  - **Development Trends of World Science and Technology**
  - **Important period of strategic opportunity for economic and social development in China, and also for development of technology**
- **Internal actuality**
  - **Chinese economic and social faced with problems**
  - **Foundation and reference of critical technology selection in China**

2. Disposition of technology foresight in China

- ***Deployment of technology foresight in China***
  - *Working property*
    - Our country-China takes technological forecasting as one of the strategic fundamental research areas of technology work.
  - *Disposition*
    - As far back as in the "10th five-year planning" period, ***the technology foresight and the critical technology selection in China was sponsored by the Ministry of Science and Technology (MOST)***, the MOST had made all-round deployment to the research work in technology foresight in China, and will develop three fields every year.

3. Review of technology foresight in China

- ***Technology foresight in the "9th Five-year Planning" period***
  - Research project ***"Selection of National Critical Technology"***
    - started in 1992 and completed in 1995.
  - Technology foresight project ***"Technology Foresight of Priority Industries in China"***
    - In 1999
    - Carried out in the fields of agriculture, information, and advanced manufacturing
    - *(Research group for "technology foresight and national critical technique selection", 2002).*

3. Review of technology foresight in China

- ***Technology foresight in the "10th Five-year Planning" period***
  - 2003：completed technical predictions for three key high-tech fields, i.e., information, biology and new materials
  - 2004：completed research in three fields－energy, resources and environment and advanced manufacturing
  - 2005：starting research in three fields－agriculture, Population and health and public security

Three. Technology Foresight in China

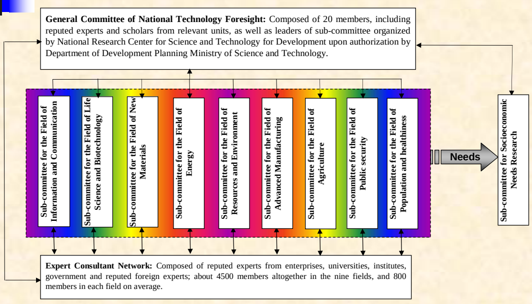
2000~Nowadays,
in the "10th Five-year Planning" period

1. Organization of technology foresight in China

- **Project leadership**
  - ***Ministry of Science and Technology (MOST)*** and under the instruction of relevant authorities
  - set up an investigation research system and an expert consultant system
- **Organization charge**
  - ***Foresight and Development Research Department of National Research Center for Science and Technology for Development*** (NRCSTD)
- **Expert Consultant Network**
  - General Committee of National Technology Foresight, Sub-committee
  - Socioeconomic Needs Research
  - Sub-committees of Fields Research
- **Expert system**
  - *University, Research institute, Industry, Government official, Others*

Government and Executive

Organization of Technology Foresight in China



2. Technological fields

- Information
- Biotechnology
- New materials
- Energy
- Resources and environment
- Advanced manufacturing
- Agriculture
- Public security
- Population and healthiness

Completed the Six important high-tech fields

Starting the three important high-tech fields

3. Methods of technology foresight in China

- ***Overseas Delphi method***
  - ***Delphi method*** was used in Technology Foresight of Japanese and Germany.
- ***Delphi method in Tech-foresight in China***
  - ***Topics selection***
  - ***Delphi survey***
  - ***Seminar***

4. Process of technology foresight in China

- ***First stage work***
  - ***Preview work***
    - the research organization and the consultation experts system were established.
    - The analysis of the needs of economic and social development in China was completed.
    - *And the research on the trend of science and technology was also finished in this period.*
  - ***Topics selection***
    - The base of the original topic list is the primary topic list, which was brought forward by the three high-tech areas research groups and discussion among the general research group and the areas research groups. The National 863 Science and Technology Plan and the some advances of S & T of the world were also being consulted with.
  - ***Designing questionnaire item***

Designing questionnaire item of technology foresight

- 16 survey items were designed in the survey questionnaire including:
  - <1> Degree of expertise
  - <2> Degree of importance to China
  - <3> Gap between China and leading countries
  - <4> Base of R&D in China
  - <5> Way of development
  - <6> Acquisitive intellectual property rights in the next five years
  - <7> Effects in promoting high technique industries
  - <8> Effects in promoting and rebuilding traditional industries
  - <9> Influence on environment and resources
  - <10> Perspective of commercialization
  - <11> Effect in promoting international competitiveness
  - <12> Cost of commercialization
  - <13> Realization time of commercialization
  - <14> Effects in improving people's living conditions
  - <15> Effective measures that the government should adopt
  - <16> Other suggestions (free opinion)

4. Process of technology foresight in China

- ***Second stage work***
  - *First round investigation*
  - *Second round investigation*
  - *Analyzing two round investigation results*
  - *China's report of technology foresight*
- ***Third stage work***
  - *Country critical-technology selection*
  - *General and special report*

1). first-second schedule of Technology Foresight in China

This technology foresight project is drift from July 2002 to December 2005, and three phases was schemed showed in figure.

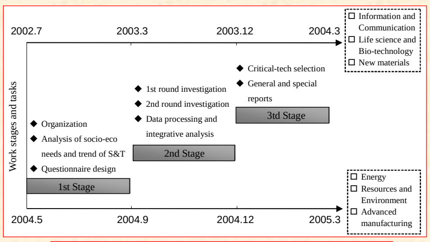


Figure. Schedule of Technology Foresight in China

2). Distribution of technology topics for selection in six fields

Field	Sub-domain	Number of topics: 1st Round	Number of topics: 2st Round
		479	483
Information and communication	Computer, Computer network and information security, Communication, Software, Integrated circuit, Video and audio	80	75
Life science and bio-technology	Agricultural bio-technology, Life science, Industry and environment, Medicine	79	83
New materials	High performance structural materials, New functional materials, Electronic information materials and Nano materials	59	64
Energy	Coal, Oil and gas, Electric power, Nuclear energy, Renewable energy, Hydrogen energy and other new energies, Building energy conservation, Industry energy conservation, Transportation energy conservation	83	83
Resources and environment	Eco-environment, Solid mineral resources, Oil and gas recourses, Land resources, Marine resources and water resources	100	100
Advanced manufacturing	Advanced manufacturing model, digital engineering for equipment, Manufacturing flow automation, Digital design, Environmentally friendly manufacturing, micro-nano manufacturing, Energy sources equipment, Transportation equipment, Process manufacturing, Agriculture equipment, environmental protection equipment, household electrical appliances, Marine engineering	78	78

3). General Information of Questionnaire Feedback Experts

We have distributed nearly 5200 sheets of questionnaires and got back more than 2000 feedbacks. See table

		Number of topics	Number of questionnaires	Number of feedback questionnaires (Return Rate %)	Enterprise	R&D Institution	University	Government	Others	Average number of feedbacks for each topic
1st round	Total	479	2725	1096 (40.2%)	293	300	410	37	56	94
	Information	80	600	328 (54.7%)	96	85	104	13	30	51
	Biology	79	280	116 (41.4%)	22	56	34	2	2	88
	New Materials	59	420	164 (39%)	38	32	81	5	8	120
	Energy	83	536	189 (36.0%)	65	34	79	6	5	112
	Resources and Environment	100	489	171 (35.6%)	41	45	68	8	9	108
	Advanced manufacturing	78	401	128 (32.9%)	31	48	44	3	2	92
2nd round	Total	483	2476	929 (37.5%)	243	292	320	24	50	109
	Information	75	350	183 (52.3%)	30	70	59	6	18	120
	Biology	83	315	138 (43.8%)	28	67	39	2	2	112
	New Materials	64	420	133 (31.6%)	31	29	57	4	12	104
	Energy	83	527	177 (33.6%)	76	31	55	6	9	116
	Resources and Environment	100	482	173 (35.9%)	45	43	70	6	9	104
	Advanced manufacturing	78	382	125 (32.7%)	33	52	40	0	0	84

4). Buildup of the feedbacks in the second round investigation

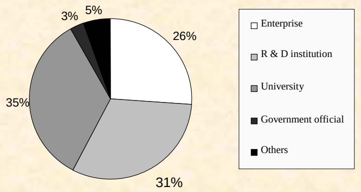
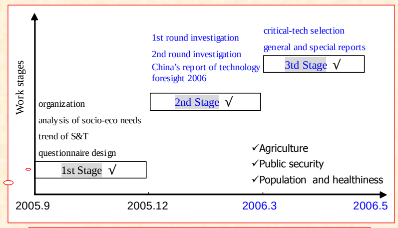


Figure: Buildup of the feedbacks in the second round investigation

根据第二轮反馈问卷进行统计，来自产业界、研发机构和高校的专家比例分别为26%、31%和35%

5). Third schedule of Technology Foresight in China

- *At present, the first round Delphi survey of the technology foresight has started in December 2005*



Starting 1st stage

Figure. Schedule of Technology Foresight in China

6). Distribution of technology topics for selection in three fields

Field	Sub-domain	Number of topics 1st Round	Number of topics 2st Round
		311	
agriculture	technology of biologic resource and utilization for agriculture, technology of propagation breeding for agriculture, technology of deleterious biology prevention and control for agriculture, technology of digital agriculture and information agriculture, water conservation technology of modern agriculture, medicine production technology of modern agriculture, refined machining and logistic technology for production of agriculture and forest, engineering technology for agriculture and intelligent equipment, technology of security producing and quality control for agriculture production, technology of high-efficiency utilization for agriculture resource, prevention and control technology of agriculture clime change and non-biology disaster	98	
Population and health	technology of Population and family planning/procreation and health, technology of clinical diagnosis and treatment, technology of medicine research and development, Chinese traditional medicine technology, technology biomedicine engineering	99	
public security	coal mine security, Dangerous chemical goods security, social security, Communication security	114	

6. Comprehensive Analysis Results of Tech-Foresight in China

- *<1>. Gap of technological R&D level between China and leading level in the world*
- *<2>. Way of technological R&D in China*
- *<3>. Technological importance*
- *<4>. Analysis on economic benefits*
- *<5>. Topics likely to exert greater impact on high-tech industries*
- *<6>. Topics likely to exert greater impact on traditional industries*
- *<7>. Topics with great function for environment protection of china and comprehensive utilization of resources*
- *<8>. Topics with great function for enhancing people's life quality*
- *<9>. Interactive analysis on technological importance and anticipated realization time of technologies*
- *<10>. Interactive analysis on functions for high-tech industries and comprehensive economic benefits*
- *<11>. The interactive analysis on functions for conventional industries and comprehensive economic benefits*
- *<12>. The interactive analysis on functions for environment protection and resources comprehensive utilization and comprehensive economic benefit*
- *<13>. Suggested measures*

Explaining typical results

Technology Foresight in China

<1>. Gap of technological R&D level between China and leading level in the world

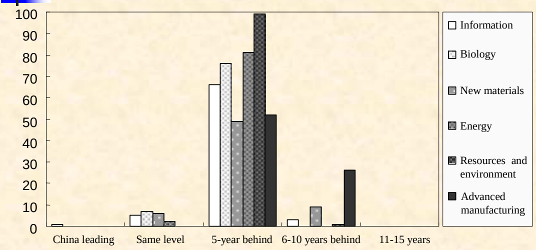
- As shown in Table, **among 483 topics under investigation, only 21 topics of China are at the world-leading level or at the same level as the advanced countries**, accounting for 4% of total number of topics;
- **423 are 5 years behind world-leading level**, accounting for 87.6% of total number of topics;
- **39 are 6～10 years behind the world-leading level**, among which 26 from field of advanced manufacturing and 9 from field of new materials, which implies that China's advanced manufacturing and new materials are in a really backward state.

	Leading topics of China	**Topics with the same level of the leading countries**	**Topics with the level of 5 years backward**	**Topics with the level of 6～10 years backward**	**Topics with the level of 11～15 years backward**
Total	1	20	423	39	
Information	1	5	66	3	
Biology		7	76		
New materials		6	49	9	
Energy		2	81		
Resource environment			99	1	
Advanced manufacturing			52	26	

Chinese information processing technology

Table: Comparison between the technological R&D level of China and that of leading countries in the world (Unit: topics)

Figure The R & D level of China in high-technology fields compared with the leading countries (Unit: topics)



However, it could be seen that the overall R&D level of China is 5 years behind the world-leading level .

<9>. Interactive analysis on technological importance and anticipated realization time of technologies

According to the two dimensional interactive analysis of the mean importance index value and the mean anticipated realization time of the six fields' topics, the result is shown in figure

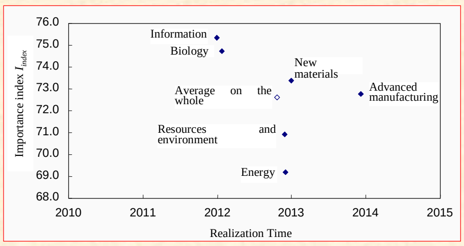


Figure: Interactive relationship between importance index and realization time of mean value of topics from six high-tech fields in China

<10>. Interactive analysis on functions for high-technology industries and comprehensive economic benefits

According to the two dimensional interactive analysis of economic benefit integrated index ECO_{index} (please refer to Annex 3) of technology topics in all fields and high-tech industry development promoting index H_{index}, the result is shown in the figure.

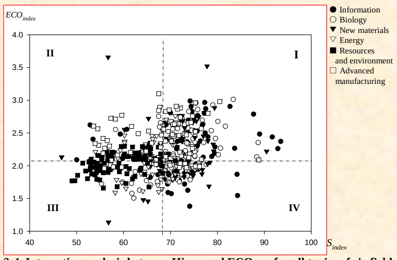


Figure 2-4 Interactive analysis between Hin_{dex} and ECO_{index} for all topics of six fields

<11>. The interactive analysis on functions for conventional industries and comprehensive economic benefits

According to the two dimensional interactive analysis of the economic integrated index ECO_{index} of technology topics in all fields and index for reformation and promotion of traditional industries T_{index}, the result is shown in figure.

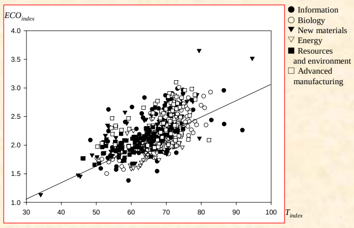


Figure 2-5 Interactive analysis between T_{index} and ECO_{index} for all topics of six fields

<12>. The interactive analysis on functions for environment protection and resources comprehensive utilization and comprehensive economic benefit

According to the two dimensional interactive analysis on economic benefit integrated index ECO_{index} of technology topics in all fields, and comprehensive utilization for resources and environment protection index S_{index}, the result is shown in figure.

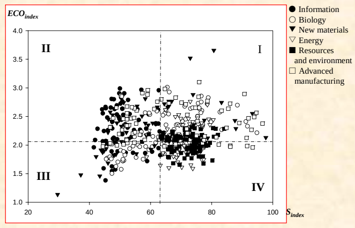


Figure: Interactive analysis between S_{index} and ECO_{index} for all topics of six fields

Accessory datum

- *Please see the "China's Report of Technology Foresight (summary)", if you are interested in Comprehensive Analysis Results of the technology foresight in China*

Production of Technology foresight in China

- ***Foresight Report***
  - ***《China's Report of Technology Foresight 2003》*** *（published report）*
  - ***《China's Report of Technology Foresight 2004》*** *（published report）*
- ***National Critical Technology***
  - ***《China's Report of National Critical Technology 2003》*** *(interior report)*
  - ***《 China's Report of National Critical Technology 2004》*** *(interior report)*
- *a series of investigate and research the report*

Production of Technology foresight in China

China's Report of Technology Foresight 2003
China's Report of Technology Foresight 2004
China's Report of Technology Foresight (Summary)

China's Report of National Critical Technology 2003
China's Report of National Critical Technology 2004

Home page of Technology foresight on China

- *Please see home page of the technology foresight in China, if you are interested in the technology foresight in China.*

- http://www.foresight.org.cn/
- http://www.nrcstd.org.cn/web_ycfzb/cn/

Thank You

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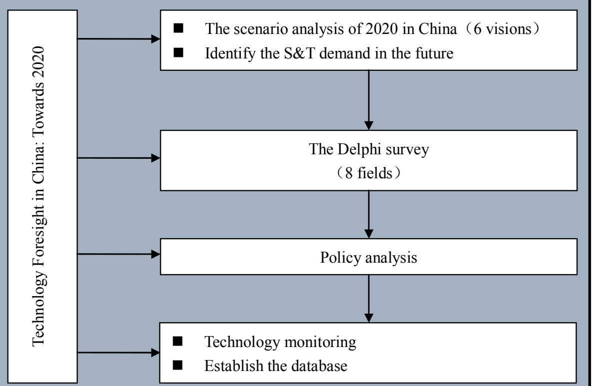
Seminar among Science & Technology Policy Institutes in Japan, China and Korea, 23-24 January 2006 Japan Tokyo

Technology Foresight of China: Towards 2020

Prof. Dr. Mu Rongping
Institute of Policy and Management
Chinese Academy of sciences
2006-01-24

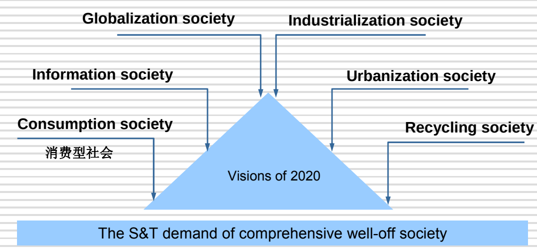
中国科学院科技政策与管理科学研究所
Institute of Policy and Management, CAS



Outline

1. Introduction
2. The Scenarios
3. The Delphi Survey
   - To divide the technology fields
   - To divide the sub-fields of technology
   - To select the technology topics
   - To design questionnaire
4. Statistic Method of Delphi Survey
5. Outcome of Delphi Survey

The scenarios



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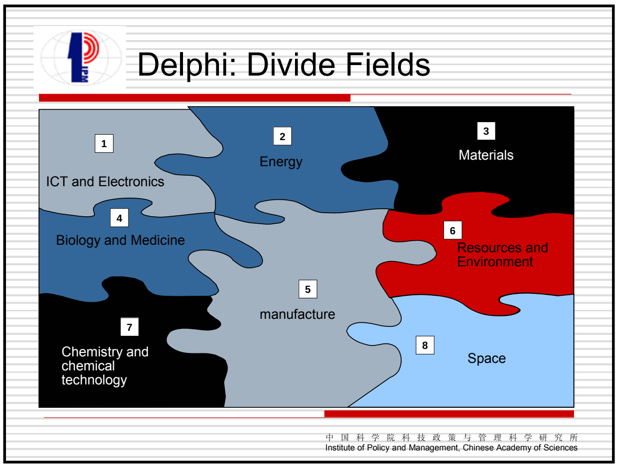
Delphi: Divide Fields
1
ICT and Electronics
2
Energy
3
Materials
4
Biology and Medicine
5
manufacture
6
Resources and Environment
7
Chemistry and chemical technology
8
Space
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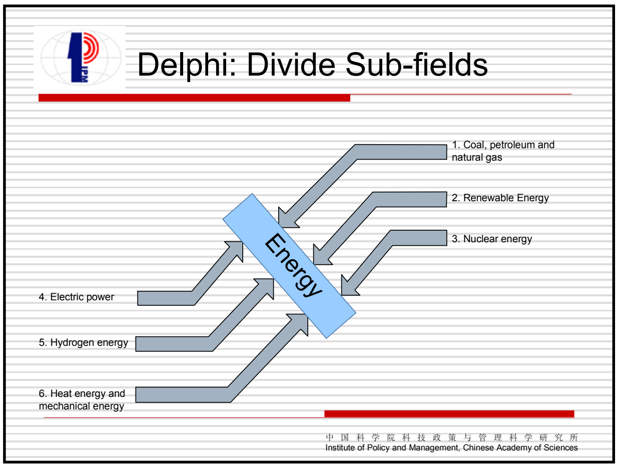
Institute of Policy and Management, Chinese Academy of Sciences


Delphi: Divide Sub-fields
Energy
1. Coal, petroleum and natural gas
2. Renewable Energy
3. Nuclear energy
4. Electric power
5. Hydrogen energy
6. Heat energy and mechanical energy
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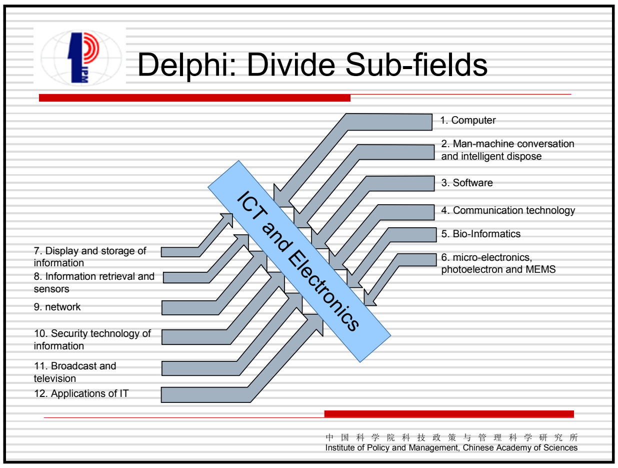
Delphi: Divide Sub-fields
ICT and Electronics
1. Computer
2. Man-machine conversation and intelligent dispose
3. Software
4. Communication technology
5. Bio-Informatics
6. micro-electronics, photoelectron and MEMS
7. Display and storage of information
8. Information retrieval and sensors
9. network
10. Security technology of information
11. Broadcast and television
12. Applications of IT
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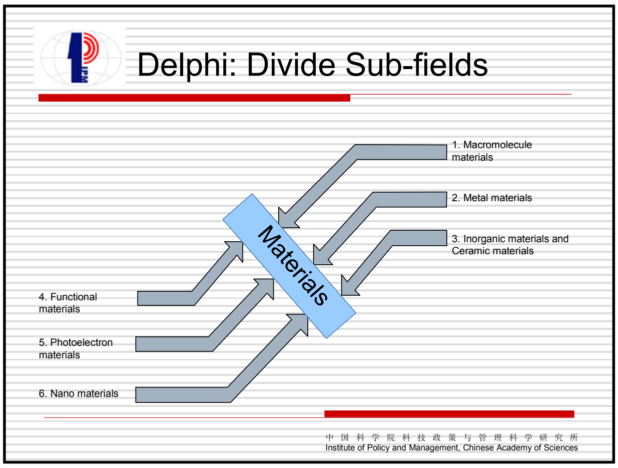
Delphi: Divide Sub-fields
Materials
1. Macromolecule materials
2. Metal materials
3. Inorganic materials and Ceramic materials
4. Functional materials
5. Photoelectron materials
6. Nano materials
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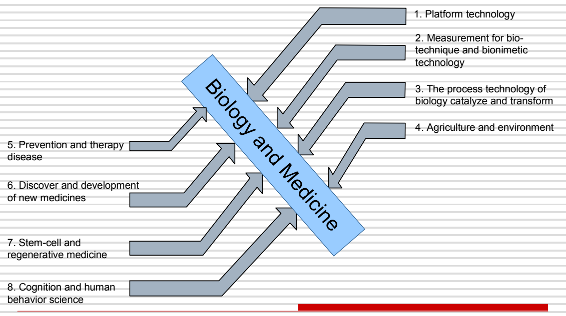
Delphi: Divide Sub-fields



Setting the topics: Numbers

Field / Stages		ICT and Electronics	Energy	Materials	Biology and Medicine
elucidation	Number of topics	7	2	0	6
	Proportion（%）	4.67	2.78	0.00	5.94
development	Number of topics	35	14	20	36
	Proportion（%）	23.33	19.44	23.26	35.64
Practical use	Number of topics	57	46	29	36
	Proportion（%）	38.00	63.89	33.72	35.64
widespread use	Number of topics	51	10	37	23
	Proportion（%）	34.00	13.89	43.02	22.77
total	Number of topics	150	72	86	101
	Proportion（%）	100.00	100	100	100.00

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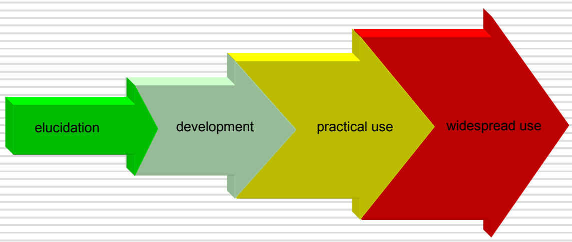
Setting the topics: Stages



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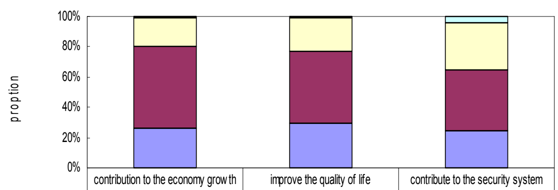
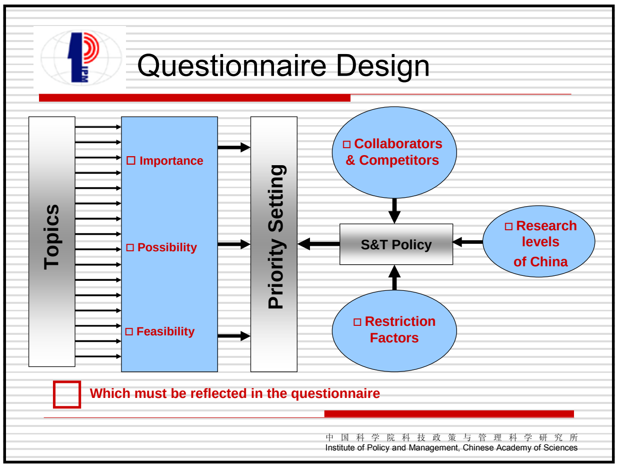
Setting the topics: Importance

unit: persons



	contribution to the economy growth	improve the quality of life	contribute to the security system
unimportant	294	362	1211
less important	6010	7057	9874
important	17013	14950	12891
very important	8461	9409	7802


Questionnaire Design
Topics
Importance
Possibility
Feasibility
Priority Setting
Collaborators & Competitors
S&T Policy
Research levels of China
Restriction Factors
Which must be reflected in the questionnaire
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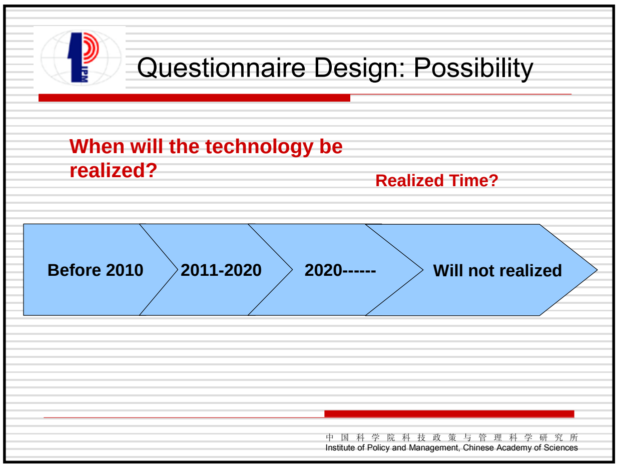
Questionnaire Design: Possibility
When will the technology be realized?
Realized Time?
Before 2010
2011-2020
2020------
Will not realized
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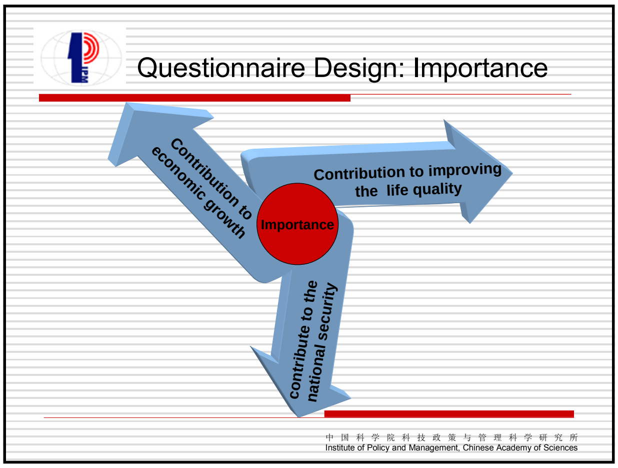
Questionnaire Design: Importance
Contribution to economic growth
Contribution to improving the life quality
Importance
contribute to the national security
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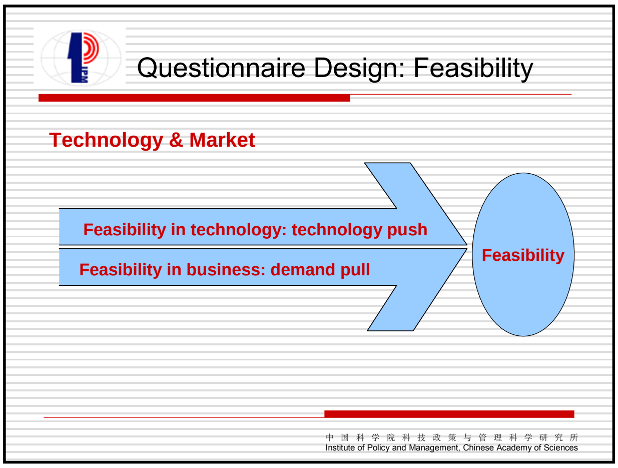
Questionnaire Design: Feasibility
Technology & Market
Feasibility in technology: technology push
Feasibility in business: demand pull
Feasibility
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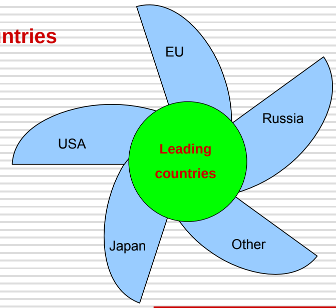
Institute of Policy and Management, Chinese Academy of Sciences

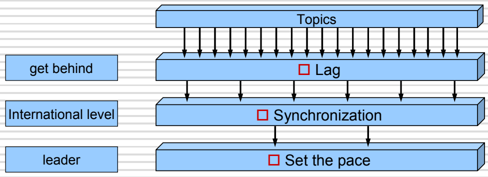
Questionnaire Design: Collaborators & Competitors

Leading Countries



Questionnaire Design: Research Levels of China

Research Levels of China



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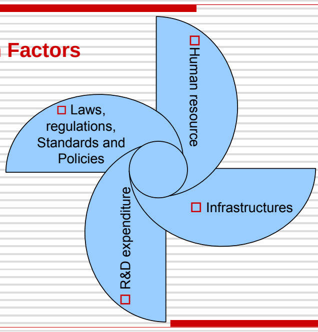
Questionnaire Design: Restriction Factors

Restriction Factors



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Questionnaire Design: Sample

您对该课题的熟悉程度				在中国预计实现时间				对促进经济增长的重要程度	对提高人们生活质量的重要程度	对保障国家安全的重要程度	当前中国的研究开发水平			技术水平领先国家|地区(可做多项选择）					当前制约该技术课题发展的因素（可选多项）					
很熟悉	熟悉	较熟悉	不熟悉	2010年之前	2010-2020年	2020年后	无法预见				国际领先	接近国际水平	落后国际水平	美国	日本	欧盟	俄罗斯	其他	技术可能性	商业可行性	法规/政策/标准	人力资源	研发投入	基础设施
	√				√			C	C	A		√		√		√				√			√	

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Statistical Method：Importance

The score of the importance of technology topics :

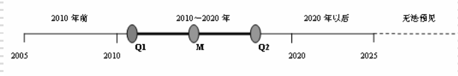
- contribution to economic growth
- contribution to improving the life quality
- contribute to the national security

$$I = \frac{I_1 \times T_1 \times 4 + I_2 \times T_2 \times 2 + I_3 \times T_3 \times 1}{T_1 \times 4 + T_2 \times 2 + T_3 \times 1}$$

Importance / Degree of familiar	Very important	Important	Important in somewhat	unimportant	Total
High	N_{11}	N_{12}	N_{13}	N_{14}	T_1
Medium	N_{21}	N_{22}	N_{23}	N_{24}	T_2
Low	N_{31}	N_{32}	N_{33}	N_{34}	T_3
Don't konw	N_{41}	N_{42}	N_{43}	N_{44}	T_4

Statistical Method：Realized-Time

Realized-time of the topics:



Among them:

Q1 : Realization time corresponding to the response at the point of the first quarter of all responses arranged in chronological order from the earliest to the latest realized-time.

M : Realization time corresponding to the response at the middle point.

Q2 : Realization time corresponding to the response at the point of last quarter.

Statistical Method：Importance

Integrated importance of three important indicators

$$I_{integrate} = \sqrt{(I_E - 0)^2 + (I_Q - 0)^2 + (I_S - 0)^2} = \sqrt{I_E^2 + I_Q^2 + I_S^2}$$

Among them:

$I_{integrate}$:Integrate three importance indicators

I_E **:Impotence indicator of "contribution to economic growth"**

I_Q **:Impotence indicator of "contribution to improve the quality of life"**

I_S **:Impotence indicator of "contribute to the national security"**

Statistical Method：Feasibility

The Realized-Feasibility of the Topics :

$$R_i = (1 - T_i)(1 - B_i)$$

Among them:

R_i **: realized-feasibility of the topics**

T_i **: infeasibility in technology realization**

B_i **: infeasibility in market realization**

Research level indicators of the topics in China :

$$RI = \frac{R_{LX} + R_{JJ}}{R_{LX} + R_{JJ} + R_{LH}}$$

Among them:

RI **: indicator of research level of the topics in China**

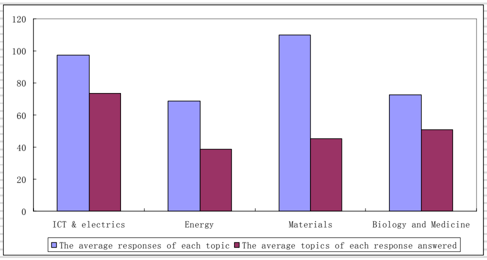
R_{LX}**: the number of experts who selected "leader"**

R_{JJ} **: the number of experts who selected "international level"**

R_{LH}**: the number of experts who selected "get behind"**

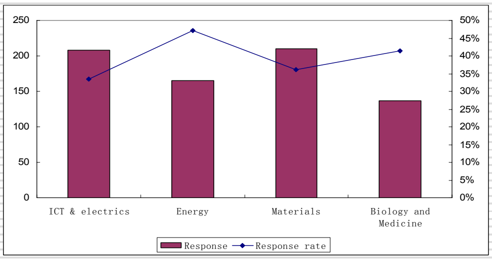
Outcome: Number of respondents

The first round:



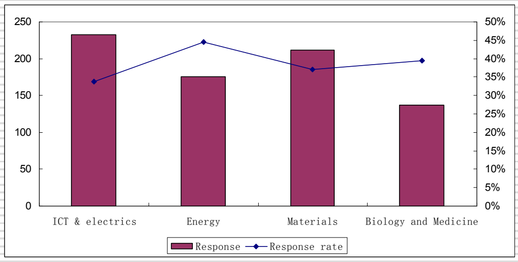
Outcome: Number of respondents

The first round:



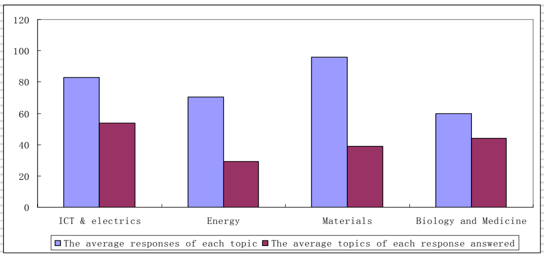
Outcome: Number of respondents

The second round:



Outcome: Number of respondents

The second round:



Survey: Top 10 sub-field

Importance to the economy growth:

Subfield	Field	Number of topics in Top 100	Rank
Agriculture and environment	Biology and Medicine	14	1
The process technology of biology catalyze & transform	Biology and Medicine	9	2
Functional materials	Materials	6	3
Micro-electronics, photoelectron and MEMS	ICT and Electronics	6	4
Metal materials	Materials	6	5
Communication technology	ICT and Electronics	6	6
Coal, petroleum and natural gas	Energy	5	7
Discover and development of new medicines	Biology and Medicine	5	8
Electric power	Energy	4	9
Software	ICT and Electronics	4	10

Survey: Top 10 sub-field

Integrated importance of three indicators:

Subfield	Field	Number of topics in Top 100	Rank
Agriculture and environment	Biology & Medicine	10	1
The process technology of biology catalyze & transform	Biology & Medicine	8	2
Micro-electronics, photoelectron and MEMS	ICT and Electronics	8	3
Functional materials	Materials	6	4
Security technology of information	ICT and Electronics	6	5
Applications of IT	ICT and Electronics	6	6
Communication technology	ICT and Electronics	5	7
Macromolecule materials	Materials	4	8
Discover and development of new medicines	Biology & Medicine	4	9
Metal materials	Materials	4	10

Survey: Top 10 sub-field

Importance to the life quality:

Subfield	Field	Number of topics in Top 100	Rank
Prevention and therapy disease	Biology and Medicine	12	1
Agriculture and environment	Biology and Medicine	12	2
Discover and development of new medicines	Biology and Medicine	11	3
Stem-cell and regenerative medicine	Biology and Medicine	7	4
Applications of IT	ICT and Electronics	7	5
Bio-Informatics	ICT and Electronics	5	6
Functional materials	Materials	5	7
Measurement for bio-technique and bionimetic technology	Biology and Medicine	5	8
Macromolecule materials	Materials	4	9
Inorganic materials and Ceramic materials	Materials	3	10

Survey: Top 10 sub-field

Importance to the national security:

Subfield	Field	Number of topics in Top 100	Rank
Information retrieval and sensors	ICT and Electronics	13	1
Security technology of information	ICT and Electronics	9	2
micro-electronics, photoelectron and MEMS	ICT and Electronics	8	3
Metal materials	Materials	7	4
Computer	ICT and Electronics	7	5
Photoelectron materials	Materials	7	6
Inorganic materials and Ceramic materials	Materials	6	7
Coal, petroleum and natural gas	Energy	5	8
Macromolecule materials	Materials	4	9
Functional materials	Materials	3	10

Survey: Top 10 topics

Importance to the economy growth:

Topics	Realize time
开发出生物能源新技术，酒精秸秆发酵生产技术、酒精连续生产新工艺、生物柴油与烃类生物转化有望实现	2014
决定农作物产量、品质、抗逆等重要性状的基因获得较全面诠释并通过生物技术进入实际应用	2017
开发出原油生物加工与开采的新技术	2017
光电转换效率高达50%的太阳能电池材料研制成功	2022
现代分子技术的应用，使主要农作物（水稻、小麦及棉花等）光合作用能量利用效率提高5%-10%	2021
全固态半导体白光照明技术得到广泛应用	2013
利用非石油资源制备聚合物的技术得到广泛应用	2020
生物技术的应用大大加快育种进程，农作物育种朝着分子设计定向发展	2017
实用化的光解水制氢技术获得突破	2022
随着生物催化技术发展的需要，开发出多样的生物催化技术平台	2015

Survey: Top 10 topics

Integrated importance of three indicators:

Topics	Realize time
光电转换效率高达50%的太阳能电池材料研制成功	2022
开发出生物能源新技术，酒精秸秆发酵生产技术、酒精连续生产新工艺、生物柴油与烃类的生物 转化有望实现	2014
高强、轻质金属材料得到大规模应用	2014
超大规模互联电网的安全、经济运行控制技术得到广泛应用	2013
开发出原油生物加工与开采的新技术	2017
高效抗病毒感染药物广泛应用于临床	2016
生化、免疫、基因检测等技术广泛应用于食品检疫	2011
决定农作物产量、品质、抗逆等重要性状的基因获得较全面诠释并通过生物技术进入实际应用	2017
10nm加工技术进入规模生产，集成电路的集成度达到1000G晶体管	2020
用于国家和社会公共安全防范的有害生物防御和监测体系得以建立	2012

Survey: Top 10 topics

Importance to the life quality:

Topics	Realize time
高效抗病毒感染药物广泛应用于临床	2016
重要疾病的流行病学模型和趋势分析技术得到建立	2012
面向个人的实时量化家庭保健和疾病预防信息系统得到广泛应用	2016
具有生物活性的人体植入材料得到广泛应用	2016
高清晰度数字电视广播得到普及	2012
药物控释和载体材料得到广泛应用	2015
绿色建材成为未来建筑材料的主导产品	2016
生化、免疫、基因检测等技术广泛应用于食品检疫	2011
开发出特异性抑制耐药菌的新型抗菌素	2015
利用仿生理论和技术，开发出人造生物器官或组织器官代用品，人类进入器官制造时代	2022

Survey: Top 10 topics

Importance to the national security:

Topics	Realize time
新型屏蔽与隐身材料和技术得到广泛应用	2015
高分辨率星载合成孔径雷达得到实际应用	2014
信息攻击与战争模拟演习系统在军事，国家和企业安全方面得到实际应用	2015
星载高分辨红外相机得到实际应用	2015
航天航空红外焦平面组件得到广泛应用	2014
提出和形成适应量子时代的密码编码和密码分析的理论和技术	2020
开发出大规模网络安全防御系统	2018
量子保密通信系统得到实际应用	2021
用于国家和社会公共安全防范的有害生物防御和监测体系得以建立	2012

Thanks for your listening!

Contact to the speaker:
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中国科学院科技政策与管理科学研究所
Institute of Policy and Management, Chinese Academy of Sciences

Korean Technology Foresight and Future Strategic Technology

Byeongwon Park
朴炳垣

kistep
Korea Institute of S&T Evaluation and Planning

Snapshots of Past and Present Korean Railway


1903 JongRo Electric Railway


1950 Evacuation Railway during Korean War


2004 KTX

GNI per capita

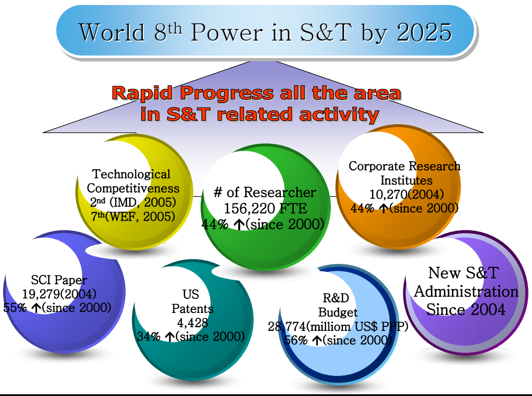
1970 =	$254
1980 =	$2,309
1990 =	$6,147
2000 =	$10,841
2003 =	$12,030

Korea has grown by more than 8 percent each year since the early 1960s, making it the fastest growing economy in the world.

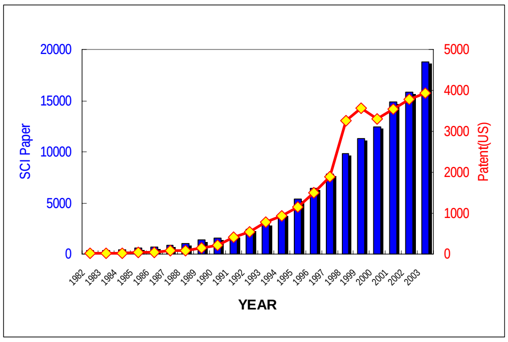
Contents

In tandem with Korea's economic development, Korea's S&T has achieved remarkable growth during the last half century.

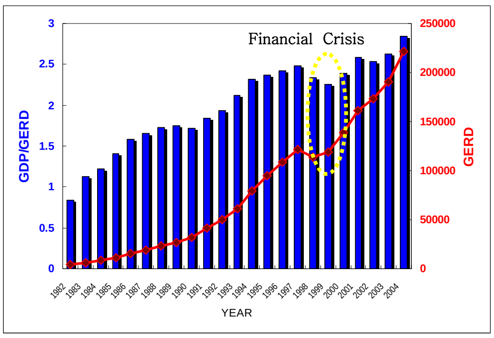
Past and Present of Korea's S&T



SCI Papers & US Patents

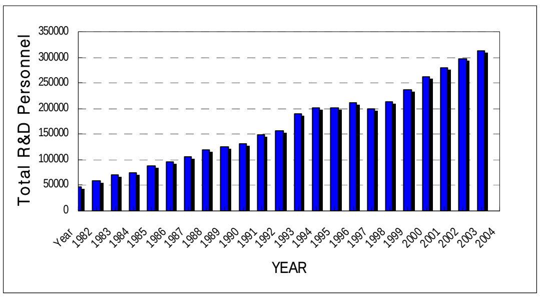


Gross Domestic Expenditure on R&D



GERD: Gross domestic expenditure on R&D

R&D Personnel



BUT,

Korea faces the new and daunting challenges in coming years.

Korean Economy in the midst of Uncertainty

Increasing risk due to new Tech
- Advances in NT, BT, ET
- Fast-follower ➔ World leader

High oil price
- 97% import of energy
- Energy-intensive industry
- (ex.steel Ind.)

Fast Ageing society
- fertility rate : 4.53('70)➔1.16 ('05)
- Net decrease in population after 2021

Socioeconomic Polarization
- Collapse of middle class
- Big Corp. vs. SMEs
- Seoul vs. Regional

FTA & economic Block
- 38.3% GDP dependence on Export
- Rising China
- -Nutcraker Situation

North Korea

Global Challenges

In 10-20 years now, humankind will face daunting global challenges such as climate change, energy crisis, clean water, emerging new disease and ageing. Korea is not an exception.

Greenhouse gas

Korea is 10th in the world

Till 2020, expect 80% increase since 2000

Energy & Clean water

Energy source import 97% till 2030

Water Stress Country('03, PAI)

Extreme polarization in society

The Rich and the Poor

The urban and the rural

The young and the old

Ageing

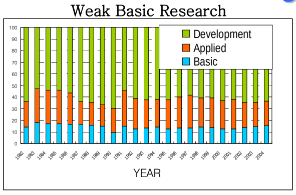
48 million ('04) ➔ 46 million ('20)

※ ageing ➔ Aged ➔ Superaged

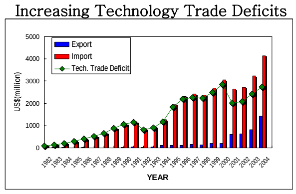
('00, 7%) ('18, 14%) ('26, 20%)

Some challenges in S&T area

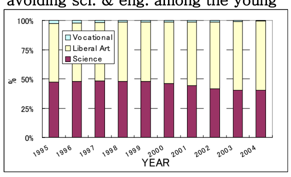
Weak Basic Research



Increasing Technology Trade Deficits



a serious sociocultural phenomena of avoiding sci. & eng. among the young



"Uncertainty cannot be pinned down or coaxed into cages. It is only partly tamable, and we must learn to live with the beast."

-Paul J.H. Schoemaker

How can Korea find a way to the future of S&T?

Korean Technology Foresight Exercise

What is Technology Foresight?

- Simply a special case of foresight
- Defined as "... a systematic means of assessing scientific and technological developments which could have a strong impact on wealth creation and quality of life ... to advance ... generic technologies and their applications .."

What is Foresight?

Systematic, participatory process, involving gathering intelligence and building visions for the medium-to-long-term future and aimed at informing present-day decisions and mobilizing joint actions

But Some differences...

- Elements of Foresight
  - Coalition building
  - Sponsorship
  - Objectives
  - Scope of Program
  - Research elements and Methods
  - Reflexivity
  - Resources
  - Level of Program
  - Type in intervention
  - Outcomes

- Diachronic axis
  - Initiation of the Program
  - Running of the Program
  - Implementation of the Results

- Structural axis
  - Pattern of relationships among stakeholders/actors
  - Allocation of responsibility and ability of actors

Foresight is booming everyway in the world.

YEAR	DELPHI	MIXED	PANEL/SCENARIO
1970-	Japan		
1989			Netherlands
1990	1st Germany 5th Japan		OECD(→*Present*)
1991			1st US-Core Tech.
1992			New Zealand, UN(→*present*)
1993	1st Korea		2nd US-Critical Tech., Germany-21C Tech.
1994	France Japan/Germany	1st UK	Netherlands
1995	6th Japan		France-100 core Tech. 3rd US-critical Tech.
1996	Japan Germany		AU-ASTEC, Finalnd(1996-98) Netherlands (Future Committee) Italy industrial forecasting ACUNU Millennium Project Nigeria, India, Philippines
1997		Spain-OPTI	Ireland
1998	Austria Germany US George Washington Univ.		South Africa, New Zealand Sweden, 4th US- critical Tech. Norway, APEC EU-IPTS Futures, Netherlands
1999	2nd Korea Spain	APEC Hungary-TEP	2nd UK, Germany-FUTUR(→*present*) Ireland, Italy
2000		Venezuela	2nd France-100 Core Tech. Italy 2nd Industrial forecasting China, Portugal, Brazil
2001	7th Japan		Czech, Mlata, Cyprus, Estonia
2002		Turkey	Bulgaria, Rumania, 3rd UK(→*present*)
2003	Chian		EU(FP 6 →(till 2006), UK (*every year*) Germany(*every year*), UN, OECD
2005	China, Japan, Korea		

Korean TF : Characteristics

- Consideration of socio-economic needs and issues in future Korea and enlargement of participation of the stakeholders
- Application of Delphi methods for emerging technology that may solve the future needs and issue
- Scenario writing for future society
  - Future prospect, needs/issues and technology
  - Internal consistency
  - Increase awareness the role of S&T in the knowledge-based society
- Offering of policy alternatives to promote knowledge-based innovative society

Time Horizon : up to year 2030
Project : Duration : 2003.7 – 2004.12
TYPE OF EXERCISE ADDRESSED: National –
covering all S&T fields and the entire territory of Korea

Korean TF : Legal Basis

- S&T basic Law : Article 13
- Every 5 years (carried out by KISTEP)
- Provide the vision and direction of emerging S&T area – identify new technology that may have high potential for growth of national wealth and betterment of quality of human life
- Has to implement in S&T basic plan (every 5 year)

Korean TF : Procedures

1st phase
Future perspectives Needs and Issues of society
(4 actors-15 categories-43 subcategories)
(Dec. 2003)

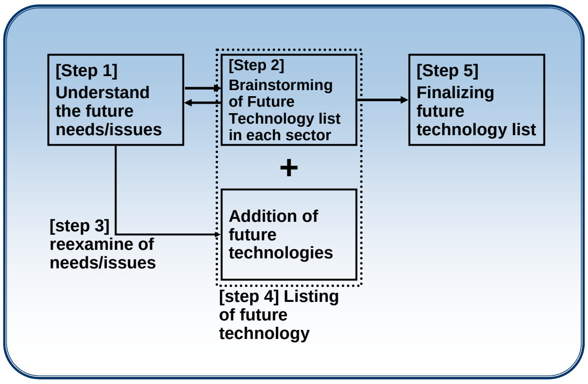
2nd Phase
Future Technology Subjects and Delphi Survey
Analysis
(Aug. 2004)

3rd Phase
Future Social Systems Scenario Building
(Dec. 2004)

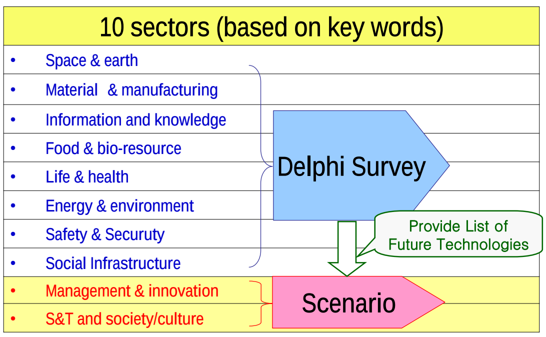
Socio-economic future needs/issues – Individual viewpoint

Actor	Needs: Main theme	Needs: Detailed theme	Needs/issues
Individual	Health life	Dealing with desease	• prevention, diagnosis and treatment of diseases that is hard to cure geriatric diseases chronic disease contagious disease • artificial organs application of bio-technology
		Quality health service	• high quality health care system (IT) • alternative medicines • secondary infection in hospital
• Society		Health normal life	• convenient normal life • health maintaining system
• Nation • World		Safer foods and products	• safer foods • safer products • environment-friendly foods and products

Identifying the future technologies for Delphi survey



Korean TF : Sector Expert Panels



Future Technology Subjects List(1)

○ Initially total 1201 subjects (suggested by 8 sector panels)

○ intra- and inter-sectoral comparison : After merging the similar ones and eliminating duplicated subjects → 809 subjects (KISTEP)

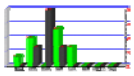
○ Review by the experts from each sector, the number of technology subjects is reduced to 813.

○ After final review by 'technology expert committee', the final number of tech. subjects is 761.

Future Technology Subjects List (2)

Space/ Earth	117	Life/ Health	95	Total
Material/ Manufacturing	94	Energy/ Environment	116	761
information/ Knowledge	71	Safety/Security	88	
Food/ Bio-resources	92	Social Infrastructure	88	

Delphi Survey (2)



Survey Items

Item	details	
Realization time	. Domestic . World	Degree of Expertise
Strategic Importance	Degree of importance	
Technology level	. country . Korea's position	
Government measures	. who will fund? . who will research? . Potential Obstacle	

Delphi Survey(1)

- Survey method
  - On line Delphi Survey (2003.12)
  - Respondents input (selection button, temporary saving function)
  - Multichoice for some questions
- Survey Period
  - 1st Survey : 761 subjects
    - 2004.6.23-2004.7.18 (25 days)
  - 2nd Survey : respondents who answer 1st survey, given a chance to revise their 1st answer
    - 2004.8.3~2004.8.22 (19 days)
- Respondents DB
  - KISTEP, Korea Research Foundation, Korea Science Foundation
    - with Ph. D. degree

Korean TF : Results

- Technology Foresight with socio-economic consideration (3rd Generation Foresight)
  - Future perspectives, assessment of future needs & issues
  - Scenario writing on future social systems (education, labor, healthcare, safety)
- Identify 761 future technology subjects
  - 61% of them will realize between 2011-2015
  - Korea is still lagging all future technology area
    - Korea has the strong competativeness in IT area
    - Space and earth is most lagging area(7-10 years)
- Strong emphasis on dissemination to the general public
  - Book, Comics, Movie
- Heavy media exposures
- Government took follow-up action quickly
  - Future Strategic Technology

Survey Respondents and Results

Sector	Survey sent	ratio	1st Survey		2nd Survey	
			Respondents	rate	Respondents	rate
Industry	1,049	3.2%	284	27.1%	217	76.4%
Academy	28,303	87.3%	4,275	15.1%	2,585	60.5%
R&D Inst.	3,059	9.4%	855	28.0%	520	60.8%
Total	32,411	100.0%	5,414	16.7%	3,322	61.4%

Sector	Sent	ratio	1st Sruvey		2nd Survey	
			Resp	rate	Resp.	rate
Space/earth	1,921	5.9 %	392	20.4%	263	67.1%
Materials/manufacturing	7,510	23.2%	882	11.7%	545	62.8%
Information/Knowledge	5,735	17.7%	714	12.5%	410	57.4%
Food/Bioresource	3,870	11.9%	659	17.0%	433	65.7%
Life/Health	8,291	25.6%	1,427	17.2%	850	59.6%
Energy/Environment	1,911	5.9%	605	31.7%	390	64.5%
Safety/Security	1,252(8,908*)	3.9%	407	4.6%	239	58.7%
Social Infrastructure	1,921	5.9%	392	20.4%	263	67.1%
계	32,411	100.0%	5,414	16.7%	3,322	61.4%

Current Technology level of Korea

R&D Level (%)	Space /Earth	Mat./ Manu.	Info/ Know.	Food/ Bio-res.	Life/ Health	Energy/ Env.	Safety/ Security	Social Infra	Total	Ratio (%)
0~20	–	–	–	–	–	–	–	–	–	–
21~40	52	1	–	3	3	3	1	–	63	8.3
41~60	61	87	42	75	86	100	59	79	589	77.4
61~80	4	6	29	14	6	13	28	9	109	14.3
81~100	–	–	–	–	–	–	–	–	–	–
Total	117	94	71	92	95	116	88	88	761	100

Distribution of Subjects Realization Time

year	Space/ earth	Material/ Manufacturing	Informatio/ knowledge	Food/ bioresource	Life/ Health	Energy/ Environment	Safety/ Security	Social Infrastructure	Total	Ratio
2009	–	–	5	1	–	–	2	3	11	1.4%
2010	–	–	9	–	–	1	7	3	20	2.6%
2011	–	2	8	2	–	6	7	16	41	5.4%
2012	2	6	9	8	2	6	18	21	72	9.5%
2013	5	13	20	23	9	24	25	16	135	17.7%
2014	19	26	9	24	9	25	19	9	140	18.4%
2015	9	17	4	15	15	14	5	7	86	11.3%
2016	9	7	2	9	12	6	3	3	51	6.7%
2017	13	7	2	5	7	18	1	6	59	7.8%
2018	13	8	2	2	17	6	1	2	51	6.7%
2019	9	4	1	1	8	3	–	1	27	3.5%
2020	6	2	–	–	12	2	–	1	23	3.0%
2021	9	1	–	1	2	–	–	–	13	1.7%
2022	3	1	–	1	1	2	–	–	8	1.1%
2023	6	–	–	–	–	1	–	–	7	0.9%
2024	4	–	–	–	1	1	–	–	6	0.8%
2025	4	–	–	–	–	–	–	–	4	0.5%
2026	2	–	–	–	–	1	–	–	3	0.4%
2027	4	–	–	–	–	–	–	–	4	0.5%
Total	117	94	71	92	95	116	88	88	761	100.0 %

Technology Leading Country

Country	Space /Earth	Mat./ Manu.	Info/ Know.	Food/ Bio-res.	Life/ Health	Energy/ Env.	Safety/ Sec urity	Social Infra	Total	Ratio (%)
USA	116	82	65	84	94	103	85	55	684	89.9
Japan	1	12	6	4	–	8	3	28	62	8.1
EU	–	–	–	4	–	5	–	5	14	1.8
Korea	–	–	–	–	1	–	–	–	1	0.1
China	–	–	–	–	–	–	–	–	–	–
other	–	–	–	–	–	–	–	–	–	–
Total	117	94	71	92	95	116	88	88	761	100

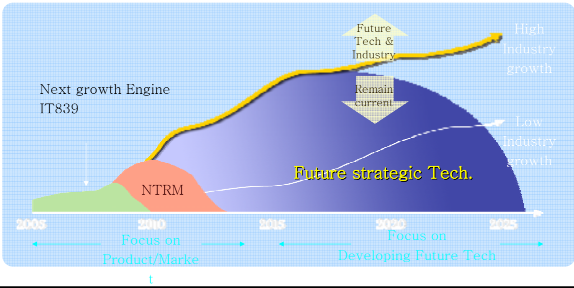
- USA is counted as a leading country in 684 subjects, 90% of Technology subject list
- Japan, 8 %, EU 2%

Potential Obstacle for realization of Subjects

item	Space/Earth	Mat./Manu.	Info/Know.	Food/Bio-res.	Life/Health	Energy/Env.	Safety/Security	Social Infra	Total	Ratio (%)
Limitation in Tech.	34	65	14	9	46	30	6	9	213	26.9
Socio-Ethics	–	–	–	1	4	–	1	–	6	0.8
Production	–	14	15	6	5	17	17	4	78	9.8
Funding (infrastructure include)	82	10	21	57	34	29	57	28	318	40.1
Economic Viability	6	7	27	24	3	43	9	50	169	21.3
Regulation/ Standard	–	–	–	–	3	4	1	1	9	1.1
Manpower	–	–	–	–	–	–	–	–	–	–
Total	122(5)	96(2)	77(6)	97(5)	95	123(7)	91(3)	92(4)	793(32)	100

Relationship to the currently on-going programs

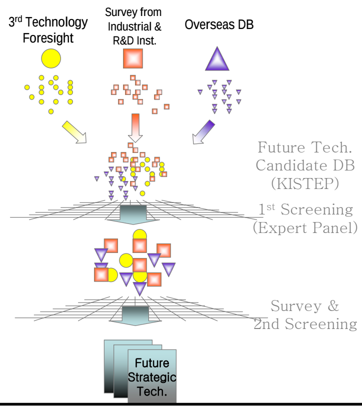
- Target for the next generation growth engines(10 products) till 2015
  May act as a new cash cow



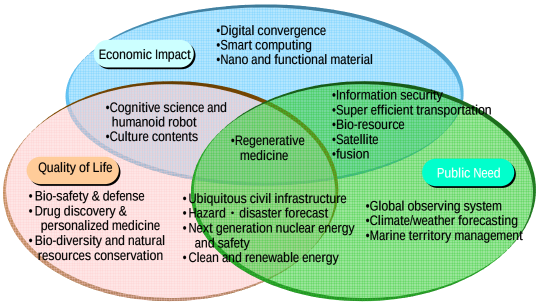
National Strategic Future Technology Initiative

- Government launches new project to identify emerging generic technologies at the national level based on 3rd Korean foresight results
- Critical attributes of national strategic technology
  - Emerging
  - Disruptive
  - Converged
  - Strategic area where government should be involved

Priority Setting Procedure



Future Strategic Technology 21



Conclusion

- The 3rd Korean Technology Foresight
  - wider acceptance among the various stakeholders
  - Extend to socio-economic foresight
  - Identify 761 future technology subjects
- Strategic Future Technology
  - Identify 21 area based on TF exercise
  - For the first time in Korean TF history, the result of TF is directly implemented in S&T policy
- Cultivation of future oriented thinking
  - Small scale and issue based foresight exercise will be carried out every year
  - Similar foresight activities are underway in several ministries
    - Ex. Ministry of Information & Communication, Ministry of Health and welfare, Ministry of Construction and Transportation

Following Action Plan for Future Strategic Technology 21

- Technology Roadmapping
- Master Action Plan for Future Strategic Technology
  - Budget allocation etc.

Key Consideration

1. 「Select & Focus」 Strategy
2. basic Science-oriented, interdisciplinary and creative research
   - Raising high caliber researchers
   - guarantee long-term support
3. role-sharing with private corporates

Thank you

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Conflicting "Regional Innovation System (RIS)" and its reality

Takaaki Matsuzawa
PhD can (GRIPS) MSc.(PREST,Manchester) MEng.(TiTech.) BSc.(TUS)

Director
The 3rd Policy Oriented Research Group (3PORG)
National Institute of Science and Technology Policy (NISTEP)

The Mission of 3PORG

- 1. Policy Research for
- 1) Regional Innovation System (RIS)
- 2) Industry-Academia Cooperation

- 2. International Affairs of NISTEP
- 1) Investigation of other countries
- 2) Cooperation with other countries

Introduction:

NISTEP 3PORG

Introduction: Characters of 3PORG

1. Providing *Research Training* for Administrators
   Only 6 researchers, but All members have administrative background and practical experience in National and Regional Government

2. *Systematic* Approach by Team
   Practical research by *Team* under *Top-Initiative* rather than individual work for research

3. Extending *Cooperative* Relations
   Extending cooperation with *Regional government* and *other countries* through our work

Attention

- My presentation is my *personal* opinion including some *personal* w rks, and therefore is "No al mment of NISTEP an

Attention

- Howe apa se expe criticism for existing d cussion for *so-called* "*Regional Innovation System (RIS)*" and "*Clusters*", which many people believe under *the world movement*.

I agree with

- *Asymmetric* innovation process in different region
- Regional *characters* and its *diversity*
- Importance regional *governance* and *capacity building*
- World *movement* of *Cluster* Policy
- *Decentralization* of innovation policy in national context

What is "RIS" ?

-Starting point for discussion -

- *RIS (especially sub-national innovation system) is, of course, a part of "NIS"*, but what does it really mean?
- We need clear *definition* for the concept of RIS

But I am wondering

-「同床異夢」: The same word with different meaning-

- The *reality* of *so- cold* "*Clusters*"

  "Cluster" is *the world movement*, but *what does "clustering" really mean?*
- *The confusion in concept* of RIS and clusters
- The *confusion* of *policy instrument* depending on *unclear RIS definition*

My Research Interest

1. **Role of Regional Government** under new political environment
2. Changing **Regional Governance** between government and actors
3. **Successful Relationship** between National and Regional Government under **Decentralization of Innovation**

Research Strategy for RIS

1. ***Unit*** **of Region (UOR)**
   Estimation of the regional potential for 47 prefectures and 13 specified cities by *profiling existing data*
2. ***Policy*** **for Region (PFR)**
   Chorological trend and *modeling* of its policy instruments
3. ***Variety*** **of Region (VOR)**
   Identifying regional diversity and typology of regions by quantitative analysis developing synthesized indicators
4. ***Lessons*** **from Region (LFR)**
   Accumulation of lessons from Comparative Case Study for *Critical Regions*

Conflicts in RIS

- Among actors (Industry, University and Gov.)
- National Gov. v.s. Regional Gov.
- Among Regional Gov. (Pref. v.s. City)
- In Regional Gov. (among different departments)
- In National Gov. (among Ministries)

Chapter 1 :

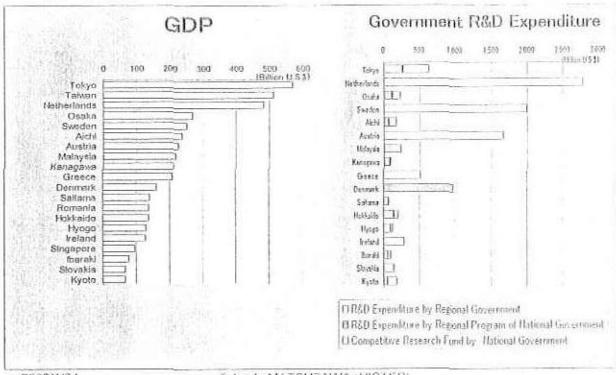
Policy for Region

What is "Region" for RIS ?

-Two different concepts for regional studies -

- Theoretically, *geographical space for innovation* may be significant to *strengthen networking* of actors
- However, *administrative Units for RIS policy* may be practically meaningful in implementation of policy

Comparison between Regions in Japan and Other Countries



The Unit of Region in Japan

- Regional Potential by profiling -

1. The Unit of Region (the Regional Governments)

   47 Prefectures and 13 Specialized Cities

2. Potential of the Unit of Region

- Economic Power equivalent to 'Small Countries'
- Sufficient achievements in S&T Output
- Further improvement required in S&T Input

Chapter 2:

Policy for Region

Changes in Regional S&T policy

1970- Decentralization of S&T Facilities and base

1970 The **Tsukuba Science City** Construction Act
1983 The **High-Tech Industrial Zone** Promotion Act etc.

1990- Development of S&T System in Regional Government

1992 *The 18th Science and Technology Policy Outline*
1995 **The Science and Technology Basic Law**
※**Responsibility** of the regional government (Article4、Article5)
1996- The **First** Science and Technology Basic Plan

2000- Strengthen the Regional Government Initiative

2001- The **Second** Science and Technology Basic Plan
※*Knowledge Cluster Initiative*

Lessons from Knowledge Cluster Initiative

Interim Evaluation

- Long-term view and impact
- Focus on regions' autonomy and initiative
- Competitive Environment

Results of Evaluation

(Common Issues)

- Selection of appropriate topics for research and the management of its progress
- Strategies on commercialization
- Strategies on intellectual properties
- Co-operation with other regions
- Fostering and obtaining S&T human resources

Knowledge Cluster Initiative

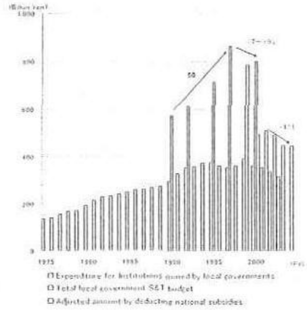
1. Introduced by the Second Science and Technology Basic Plan
2. 18 Regional Governments
3. Annual budget: 10 billion yen (FY2005)
4. Characteristics

- Focusing on initiative of each regional government
- Promotion Agents allocate research budgets for Universities and Institutions
- Leadership of the Cluster Headquarters
- Introducing the principle of competition among the regions

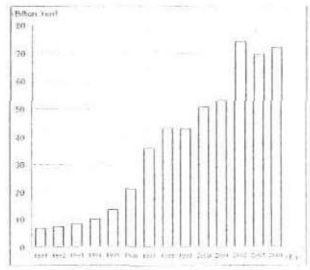
Source: MEXT

The Regional S&T Budget

- The S&T Budget of Regional Governments



- The National Budget for Regional S&T



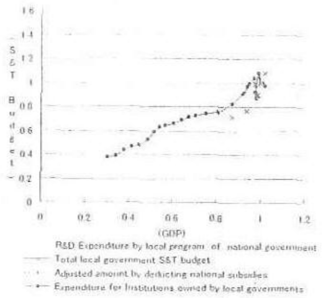
Source: NISTEP

Budget for Regional S&T

- The S&T budget amount of regional governments depends on the economic growth.
- The National Budget for Regional R&D has been increasing as policy requires, in spite of the economic slowdown

(Complementary effect of the National and regional governments)

the figures are standardized with the amount of the year 2001 as 1.



Calculated by NISTEP data

Chapter 3:

Variety of Region

Summary Japanese Situation of RIS

1. Unit: Some Prefectures equivalent to "Small Countries" in the size of economy and science out-put (Regional Potentiality)
2. Policy: Shifting from "Decentralization of national base" to "Regional capacity building"
3. Budget: Complement to Regional government activities by increasing "*Regional S&T programs*" of National government
4. Environment: Regional Competition, Decentralization, Independence of national actors from central government etc.

Variety of Region

1. Regional Diversity
- ①Characterization:
  Variety of R&D resources, management, governance etc. in different regions
- ②Efficiency:
  The asymmetric progress of efficiency in R&D and innovation in different regions

2. Measurement
Collecting regional indicator and development of measurement for region in NISTEP (ongoing research)

Development of indicators for regional S&T

(NISTEP 3rd policy oriented research group)

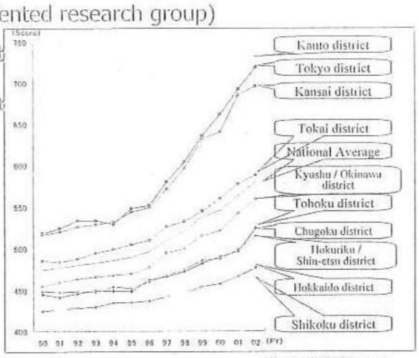
Principal Component Analysis (PCA)

2004 trial development
2005~ Improving to measure regional potential

Data Envelop Analysis (DEA)

- (2005~)
- 2005~ Developing to measure regional efficiency

(Ongoing research)

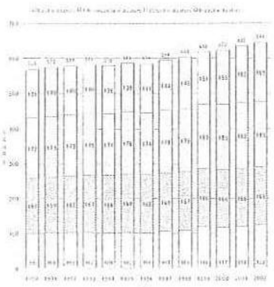


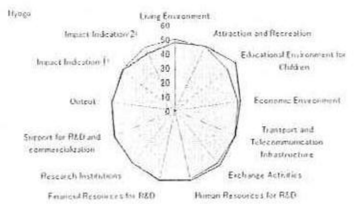
Source:NISTEP report

Chapter 4:

Case Study for Region

Example: Hyogo Prefecture





Source: NISTEP report

Case Study for Kobe

Why Kobe?

①Typical region of "Bio-cluster" in Japan

②Regional Governance:
- ·Active regional government (Kobe city)
- ·Clear plan
- ·Active regional R&D function

③National Support:
- ·Excellent research institute(RIKEN)
- ·Sufficient national support(Knowledge cluster Initiative etc.)

④Industrial Development
- ·Emerging accumulation of 81companies/5years(2001~)

Approach

- 2005. July Comparative study with other "bio-clusters" like Seattle (continues)
- 2005.Aug. Luncheon Meeting with SMEs
- 2005. Nov. Survey for SMEs etc. in the "cluster"

(ongoing)

- Structural interview for regional actors

My Conclusion

- Explaining my current strategy for RIS and ongoing projects
- Conceptual development for RIS may be required
- Describing current trends of RIS in Japan
- Consideration into unit, policy and diversity of region may be important components for RIS
- Development of measurements such as synthesized indicators may contribute to understand regional potential and characters
- Case studies and comparative work may be useful to accumulate lessons from successful region

Science and Technology Policy Research Seminar, NISTEP

Diversity of Region

January 24, 2006

Yoshihiro Maruyama
Visiting Researcher,
3rd Policy-Oriented Research Group, NISTEP

"Composite Indicators Measuring Regional S&T Activities toward Innovation "

(Purpose)

To comprehensively assess regional innovation efforts at the central government level as well as efforts to promote S&T local government capability.

(Method)

"Composite Indicators Measuring Regional S&T Activities toward Innovation (Regional Composite Indicator)" consist of 4 component indicators (i.e.; input, Infrastructure, output and impact indicators) and represent the aggregate scores based on principal component analysis.

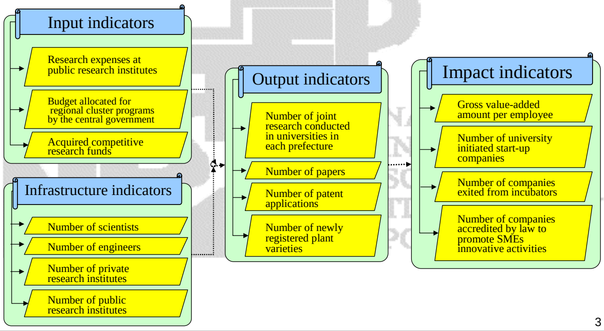
2

Activities of the previous Year

1

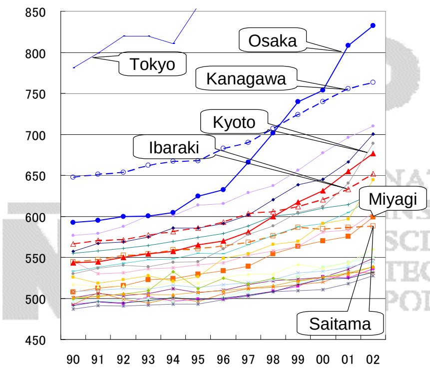
Development of "Regional Composite Indicators" Measuring Regional S&T Activities toward Innovation

- Intended to precisely capture achievements of regional innovation from input, infrastructure, output, and impact-related indicators



3

Trends in Top 25 Growing Prefectures (FY1990-2002)



Ranking by Increase 1990-2002		Ranking by Total score in 2001
1	Tokyo	(1)
2	Osaka	(2)
3	Fukuoka	(6)
4	Hokkaido	(5)
5	Kyoto	(7)
6	Aichi	(4)
7	Hiroshima	(9)
8	Miyagi	(13)
9	Kanagawa	(3)
10	Hyogo	(11)
11	Ibaraki	(8)
12	Ishikawa	(16)
13	Chiba	(10)
14	Shizuoka	(12)
15	Fukui	(17)
16	Gunma	(18)
17	Iwate	(24)
18	Kagawa	(30)
19	Kumamoto	(27)
20	Nagano	(15)
21	Tokushima	(28)
22	Saitama	(14)
23	Okayama	(21)
24	Yamaguchi	(20)
25	Gifu	(19)

4

The Questionnaire Research

by NISTEP and MRI, Inc

(Purpose)
To perceive the state of the progress in programmes and systems related to the promotion of Industry-University Co-operation / Regional Innovation.

(Respondents)
- Prefectures, Specified cities and cities with a population of over 50,000.
- Promotion organizations of Industry-University-Government Co-operation and research institutes established by local governments.
- National universities, private universities, prefectural and municipal universities, national research institutes and independent administrative corporations
- Major, small and medium enterprises and the Chamber of Commerce and Industry

(Period of Questionnaire Distribution)
May to July, 2004

5

Activities of the Current Year

6

Hypothesis

Do issues related to Regional S&T become increasingly diversified according to characteristics and needs of the region?

This study extracts issues related to Regional Industry-University Co-operation and inspects whether they differ depending on the region.

7

Method

Quantitive Indicators

Classification by the
"Regional Composite Indicator"
+

Survey Research

Study based on
"The Questionnaire Research"
Conducted by NISTEP and MRI, Inc. in 2004
||

Extraction of issues related to Regional Industry-University Co-operation concerning the regional characteristics.

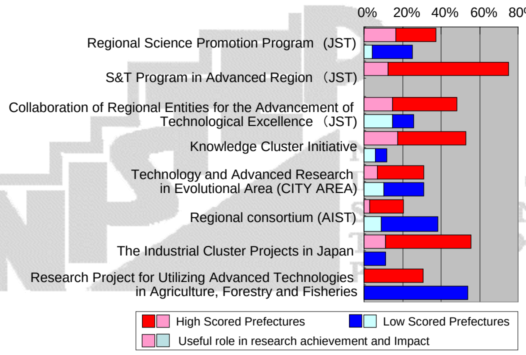
8

Comparison between High Scored Prefectures and Low Scored Prefectures

	High Scored Prefectures	Low Scored Prefectures
Average of Population (2000)	5.5 Million	1.1Million
Average of GDP (2002)	22.8 Trillion Yen	4.4 Trillion Yen
Average of Scientists (2000)	8.5 Thousand	0.5 Thousand
Average of Technicians (2000)	123.4 Thousand	15.7 Thousand
Total Expenditure in Regional Government (2003)	1.8 Trillion Yen	0.6 Trillion Yen
R&D Expenditure by Regional Government (2003)	1.7 Billion Yen	0.5 Brillion Yen
R&D Expenditure by Regional Program of National Government (2003)	1.6 Billion Yen	0.3 Billion Yen
Average of Papers (2003)	5,360	469
Average of Patent Applications (2003)	22,522	393

9

Comparison of National Government Policy to Promote regional innovation for High Scored Prefecture and Low Scored Prefecture



10

Major Issues of Industry-academia-Government Co-operation in Region

11

Questionnaire to Regional Government (47Prefectures)

(Question)

What are challenges of industry-university-government co-operation in the prefecture? Please adopt 3 answers from the following 9 alternative. (Multiple Answers)

A1: Although a part of researchers are enthusiastic, they are indifferent to the region and local businesses as a whole.

A2: The top of universities is not eager to develop industry-academia co-operation.

A3: There are mismatches between universities' awareness and local businesses' needs.

A4: There are not any businesses in the local area at which research at university can be utilized, in terms of their technical standard and characteristics of research.

A5: There is an emotional barrier against industry-academia co-operation between local businesses and universities.

A6: Sufficient resources (personnel and financial) cannot be obtained in order to plan and launch own promotion programmes.

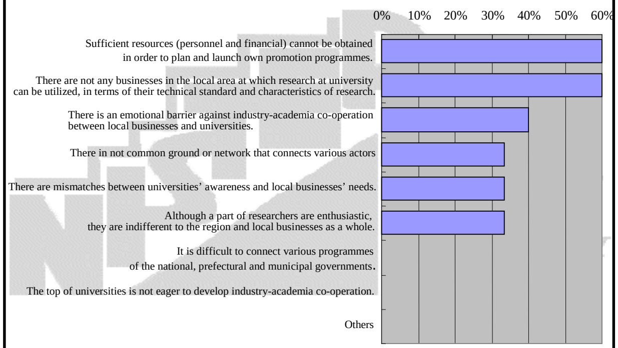
A7: It is difficult to connect various programmes of the national, prefectural and municipal governments.

A8: There in not common ground or network that connects various actors.

A9: Others.

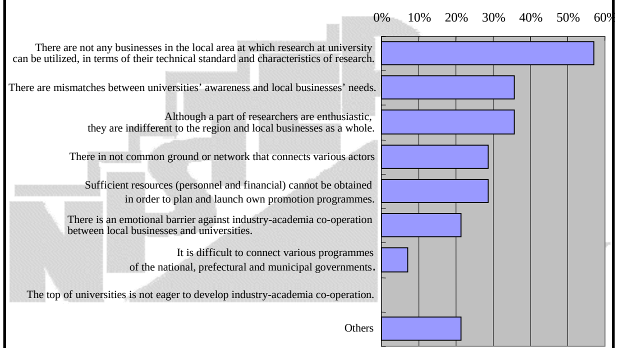
12

Major Issues of Industry-academia Co-operation (Answers of Low Scored Regional Governments)



14

Major Issues of Industry-academia Co-operation (Answers of High Scored Regional Governments)



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Obstacles to Collaboration from the Prefectures' Viewpoint

(Common Issue)

- Lack of local businesses in which academic researches can be utilized

(Issues in High Scored Prefecture)

- Mismatches between universities' awareness and local businesses' needs
- A part of researchers are indifferent to the region and local businesses.

(Issue in Low Scored Prefecture)

- Insufficiency of resources (personnel and financial)

(Common Advantages)

- Effective utilization of various programmes
- Lack of sensitivity to cooperate between Industry, Academia and government

15

Questionnaire to Universities

(Question)

What are obstacles to conduct co-operation with local public entities and businesses in the region? Please select answers from the followings. (Multiple choice)

A1: There are not any businesses in the local area at which research at university can be utilized, in terms of their technical standard and characteristics of research.

A2: There is an emotional barrier against industry-academia co-operation between local businesses and universities.

A3: The prefectural government lacks the budget and manpower to establish the policy to promote collaboration with local businesses.

A4: Do not intend to collaborate with local businesses, therefore there is no obstacle.

A5: Others.

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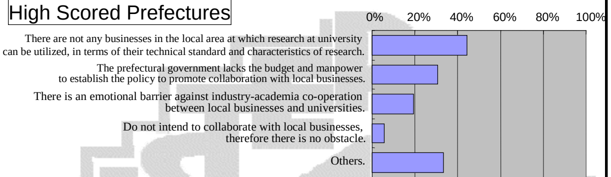
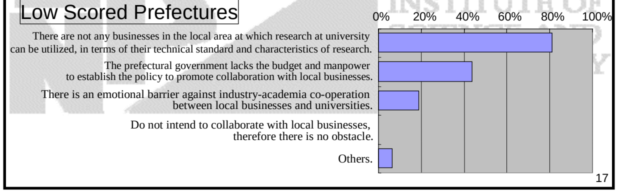
Major Issues of Industry-academia Co-operation
(Answers from the Low Scored Universities in the Rigions)

High Scored Prefectures



Low Scored Prefectures



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Obstacles to Collaboration from the Universities' Viewpoint

(Common Issue)

- Lack of local businesses to utilize universities' research

(Issue in Low Scored Prefecture)

- Insufficiency of resources (personnel and financial)

(Common Advantages)

- Emotional barriers
- Lack of sensitivity to cooperate

18

Questionnaire to Regional SME

(accessible population)

SME without experience of research co-operation

(Question)

What are the reasons why your company has not carried on any cooperative research activities with universities?

Please select and circle one or two of the following options

A1: Lack of information about researches at university

A2: Absence of information about the procedures for establishing cooperative research

A3: The complicated procedures for establishing cooperative research

A4: Possible problems with attribution of the achievements in cooperative research activities

A5: Lack of possibility of gaining cost-worthy achievements

A6: Difficult to bear the cost for cooperative research activities.

A7: Receiving sufficient advice from researchers at university and information exchange with them.

A8: Absence of subjects to be the theme of cooperative research.

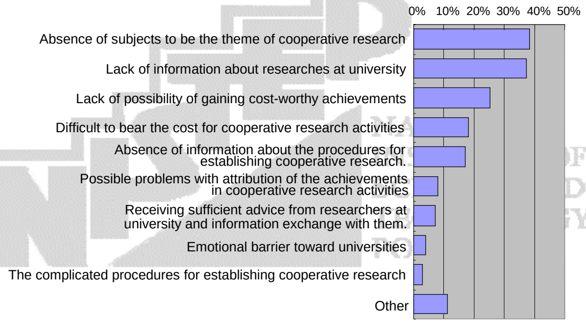
A9: Emotional barrier toward universities

A10: Other

19

Major Issues of Industry-academia Co-operation
(Answers of High Scored Regional SMEs)

High scored Prefectures



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Obstacles to Collaboration from the SMEs' Viewpoint

(Common Issue)
- Absence of Research Subjects at University

(Issue in High Scored Prefecture)
- Lack of Information

(Issues in Low Scored Prefecture)
- Low Cost-efficiency
- Lack of funding

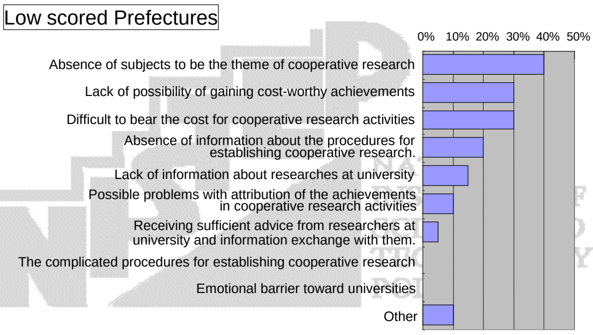
(Common Advantages)
- Emotional barriers
- Complicated procedures for cooperative activities

(Advantages in Low Scored Prefecture)
- Lack of Information

22

Major Issues of Industry-academia Co-operation
(Answers of Low Scored Regional SMEs)

Low scored Prefectures



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Conclusion

This research find out
Issues of industry-university co-operation differs according to the potential level of the region by combining the Quantitive research (Indicators) and the Survey research (Questioners).

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Thank you for your attention!

Please visit our web site

http://www.nistep.go.jp/index-e

24

The Research of Regional Independent Innovation Capacity in China

Mr. Shuhua-Wang

National Research Center for S&T for Development, China

January 23, 2006

OUTLINE

1.Status quo characteristics of Innovation capacity

2. Existing Main Problems in China

3. Some Advice and Opinions to discuss

Background:

With the global economy development, regional innovation capacity is becoming one of the most important factors to enhance international competition dominance. And , Nowadays, innovation capacity is inseparable with competition ability. Such as IT Industry in Silicon Valley, Computer Manufacture in Xinzhu, Software Industry in Bangalou.

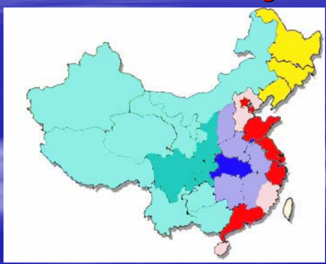
China, a developing country

——vehement market competition

—— the pressure that comes from resources and environment

1. Status quo characteristics of Innovation capacity in China

- Some innovation regions are forming



——Northeast district

——Eastern district

——Middle district

——Western district

the common characteristics are as follows:

—— Highly centralizing innovation resources

the technological personnel accounted for 60.3% of the whole nation;

R&D investments by eastern district amounted to 55.7% in 2002.

——Stronger innovation output

the quantities of patents account for 71.6% of the whole country

technological papers account for 79.2% in 2002

——Typical innovation mode

For example, "special town" in Zhujiang delta. the service platform of technological innovation has been constructed.

Table 1 Main Technological Index in Guangdong Province Enterprises in 2003

Index	personnel Number (10^4)	Technological Investment (10^8 Yuan)	R&D investment (10^8 Yuan)	Organization Number
Whole Province	30.5	362.96	179.8	2527
Percentage of Enterprises (%)	80%	87.7%	69%	73.5%

1. Status quo characteristics in China

➢ **Enterprises or firms are becoming the most active power in regional innovation system**

R&D investment is continuously increasing

In 2003, R&D outlay of Chinese enterprises has increased up to 61.2% from 40% at the beginning of 1990's.

Take Shenzhen as example, 4 data of 90%:

—— 90% R&D personnel

—— 90% R&D organization

—— 90% R&D outlay

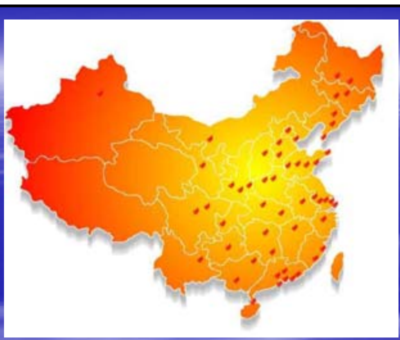
——90% patents

In China, with the increasing investment, some enterprises with stronger competition capability is springing up, such as Huawei, Haier, Chery and so on.

they are not only the pioneers of independent innovation, but also the backbones of region economy.

1. Status quo characteristics in China

➢ **National high-tech zones have been the important carriers of region technological innovation**



—— Creating well innovation condition

——Centralizing a lot of innovation resources

——Training large quantities of high-tech enterprises

1. Status quo characteristics in China

➢ **Region cooperation for science and technology is more active**

Under the impulse of central and local government, Region cooperation for S&T tend to strengthen.

As an example: in Yangtze delta, Shanghai, Jiangsu, Zhejiang governments sign the agreement on advancing construction of regional innovation system. and build the regional innovation platform together such as Yangtze Delta Institute of Applied technology, Hangzhou S&T Zone of CAS, Jiaxing Life Science Industry Zone.

1. Status quo characteristics in China

➢ **Industry clusters are becoming the main mode of regional innovation**

In China, the industry clusters with marked regional feature have rapidly developed in Zhongguancun of Beijing,Wenzhou and Ningbo of Zhejiang, Jiangsu and so on.

——**IT industry clusters**, clothes industry **clusters**, electric-machine industry **clusters**, **etc**.

All these industry clusters have evidently significance on improving region independent innovation capacity.

2. Existing Main Problems

➢ **Problem 1: Environment construction of regional independent innovation need to be strengthened.**

—— Policies, laws and regulations are not perfect.

——Service system of encouraging enterprises or firms technology innovation is still weak.

2. Existing Main Problems

➢ **Problem 2: regional innovation resources need to be well allocated.**

—— The spatial distribution of innovation resources is out of balance. ⟹ dispersed layout / repeated constructions/ restrict the spatial flow of factors or resources.

——The market system on the innovation resources is not being efficiently executed. ⟹ difficult to share the existing innovation resources. /makes innovation resources continuously unused and wasted. In 2001, the quantity of average patents per research project is only 0.55.

2. Existing Main Problems

➢ **Problem 4:Regional innovation system ignores the supply of public S&T service**

The improvement for the capacity of public S&T is related to the national economy and the people's livelihood, the people's health and welfare.

but In China, the investment and emphasis on public science and technology service resources are insufficient. Such as commonweal technology, industry commonness technology, S&T infrastructure and so on.

2. Existing Main Problems

➢ **Problem 3: Regional innovation capacity is insufficient and the gap is great .**

——innovation capacity is insufficient in the whole.

At present, most regions in China, large quantities of technology are introduced, a few technologies are absorbed.

For example, in Guangdong province the investment rate of technology introducing and absorbing is far below that of Japan and Korea with1:5-8 level.

——The region gap is great. higher in eastern district near the sea, lower in western district.

3. Some Advice and Opinions

➢ **Advise 1:Establish the harmonious system**

——**the function of market economy** should be followed to allocate regional S&T resources.

——**the government roles** should be played in organization and harmony. In order to allocate the innovation resources into the important regions and fields.

——**non-government harmony organizations** such as regional industry association should be actively leaded and supported.

3. Some Advice and Opinions

➢ **Advise 2: Execute the regional S&T strategic programs**

In recent years, China has put forward several strategic programs in economy, such as executing western development, redeveloping the old industry base in northeastern regions and promoting the development of middle district.

so, In order to cooperate the strategic programs, the strategic programs of regional S&T development need to be set down and be executed.

3. Some Advice and Opinions

➢ **Advise 3: Strengthen the S&T infrastructure construction**

——increase the support in mid-western undeveloped areas.

——exert and lead the local governments to take part in the construction of national S&T condition platform.

——enforce the harmony between central and local governments, form the mechanism of S&T infrastructure that the central and local governments invest, construct, use and manage, promote the sharing of regional S&T infrastructure.

3. Some Advice and Opinions

➢ **Advise 4: Create a good condition which is advantage to the development of small technology-based firms**

—— governments should pay more emphasis on the development of small technology-based firms.

—— the plan of regional industry clusters and the whole service for middle or small firms should be strengthened.

including technology, information, finance, knowledge property right, financing and laws, etc.

CONCLUSION

As the emphasis of S&T work in every nation and region, the construction of regional innovation system conforms to the world development trend.

So, in the end, I wish the construction of regional innovation system in China make more contribution to the development of world science and technology.

Thanks

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Central Government's Efforts to Promote Innovation at Regional Level in China

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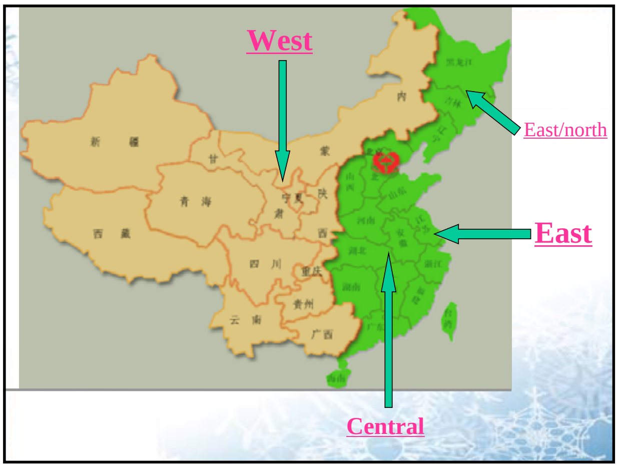
Chinese Academy of Sciences

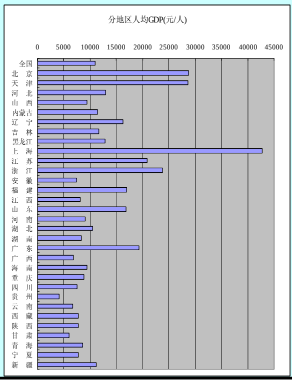


Outline

- Problems posed by regional differences
- Actions to promote innovation at the regional level
- Policy implications

Problems posed by regional differences

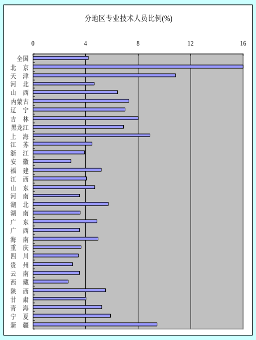
GDP per capita by regions



GDP (2004) data:
China Statistical Yearbook
2005
population data:
2000 population census
the richest: Shanghai
the poorest: Guizhou

Shanghai/Guizhou=10.5

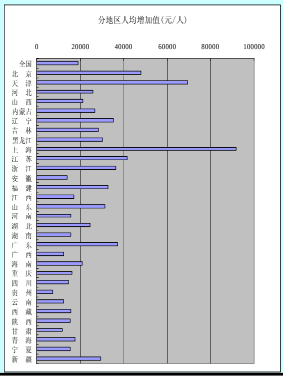
Scientific and technical personnel (%)



S&T personnel data
from: China Statistical
Yearbook 2005
population data from:
2000 population census
the highest: Beijing
the lowest: Tibet

Beijing/Tibet=6.0

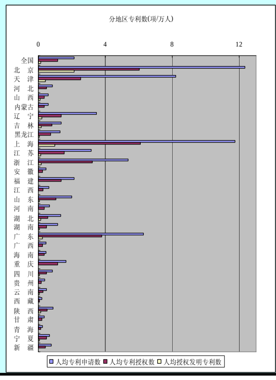
Value added per capita by regions



value added (04) data:
China Statistical Yearbook
2005
employed persons (04)
data: China Statistical
Yearbook 2005
the efficiency gap:

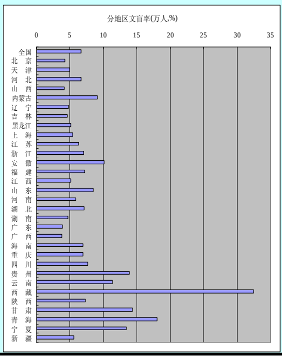
Shanghai/Guizhou=12.5

Patent (per 10,000 person)



patent (04) data:
China Statistical
Yearbook 2005
applications examined:
Beijing/Tibet=54.5
applications grant:
Shanghai/Tibet=72.7
invention patents grant
Beijing/Tibet=196.9

Illiterate and semi-literate population aged 15 and over (%)



data from:
2000 population census

Tibet: 32.5%;
Qinghai: 18.03%
Gansu: 14.34%

Guangxi: 3.79%
Guangdong: 3.84%
Shanxi: 4.18%

National Strategies

- Western Development Strategy 西部開發
  January 2000~
- Revitalizing the Old Industrial Bases of Northeast China 振興東北
  January 2004~
- Rise of Central China 中部崛起
  under analysis and planning

Sci. & Tech. Policy?

Question

To develop the eastern coastal regions for a good growth ?

To spill over into the rest regions ?

How to develop lagged regions ?

Actions to promote innovation at the regional level

Commission of Reform & Development

- 西部高技術產業化專項, 2000~
  Special Program of Hi-tech industrilazition in the Western Region
- 振興東北老工業基地高技術產業化專項, 2004~
  Special Program of Hi-tech industrilazition in the north-east Region

Funding market-oriented innovations

Ministry of Education

- 大學生志願服務西部計畫:
  Volunteer To West: 6000 persons in 2005
- 西部大學校園網路工程:
  Internet in 152 Western Universities
- 國家西部地區"兩基"攻堅計畫 (2004—2007)
  9-year compulsory education
  elimination of adult illiterate person

Enable potential qualified Labor

Ministry of Science and Technology

- 西部科技行動計畫 Western S&T Actions Program
  "縮小數字鴻溝"西部行動 Closing Digital Divide
  西部新材料行動 to Develop New Materials in the West
  西部新能源行動 to Develop New Energy in the West
  西部生產力促進行動 to Improve Productivity in the West
- 振興東北老工業基地科技行動 North-East S&T Actions
- 其他計畫的優先傾斜 To Give Priority to these Regions

Stimulate region-relevant research at local

Ministry of Personnel

- 《西部地区人才开发十年规划》
  Human Resource Planning
- 《进一步加强东北地区人才队伍建设的指导意见》
  Continued Education of Professional Persons
- 东西部公务员对口培训
  Training of Western Public Servant at Eastern Regions
- 国家人事人才培训网卫星远程培训
  E-education under the National Training Website

Enhance the talent competencies

Ministry of Business

- 2005 FDI: east 90.2%; middle 6.7%; west 3.1%
- 2004 hi-tech products export:
  east 98.68%; middle 0.55%; west 0.77%
- How to encourage FDI to the west and middle regions?
- easy-passing Custom (便捷通关)
  from $100m to $10m for the western hi-tech firms

Facilitate hi-tech firms to run

Policy implications

Chinese Academy of Sciences

- 中國科學院西部行動計畫 CAS West Actions
- 中國科學院東北振興科技行動計畫 CAS N-E S&T Actions
- **Including**
  科研基地建設: Improve institutes' research capability
  重大科學問題研究: Arrange large R&D projects
  人才隊伍培養: Train young scientists and leading talents
  重大決策諮詢: Consulting of important issues by Academician

Strengthen strategic research

Integration

- Central Government made separate funding streams available to support regional innovation
- The regions devote increasing resource to support innovation in their regions
- Need a closer integration of national and regional innovation strategies

Knowledge mobilizing

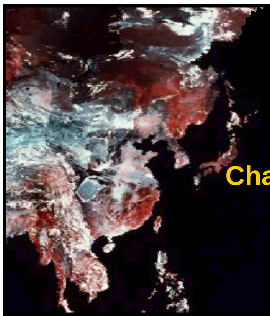
- Funding of project, infrastructure and labor
- Need more policies for formation and functioning of regional innovation network
- Need to improve the channels, mechanisms and conditions

Thanks!

Yibing Duan
Inst. of Policy & Management
Chinese Academy of Sciences

Main objective

- With a focus of natural resource, traditional industry and environment
- Maximize the number of jobs
- Need to attract high value-added, fast growth business



2006 NISTEP International Symposium

Innovation Clusters in Changing Global Production Networks of East Asia

24 Jan 2006

Jeong Hyop Lee
Science & Technology Policy Institute
Korea

I. Introduction

Contents

Heterogeneous production capabilities and a high degree of intra-regional complementarities of East Asia formulated on the economic development progressed in phases

Acceleration of sub-regional economic integrations in East Asian

This paper examines the characteristics of industrial transformations and responses of industrial clusters in East Asia from the perspective of Global Production Networks (GPN).

II. GPNs and Innovation Clusters

The GPN focuses on the dynamic strategic coupling of global production networks and regional assets, an interface mediated by a range of institutional activities across different scales (Coe, *et al*, 2003, Bathelt, *et al*, 2004).

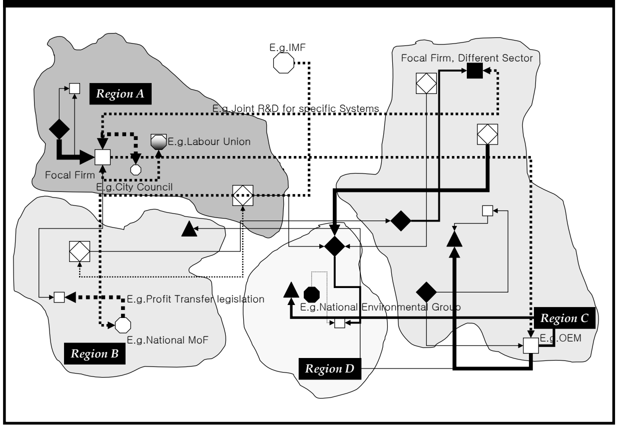
Regional development in the global economy depends on the abilities of the coupling to engender processes of value creation, enhancement, and capture.

GPNs are assembled to access location advantages at each network node associated with the increasingly specialized technology, skills, and know-how that are resident there (Borrus et al, 2000).

The GPN represents inter-and intra-firm relationships through which a firm organizes the entire range of its business activities: from R&D, product definition and design, to supply of inputs, manufacturing (or production of service), distribution, and support services (Borrus et al, 2000).

So entire networks of GPN include not only cross-border relationships between a lead firm and its own affiliates and subsidiaries, but also those of its subcontractors, suppliers, service providers, or other firms participating in cooperative arrangements, such as standard setting or R&D consortia.

Example of GPNs



Specialized capabilities of each region originate from multiple sources (Borrus et al, 2000).

The technology transfers from multinational firms (Ernst and Kim, 2002) and increasing investment in process and product development on the part of firms in those regions are considered to be the main resources.

The role of the state will foster the region's rapid industrial transformation, its capability build up, and its particular pattern of economic integration into the GPNs.

Rapid and Continuous Expansion of East Asian Economies

Import and Export Shares of Major Components of East Asian Countries

(Unit: 1,000 US$)

	Import			Export		
	1995	2000	2003	1995	2000	2003
China	4.6%	9.6%	20.1%	3.1%	6.3%	11.5%
Hong Kong	12.0%	12.4%	14.6%	8.3%	9.7%	13.1%
Indonesia	1.6%	0.5%	0.5%	0.3%	1.0%	0.9%
Japan	10.2%	10.4%	8.7%	35.4%	24.4%	20.4%
Korea	7.5%	9.6%	8.7%	11.9%	11.6%	12.1%
Malaysia	10.2%	9.8%	9.1%	8.5%	8.4%	8.4%
Philippines	1.3%	3.2%	4.6%	1.1%	5.6%	5.0%
Singapore	15.4%	12.4%	10.2%	12.2%	12.6%	12.4%
Vietnam	1.8%	0.3%	0.0%	0.0%	0.1%	0.0%
Thailand	3.6%	4.3%	4.2%	2.3%	2.6%	2.8%
USA	31.8%	27.6%	19.6%	16.7%	17.7%	13.5%
Total	157,671,937 (100.0%)	224,791,084 (100.0%)	247,847,568 (100.0%)	154,069,668 7(100.0%)	223,634,823 (100.0%)	252,181,825 (100.0%)

Data: UN COMTRADE

III. The Transformation of GPNs in East Asia

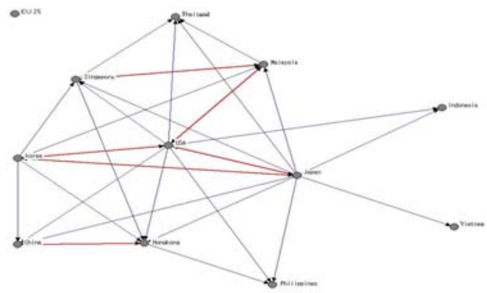
Trade Networks Changes in East Asia

Centrality and Centralization Index of Major Components of East Asian Countries (1995-2003, Import)

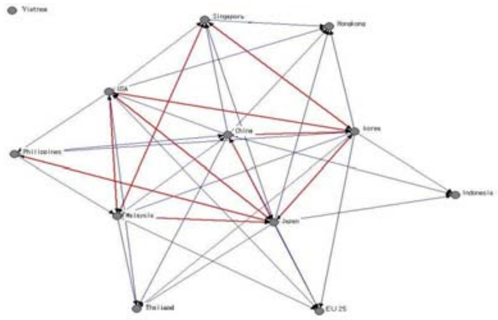
	In-degree centrality			Out-degree centrality		
	1995	2000	2003	1995	2000	2003
EU 25	0	0.273	0.455	0	0	0
China	0.364	0.364	0.364	0.091	0.273	0.727
Hong Kong	0.455	0.455	0.455	0.182	0	0
Indonesia	0.182	0.182	0.273	0	0	0
Japan	0.182	0.364	0.455	0.909	1	0.909
Korea	0.182	0.182	0.364	0.545	0.636	0.909
Malaysia	0.364	0.273	0.455	0.273	0.455	0.545
Philippines	0.273	0.273	0.273	0	0.182	0.273
Singapore	0.364	0.455	0.455	0.273	0.364	0.273
Vietnam	0.091	0.182	0	0	0	0
Thailand	0.364	0.364	0.455	0	0	0
USA	0.273	0.455	0.364	0.818	0.909	0.727
Centralization	**21.5%**	**14.9%**	**9.9%**	**71.1%**	**74.4%**	**59.5%**

Data: UN COMTRADE

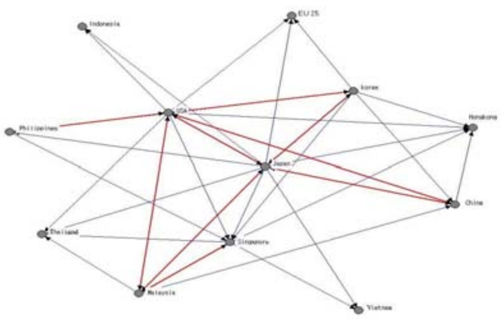
Production Network of East Asia (1995)



Production Network of East Asia (2003)



Production Network of East Asia (2000)



IV. Responses of Clusters in East Asia

Growth Triangle around Singapore

Singapore has been dramatically and successfully engaged in the global production network since its independence by attracting foreign companies, such as US electronics and computer companies (Yeoung, 2006). Singapore has developed into a hub among the South East Asian countries, especially building the so-called *Growth Triangle*, involving neighboring Indonesia, Malaysia and Singapore (Phelphs, 2004).

In the 1990's, rapid growth of the Chinese economy has challenged the Singaporean economy because foreign companies that invested in Singapore began to move to China. Singapore responded to the change by having a more open economy. On the one hand, Singaporean companies actively invested in China and the Singaporean government supported them in various ways. On the other hand, it built up the science town *One-North* in Singapore, to attract advanced industries such as the IT and BT industries.

Display Clusters in East Asia

Competitive display clusters that are under construction in East Asia, triggered by the rapid expansion of the global TV display market with its cut throat competition among producers in Korea, Japan, Taiwan and China

	Location	Size	Major Companies
Korea	Tangjeong Paju	1,740 acres 890 acres	Samsung LG-Philips
Japan	Kameyama	80 acres	Sharp
Taiwan	Hsinchu Taichung Tainan	Refer to the note	CMO, Hannstar
China	Sanghai Beijing	310 acres 335 acres	Diverse display companies

Hsinchu Science Park in Taiwan

Hsinchu has been recognized as one of the most successful science parks, and a close connection to Silicon Valley has been its key strength. Many famous IT companies in Hsinchu have spun off from government-led projects. The Industrial Technology Research Institute (ITRI) has played a key role in the spin-off of these companies and establishing networks of diverse companies in Hsinchu.

The massive exodus of small & medium sized companies to China has become a serious challenge to the Hsinchu science region in Taiwan. To cope with these difficulties, Taiwanese companies devised a new form of vertical division of labor between Taiwan and China. Taiwan companies are more specialized in the design and new product development and use manufacturing capacities in China. On the other hand, Taiwan tries to transform its economy focusing on Digital Contents and BT through establishing special parks such as the Biomedical Science Park located north and south in Taiwan.

5. Conclusion:

Suggestions for further study on comparative analysis of innovation clusters in East Asia

Accelerated integration of world economies has strengthened global competitive pressures on domestic and international markets, while localization has become a new engine of economic development. In this paper, I examined the transformations of the international division of labor and responses of innovation clusters in East Asian from the perspective of GPN.

The results show that the trade volume among East Asian countries continued to increase and that the central position of trade networks moved from the U.S. to East Asian countries like Japan and China. Decreasing centralization of the trade networks indicates the changing division of labor among East Asian countries. Hsinchu Science Park in Taiwan, the Growth Triangle around Singapore and the competition of display clusters in this region reflect their strategies against the changes, and provide policy implications for innovation cluster strategies.

Research based on the classification of clusters and their development paths are necessary to successfully design innovation clusters in this region.

Classification of clusters by two criteria - knowledge/technology maturity and characteristics of relationships.

Four types of clusters

- Silicon Valley (emerging technology, informal relationship)
- Baden Wurtemberg (exising technology, formal relationship)
- The 3rd Italy (existing technology, informal relationship)
- Sophia Antipolis (emerging technology, formal relationship)

Based on the analyses of the clusters, the developmental paths of clusters will be elaborated by the challenges and responses in three important spatial dimensions: global, national, and regional.

I believe East Asian clusters are very distinctive from western clusters such as Silicon Valley, Baden Wurtemberg, etc. The central governments in East Asia countries play an important role in initiating the cluster build-up processes, and major conglomerates such as Samsung and Toyota will have more influential effects on the formation of cluster models.

Complex global competition in East Asian production networks provides both the opportunity for and threat against building competitive innovation clusters in East Asian countries. Models and strategies of innovation clusters will be very different according to their conditions in the rapidly changing global economy.

Comparative analyses of clusters in East Asia, especially analyses of Ulsan, the automobile cluster of Korea; Toyota of Japan; Hsinchu of Taiwan; and Growth Triangle of Singapore; etc., not only will help in making strategies for each country but also help with developing new models for cluster studies.

I expect this kind of comparative analyses of innovation clusters in East Asia provide new models that are quite distinctive/differentiated from western experiences and a guideline that helps to promote cluster projects by central governments in East Asian countries.

Thank you !

Policies and Strategies for Strengthening Regional Innovation Capacity in Korea

Jan. 2006

Jooyoun Hahn

kistep 한국과학기술기획평가원

I. Why do regions want innovation?

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Outline

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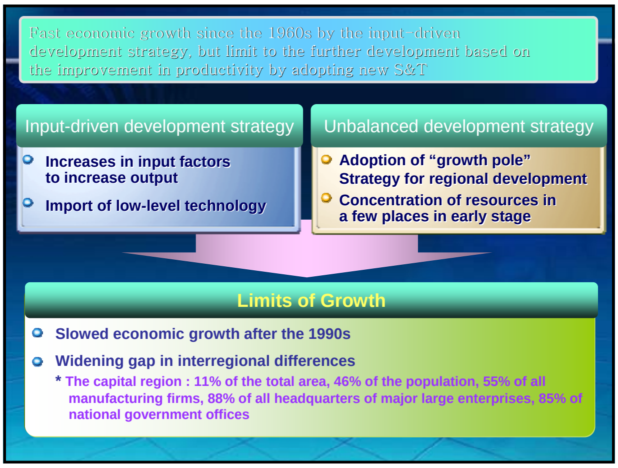
Korea's economic situation : GDP Growth

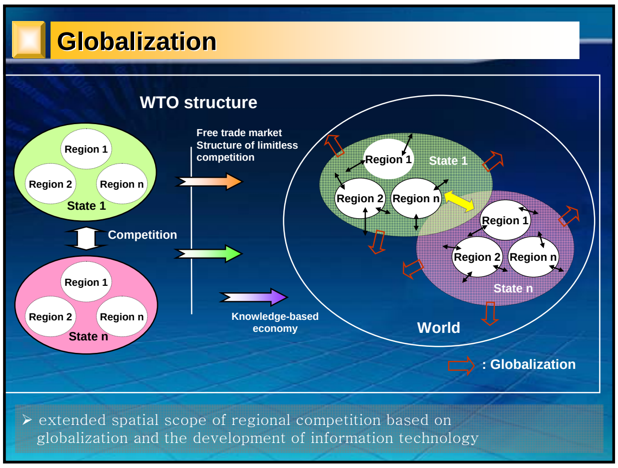
GDP and Trade : Fast Economic Growth

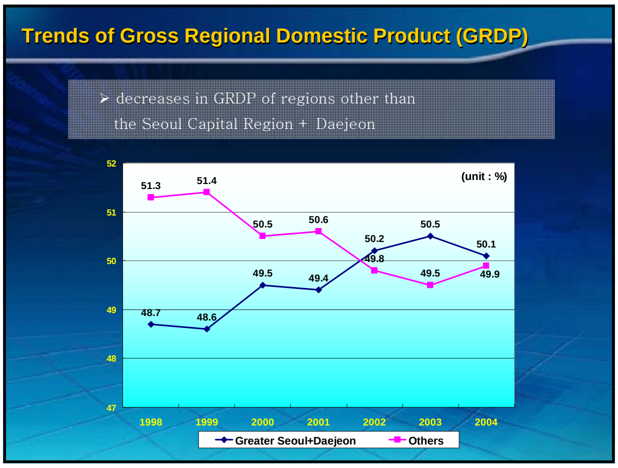
- GDP in 2004 : $680 billion (10th largest in the world)
- per capita GDP in 2004 : $14,162 (30th in the world)
  ※ per capita GDP : $82 (1961) → $11,432 (1995) → $14,162(2004)

Export-oriented Growth Policy and Dependence on Trade

- Trade volume in 2004 : $478 billion (12th in the world)
  ※ Trade volume : $0.36 billion (1961) → $478 billion (2004)
- Amount of export by SMEs 42.2% of the entire trade volume in 2003
  ※ Proportion of export by SMEs : 31.0% (1998) → 42.2% (2003)


Fast economic growth since the 1960s by the input-driven development strategy, but limit to the further development based on the improvement in productivity by adopting new S&T
Input-driven development strategy
Increases in input factors to increase output
Import of low-level technology
Unbalanced development strategy
Adoption of “growth pole” Strategy for regional development
Concentration of resources in a few places in early stage
Limits of Growth
Slowed economic growth after the 1990s
Widening gap in interregional differences
* The capital region : 11% of the total area, 46% of the population, 55% of all manufacturing firms, 88% of all headquarters of major large enterprises, 85% of national government offices


Globalization
WTO structure
Region 1
Region 2
Region n
State 1
Competition
Region 1
Region 2
Region n
State n
Free trade market
Structure of limitless competition
Knowledge-based economy
Region 1
State 1
Region 2
Region n
Region 1
Region 2
Region n
State n
World
: Globalization
➢ extended spatial scope of regional competition based on globalization and the development of information technology


Trends of Gross Regional Domestic Product (GRDP)
➢ decreases in GRDP of regions other than the Seoul Capital Region + Daejeon
(unit : %)
52
51
50
49
48
47
51.3
51.4
50.5
50.6
50.2
49.8
50.5
50.1
49.5
49.4
49.5
49.9
48.7
48.6
1998
1999
2000
2001
2002
2003
2004
Greater Seoul+Daejeon
Others


Demand for New Development Strategy : Closing the Gap
Increasing TFP(Total Factor Productivity) gains Through innovation
Increases in R&D expenses
Creation of new knowledge, technology
Lead to broader horizons, new markets, etc.
Endogenous economic growth
An integrated regional innovation policy as a core national development strategy
national economic growth as a result of accumulated wealth of regions based on regional innovation

II. National Framework Policy for Promoting Regional S&T

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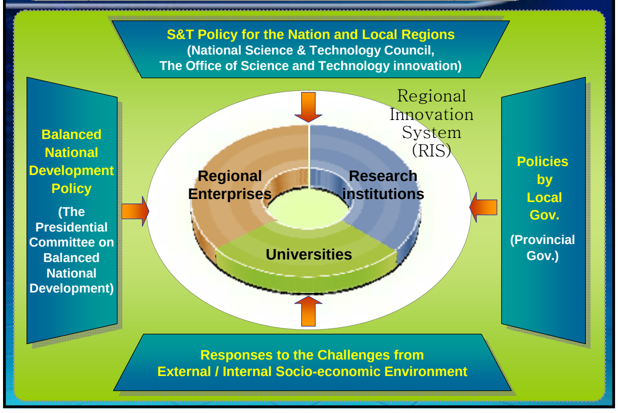
Basis of Policies for Promoting Regional S&T

System	Basic Law for Science & Technology(2001) Special Law for Balanced National Development(2003)
Policy	Second Comprehensive Plan for Promoting Regional Science & Technology (2005) First Five-year Balanced National Development Plan (2004)
Organization	National Science & Technology Council (NSTC) The Presidential Committee on Balanced National Development

Development of the Korean Regional S&T Policy

Periods	Regional S&T Policies
After 1960s	▪ Beginning of S&T infrastructure ▪ No substantial regional R&T policies
Early 1970s to mid 1980s	▪ Trying to reduce interregional gap ▪ Beginning of the construction of regional R&D complex in Daedoek
Mid 1980s to 1994	▪ Establishing Regional High-tech Industrial Complexes ▪ Improving innovation capabilities of regional industrial bases
1994-2003	▪ starting ▪ Introduction of regional innovation policy ▪ The First Comprehensive Plan for Promoting Regional S&T in 1999
After 2003	▪ Full scale implementation of regional innovation policy ▪ The First Five-year Balanced National Development Plan in 2004 ▪ The Second Comprehensive Plan for Promoting Regional S&T in 2005

Framework for Promoting Regional S&T in Korea



III. Current Status of Regional R&D in Korea

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Current Status of Regional S&T 1

▪ Continuing gap in R&D infrastructures among regions

Increases in R&D expenses and establishing major R&D centers

- Since the First Comprehensive Plan for Promoting Regional S&T, substantial increases in R&D expenses for establishing infrastructures

  ※ about 4 trillion Won (60% of total expenses) during the period of the First Comprehensive Plan for Promoting Regional S&T

The gap of R&D expenses, infrastructure, and outcomes among regions

- Continuing concentration of R&D institutions, human resources, and infrastructures

  ※ Greater Seoul + Daejeon : 62% of the total institutions, 60% of the total human resources, 65% of the total R&D expenses

Major Outcomes of the First Comprehensive Plan for Promoting Regional S&T (1999-2004)

❖ The first plan to mobilize S&T in regions outside the Seoul Capital Region before the Balanced National Development Policy was fully implemented

Increases in expenses for regional R&D

Expenses for Regional S&T by the national and local governments
※ 0.9 trillion Won (2000) ⇒ 2 trillion Won (2004)

Establishment of regional R&D infrastructures

Establishment of major strongholds for regional R&D
※ 8 regional centers of major R&D institutes
※ RRCs 37(2000) ⇒ 59(2004), ERCs 47(2000) ⇒ 63(2004)

S&T related organization in regional governments

Number of regional governments with department specialized in S&T matters
※ 2 in 1999 ⇒ 12 in 2004(including 2 basic self-governing bodies)

R&D Activities in Regions : Research Institutions

Regional Distributions of R&D Performing Units

- More than 60% of the total institutions are concentrated in the Seoul Capital Region.

< R&D performing units by sector of performance and region >

(unit : number, %)

	Public Research Institutes		Univ. & Colleges		Companies		Total	
	2000	2004	2000	2004	2000	2004	2000	2004
Greater Seoul	90 (39.5)	97 (39.4)	135 (36.7)	131 (32.5)	3,039 (65.6)	4,760 (64.0)	3,264 (62.4)	4,988 (61.7)
Daejeon	22 (9.6)	24 (9.8)	24 (6.5)	25 (6.2)	210 (4.5)	383 (5.1)	256 (4.9)	432 (5.3)
Others	116 (50.9)	125 (50.8)	209 (56.8)	247 (61.3)	1,382 (29.8)	2,296 (30.9)	1,707 (32.7)	2,668 (33.0)
Total	228 (100)	246 (100)	368 (100)	403 (100)	4,631 (100)	7,439 (100)	5,227 (100)	8,088 (100)

R&D Activities in Regions : Human Resources

Regional Distributions of Human Resources

- About 60% of the total R&D related human resources are concentrated in the Seoul Capital Region.

< R&D personnel by sector of performance and region >

(unit : headcount, %)

	Public Research Institutes		Univ. & Colleges		Companies		Total	
	2000	2004	2000	2004	2000	2004	2000	2004
Greater Seoul	8,364 (38.8)	9,422 (39.2)	45,018 (44.7)	58,450 (47.9)	81,445 (70.8)	118,528 (71.3)	134,827 (56.8)	186,400 (59.7)
Daejeon	7,610 (35.3)	8,371 (34.8)	7,928 (7.9)	8,519 (7.0)	6,452 (5.6)	8,464 (5.1)	21,990 (9.3)	25,354 (8.1)
Others	5,589 (25.9)	6,264 (26.0)	47,697 (47.4)	54,999 (45.1)	27,129 (23.6)	39,297 (23.6)	80,415 (33.9)	100,560 (32.2)
Total	21,563 (100)	24,057 (100)	100,643 (100)	121,968 (100)	115,026 (100)	166,289 (100)	237,232 (100)	312,314 (100)

R&D Activities in Regions : R&D Expenses per Personnel

Regional Distributions of R&D Expenses per Personnel

- The R&D expenses per personnel in Daejeon area are higher than the rest of the country.

< R&D expenditure per personnel by sector of performance and Region >

(unit : million won)

	Public Research Institutes			Univ. & Colleges			Companies			Total		
	2000	2004	change	2000	2004	change	2000	2004	change	2000	2004	change
Greater Seoul	68.6	93.3	36.0%	15.0	19.4	29.3%	88.3	105.3	19.3%	62.6	77.7	24.1%
Daejeon	140.0	181.7	29.8%	16.4	17.5	6.7%	121.4	103.3	-14.9%	90.0	100.4	11.6%
Others	70.3	90.2	28.3%	15.9	16.7	5.0%	83.9	93.3	11.2%	42.6	51.2	20.2%
Total	94.2	123.2	30.8%	15.5	18.0	16.1%	89.2	102.4	14.8%	58.4	71.0	21.6%

R&D Activities in Regions : R&D Expenses

Regional Distributions of R&D Expenses

- About half of the total expenses by public research institutes are directed to Daejeon.

< R&D exp. by sector of performance and region >

(unit : one hundred million won, %)

	Public Research Institutes		Univ. & Colleges		Companies		Total	
	2000	2004	2000	2004	2000	2004	2000	2004
Greater Seoul	5,738 (28.2)	8,788 (29.6)	6,733 (43.1)	11,332 (51.5)	71,946 (70.2)	124,775 (73.3)	84,416 (61.0)	144,895 (65.3)
Daejeon	10,653 (52.4)	15,210 (51.3)	1,301 (8.3)	1,491 (6.8)	7,834 (7.6)	8,744 (5.1)	19,789 (14.3)	25,446 (11.5)
Others	3,929 (19.3)	5,648 (19.1)	7,585 (48.6)	9,186 (41.7)	22,767 (22.2)	36,679 (21.6)	34,280 (24.8)	51,512 (23.2)
Total	20,320 (100)	29,646 (100)	15,619 (100)	22,009 (100)	102,547 (100)	170,198 (100)	138,485 (100)	221,853 (100)

R&D Outcomes in Regions : Patent

Growth rate of Patents application

- Higher regions : Greater Seoul, Central region
- Lower regions : Honam region

< patent applied per 100,000 population by Region >

(unit : case, %)

Region	2000	2004	Growth rate	Average (2000~2004)
Greater Seoul	207.3	308.9	10.5	237.0
Central Region	147.5	231.6	12.0	182.0
Honam Region	68.9	77.6	3.0	73.1
Yoengnam Region	94.6	112.5	4.4	102.6
Others (Kangwon, Cheju)	33.4	40.3	4.8	34.8
The whole country	146.4	211.4	9.6	167.7

Current Status of Regional S&T 2

▪ trends of R&D expenses by the national government

Increases in national R&D expenses for regions outside the Capital region

- Increasing trend of R&D expenses in regions other than Greater Seoul and Daejeon.
  - ※ 20.6% of the total national R&D expenses in 2001 → 26.2% in 2004

Continuing gap between the Capital region and the rest of the nation in National R&D expenses

- R&D expenses regarding the volume of the GRDP
  - ※ the ratio of national R&D expenses to the GRDP
    Greater Seoul + Daejeon 1.5% : (2003), other regions : 0.4% (2003)

Current Status of Regional S&T 3

▪ Basis for the implementation of regional S&T policy

Administrative organization and budget

- Increasing trend of R&D budget in regions other than Greater Seoul and Daejeon
  - ※ aimed at 40% of the total R&D budget in 2007
- Increases in the number of S&T related organization in regional governments
- Increases in the S&T related budget in regional governments

Need for regional S&T policies driven by regional governments

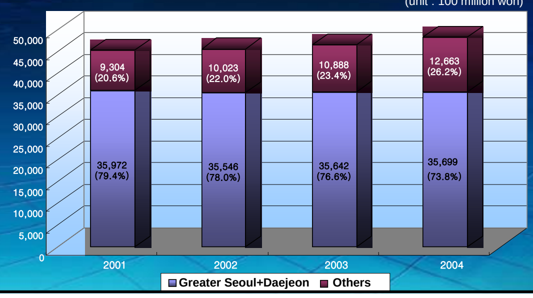
- Improving bases for S&T policy implementation in regional governments
- However, need for strengthening capacities of related personnel

R&D Expenses by the National Government

➢ steady increases of the national R&D expenses in regions other than Greater Seoul and Daejeon

- 20.6% of the total national R&D expenses (2001) -> 26.2% in 2004 (data from the results of "the Survey, Analysis, and Evaluation on the National R&D Programs")

(unit : 100 million won)



S&T Related Organization of Regional Governments

Year	1999	2001	2005
Division	0	1 (DAEGU)	2 (DAEGU, GYEONGBUK)
Department	2 (DAEJEON, KYUNGBUK)	3 (DAEJEON, KYUNGBUK, JEONBUK)	8 (BUSAN, INCHEON, GWANGJU, DAEJEON, GYEONGGI, CHUNGNAM, JEONBUK JEONNAM)
Team	4 (INCHEON, GWANGJU, GANGWON, JEONBUK)	9 (INCHEON, ULSAN, GYEONGGI, GANGWON, CHUNGBUK, CHUNGNAM, JEONNAM, GYEONGNAM, JEJU)	6 (SEOUL, ULSAN, GANGWON, CHUNGBUK, GYEONGNAM, JEJU)
Total	6	13	16

Note : The unit of regions are provinces and larger metropolitan areas.

R&D budget of the National and Regional Governments

Increases in the ratio of S&T related budget to the total budget of regional governments

- 0.7% (2000) ⇒ 1.6%(2004)
- lower than the ratio in the budget of the national government

(unit : one hundred million won)

		2000	2001	2002	2003	2004
Central Gov.	The general account	887,363	991,801	1,096,298	1,181,323	1,201,394
	R&D general	35,313	41,635	48,501	52,678	57,418
	Ratio	(4.0%)	(4.2%)	(4.4%)	(4.5%)	(4.8%)
Local Gov.	Local Gov. budget	38,363,276	47,346,208	56,997,075	56,081,368	59,660,992
	S&T related Budget	285,253	374,851	544,040	651,290	963,212
	Ratio	0.7%	0.8%	1.0%	1.2%	1.6%

Source : Regional S&T Yearbook 2004

Structure of the National R&D Programs

- Demand for more programs for technology development and for nurturing human resources

(Unit : million Won)

Category	Greater Seoul / Daejeon		Other Regions		Total	
	2002	2003	2002	2003	2002	2003
Technology Development	19,217 (81.3%)	20,532 (80.1%)	4,407 (18.7%)	5,115 (19.9%)	23,624 (100%)	25,647 (100%)
Nurturing Human Resources	2,117 (84.9%)	890 (54.7%)	376 (15.1%)	737 (45.3%)	2,493 (100%)	1,627 (100%)
Infrastructures	5,603 (59.7%)	5,391 (62.3%)	3,777 (40.3%)	3,265 (37.7%)	9,380 (100%)	8,656 (100%)
Supporting R&D Institutes	8,610 (85.5%)	8,829 (83.3%)	1,462 (14.5%)	1,771 (16.7%)	10,072 (100%)	10,600 (100%)
Total	35,547 (78.0%)	35,642 (76.6%)	10,022 (22.0)	10,888 (23.4%)	45,569 (100%)	46,530 (100%)

Current Status of Regional S&T 4

▪ trends of regional R&D programs

Administrative organization and budget

- More regional R&D programs, which specifically aimed at promoting R&D in regions outside the Capital region are still mainly directed to establishing infrastructures.

Lack of R&D programs utilizing existing infrastructures

- More programs needed for the maximum use of the R&D related personnel, institutes, and regional universities

IV. Future Directions for More Efficient Regional S&T Policy

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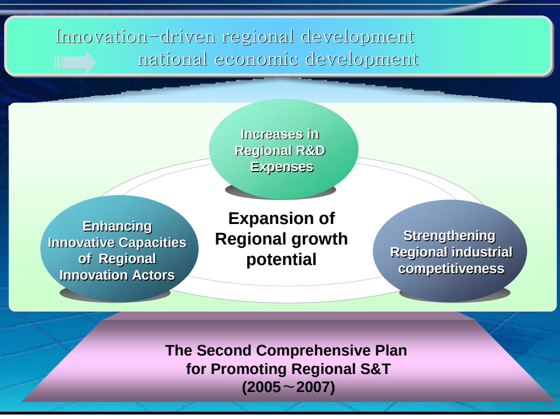
Future Prospects



Establishing Innovative Clusters

- creating clusters based on networks among major innovation actors in local regions
- designating seven pilot clusters for linking existing industrial clusters to R&D centers
- designating "Daedeok R&D Special Zone" for promoting commercialization of research outcomes of Daedeok R&D Complex

New Departures for a More Efficient Regional Innovation Policy

The formation of Networks

- Building networks among existing R&D facilities
- Linking existing R&D centers in regions to industrial clusters
  ※ Implementing cluster policies
- Intensifying networks among regional innovation actors (universities, enterprises, research institutes)
- Sharing major research facilities and S&T information
- Supporting the evolution of RIS that take into account the social and economic characteristics of the regions

The development of specialized regional technologies

- Establishing Regional Technology Roadmap (RTRM)
- Implementing regional R&D programs based on RTRM
- Designing more R&D programs which meet the needs from the regions and capitalize existing S&T and industrial infrastructures

New Departures for a More Efficient Regional Innovation Policy

More R&D programs initiated by regional governments

- Need for strengthening capabilities of R&D planning, management, evaluation by regional governments
- Supporting education programs for personnel in change of S&T related matters in regional governments
  ※ intensifying the evaluation system for regional R&D programs
- More efforts to capitalize on the potential of innovation actors within regions and to initiate interaction among them

Reinforcing commercialization of R&D outcomes

- Active commercialization of R&D outcomes by networking regional universities, R&D institutes and SMEs
- Reforming technology transfer organizations within regions and the related system
- Fostering business start-ups aimed at actively promoting innovative SME start-ups.


V. The Expected Role of
Major Regional Innovation Actors
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Thank you !
Innovate Korea! Ask KISTEP
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Major Actors for the Regional Innovation
National Government
Setting up the visions, Coordination, Guideline, Monitoring, Evaluation
Regional Governments
Initiating regional R&D programs regarding local needs, Organizing stable R&D supporting system, Implementing regional R&D policies
S&T Related Personnel
Creating innovation

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