

Evaluating Research Institutes: Segmentation and Convergence of Indicators

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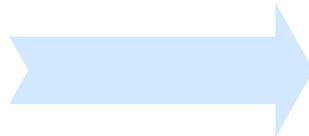
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CAS: Cradle of Science and Innovation in China

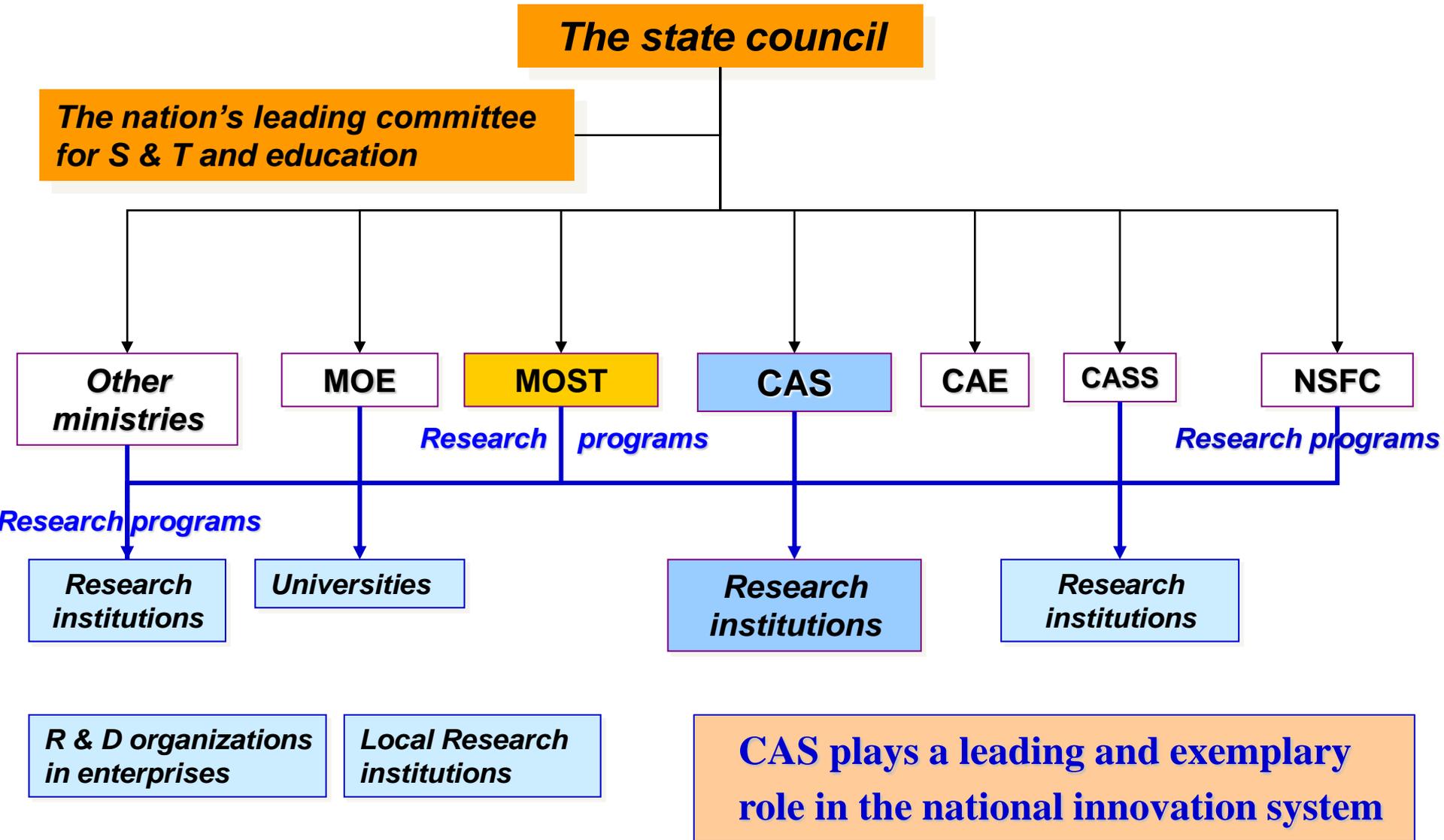
- Founded in Nov. 1949
- Home to the largest number of best talents in China
- A powerhouse of scientific knowledge and innovation



CAS headquarters (1949-1979)



CAS headquarters (1979-)





Role in China's National Innovation System of CAS

A "National Team"

representing the highest standards of S&T in China

A "Super University"

training next-generation scientists, engineers and innovators

A "Pioneer"

in the reform of China's R&D system

A "Think Tank"

advising the Government on major S&T issues

An "Engine"

driving China to become an innovative society

CAS

Take the lead in: 1) making a great advance in S&T development; 2) serving as a key national platform for training innovative talents; 3) developing a national high-level scientific think-tank; and 4) building a first-class scientific institution meeting international standards.



Mission, Structure and Strategy



Mission

Committed to excellent S&T, high-caliber talent and offering strategic advice to decision-makers

Structure

Three integrated elements: a large number of institutes, a merit-based academy and higher education institutions

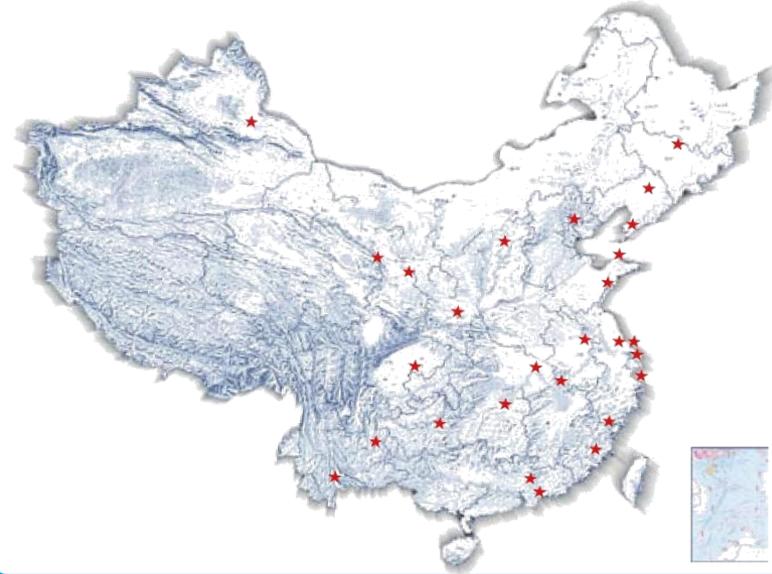
Strategy

Development Strategy: use democratic management, scientific openness and a commitment to nurturing talent to create a flourishing academy

Important Facts & Figures (as of 2013)

- ✦ 104 Institutes
- ✦ 12 Branch offices
- ✦ 2+1 Universities
- ✦ 88 State Key Labs
- ✦ 42 National Eng. Centers
- ✦ 3 Botanic Gardens
- ✦ 26 Herbariums
- ✦ 600+ Spin-off Companies

Distribution of CAS Institutes



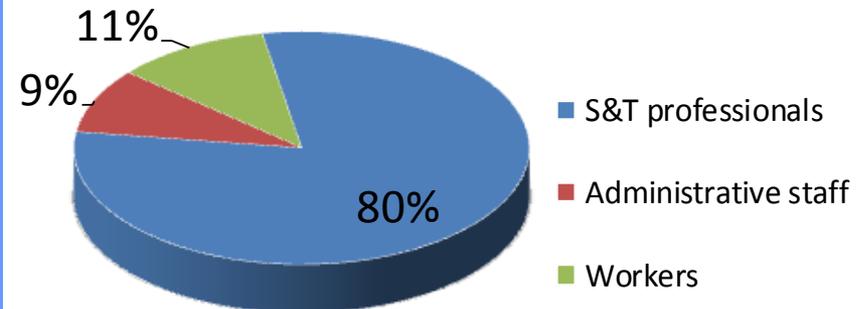
Total staff: 67,900+

Graduate Students: 52,000+

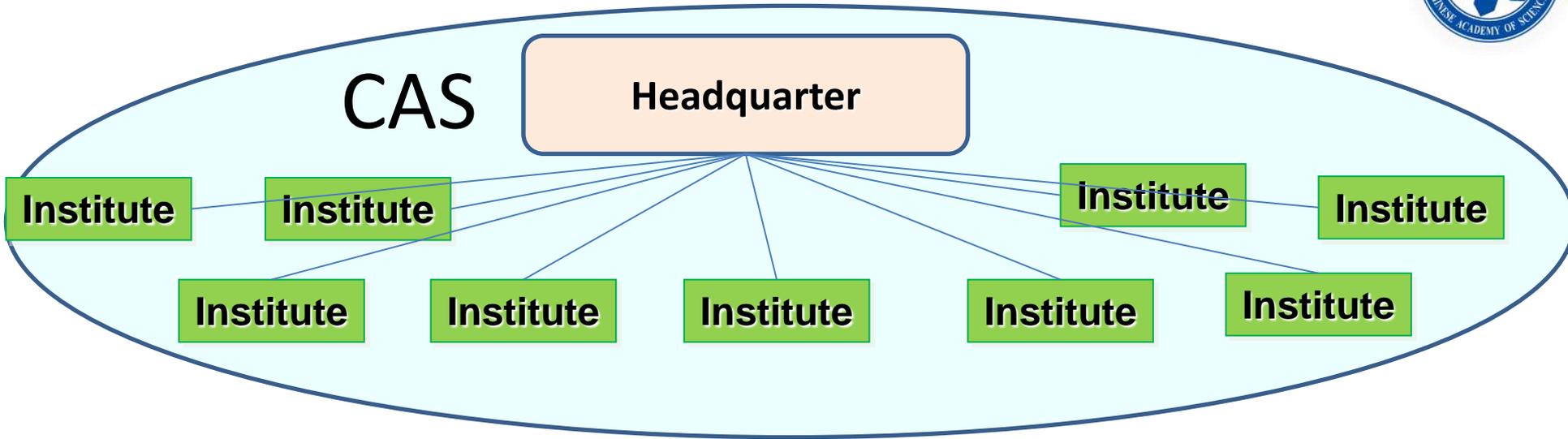
CAS Members: 750

Foreign Members: 72

Budget : RMB 45 Billion



The relationship between the headquarter and institutes



CAS institutes are institutional legal bodies:

Who have autonomy concerning S&T innovations and administration, and serve as public research platforms open to the whole country.

The CAS headquarters takes charge of:

- **Appoint the director and leadership of the institutes**
- **Approve the strategy of the institutes**
- **Evaluate the institutes**
- **Allocate resources for institutes**
- **Guide the institutes by the regulation and policy**
- **Set up two types of program crossing institutes**

Research Portfolio

Physical Sciences

- Mathematics
- Physics
- Mechanics
- Astronomy
- Chemistry



Earth and Environ. Sciences

- Geology
- Geography
- Ecology
- Oceanology
- Atmospheric Sciences



Life Sciences

- Botany, zoology & microbiology
- Genetics, genomics, proteomics and phenomics
- Biomedical sciences
- Agricultural sciences



High Tech

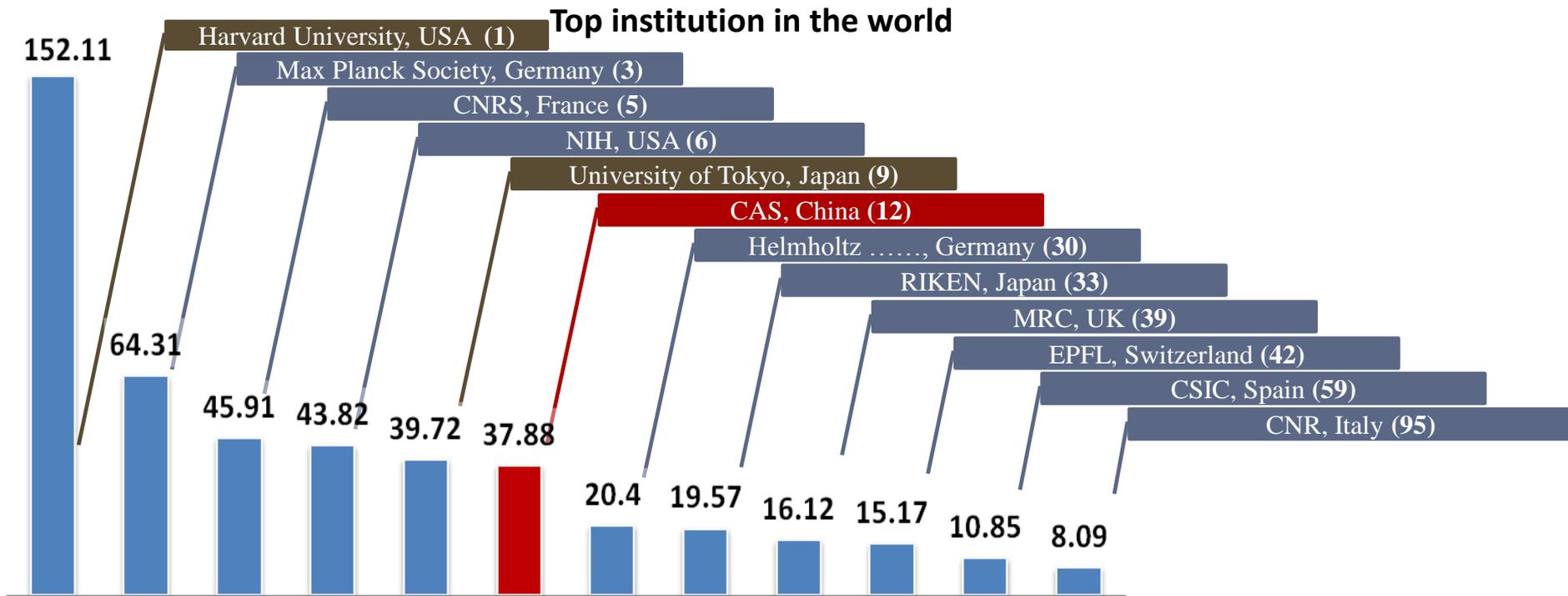
- Space science
- Opto-electronics
- Energy and materials
- Information technology
- Biotechnology



Great emphasis on interdisciplinary efforts to advance science and technology and tackle major S&T challenges

International Standing: by Publication

2012 Nature Publishing Index Ranking of Institutions



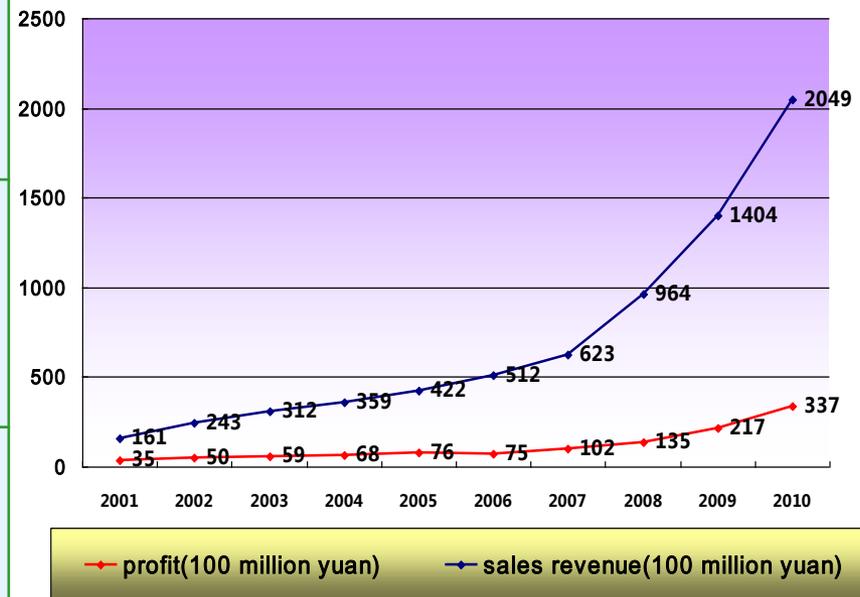
Source: 2012 Nature Publishing Index

Technology Transfer and Commercialization

- Translate research results into value-added technology and products
- Establish joint research institutes, technology transfer centers and incubation centers with local government and industry
- Serve regional economic development

With local government	Jointly established institutes	11
	CAS technology transfer or incubation centers	28
	Institute-level technology transfer or incubation centers	349
With industry	Institute-level technology centers or engineering centers	392

Sales revenue and profit as a result of CAS technology transfer



S&T Evaluation System in CAS

✧ Self Evaluation of CAS: Supporting strategic management

✦ Situation Analysis of CAS

✦ Assessment of S&T layout

✦ Plan and policy evaluation

✦ evaluation of S&T Innovation Base

✧ Institute Evaluation: to promote competition & development

✦ Overall quality evaluation

✦ Innovation capacity Monitoring

✦ Input-output analysis of institutes

✧ Specific Evaluation: demonstrating policy orientation

✦ Project evaluation

✦ Evaluation of human resource

✦ Evaluation of Laboratory

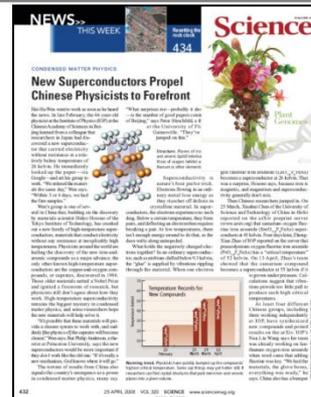
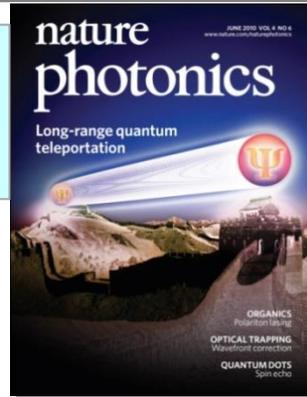
✦ Assessment of policy guidance

Since 2011, CAS has been building a major R&D outcome-oriented evaluation system.

The orientation of 6 types of major outputs

➤ **Solve major scientific problems:** to solve the widely acknowledged major scientific problems, or solve the scientific problems crucial in social or economic development.

Quantum
Teleportation



Series Research on
Iron-based
superconductivity

6
types

➤ **Create new research fields:** to establish a new cognitive frame, bring new theoretical frameworks, find new phenomenon or important materials with theoretical justification, to develop new approaches to verify theoretical hypothesis, or to invent new instruments leading to new research field.



Proving of
Mathematics
Mechanization



Deep UV Angle-
Resolved
Photoelectron
Spectrometers

➤ **Break through a key technology:** to make major technology breakthroughs in the industry, key technology breakthroughs in an emerging industry, new revolutionary technology in applied fields.



Laptop with Loongson CPU



Coal-to-Oil
Demonstration Plant

6
types

➤ **Provide a solution:** to provide user-oriented, systematic, advanced solutions by making crucial technology breakthroughs, and synthesizing several existing technologies; to creatively build and efficiently operate world class large-scale scientific facilities, which have become indispensable tools for major scientific findings or technical breakthroughs.

Ecological Rehabilitation
Mechanisms & Tech. in
Environmentally
Vulnerable Western Areas



Pilot Project of
Farmland Preservation
& Sustainable High-
Efficiency Modern
Agriculture

➤ **Achieve remarkable social or economic benefits: to develop, apply and disseminate S&T results, thus to create new standards or new industry or large-scale demonstrative applications, and bring great social economic benefits.**



“Dalian No. 1” Hybrid Abalone



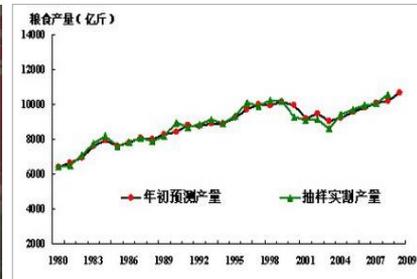
Red Flag Series Software

6

types

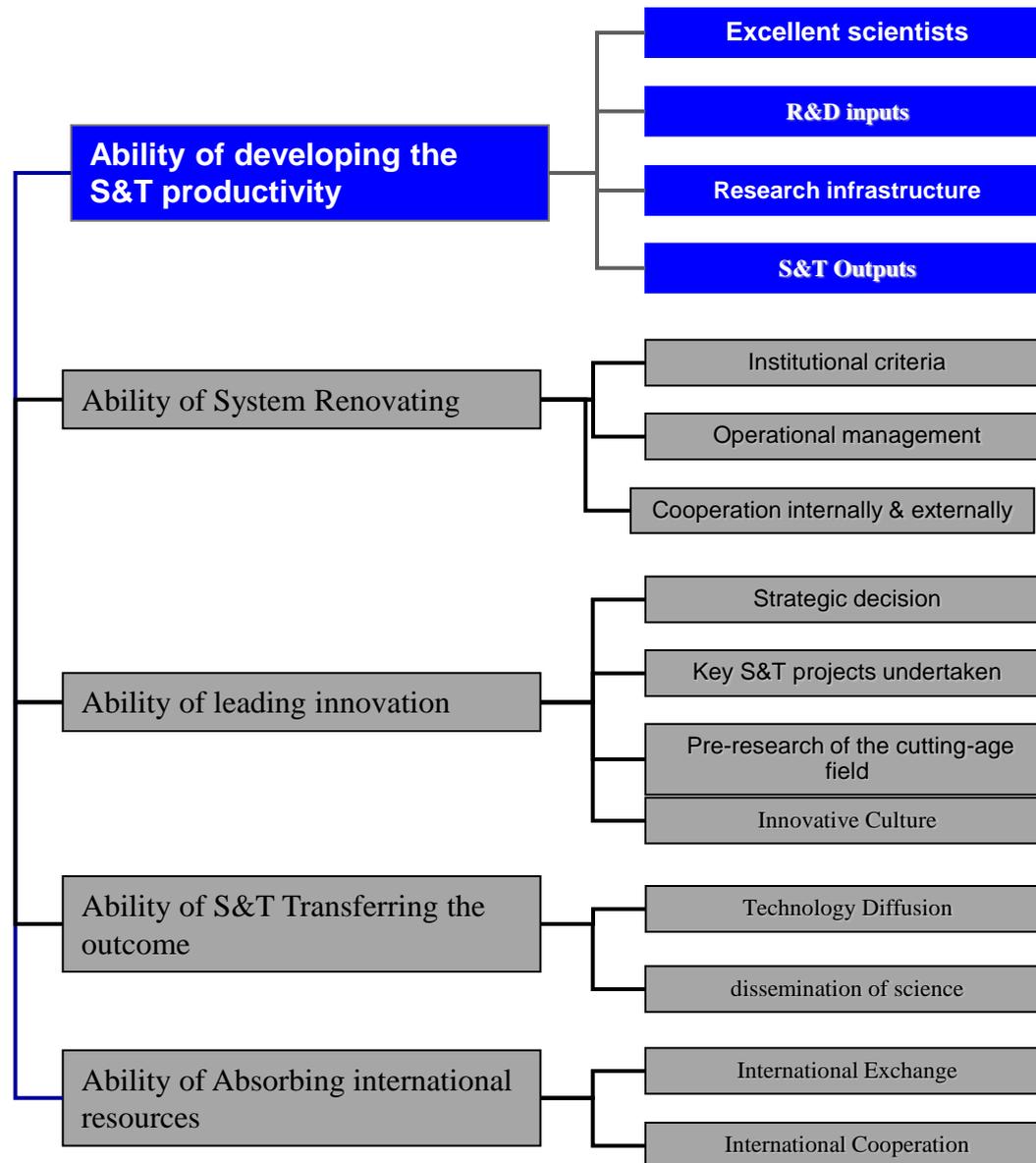
➤ **Provide significant and influential advice: to provide scientific advice and forecast on either strategic planning, or law formulation, or policy making involving major issues in social, economic, technology development with great impacts.**

Strategic Research on Roadmap of S&T Development to 2050



Forecast of the Nation's Crop Yield

Evaluation Indicators



1	Publications: papers, works
2	Academic Presentations
3	Awards
4	Patents
5	Copy right of software
6	New medicine, pesticide, new veterinary drugs , new fertilizer , new breed
7	Standards establishment
8	Consultation report
9	Technology transferring
10	Economic benefits of stock-owned enterprise
11	Social and economic benefits of technology transferring
12	graduates education
13	Postdoctoral training and academic visitors
14	Training and science popularization
15	Construction and maintenance large scale research equipment/platform
16	Significant innovation contribution
17	Project
18	Excellent research leaders
19	Infrastructure and capacity
20	Funds
21	Achievement of S&T goal
22	Policy implement
23	Building of innovation culture
24	Education

2015-Expert diagnosis assessment: Strategy Planning

Strategy of each institute includes clear positioning and priority areas of development, Evaluation of institutes focuses on breakthrough in 3 areas

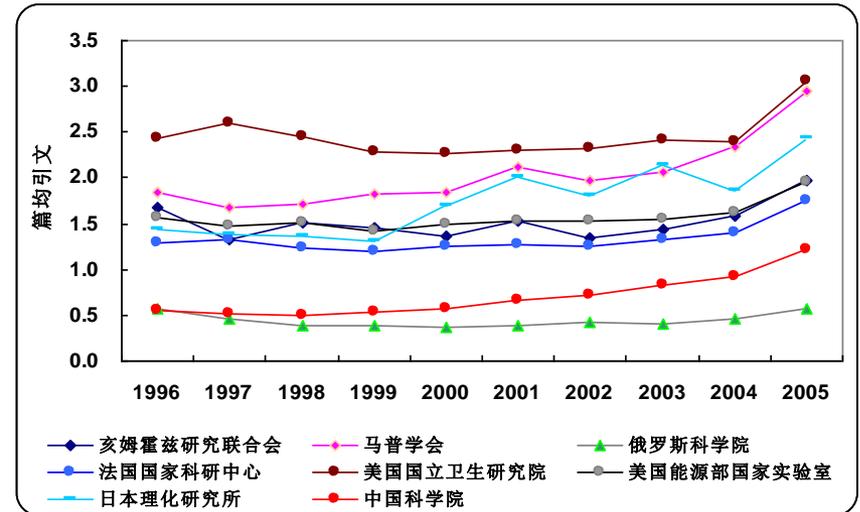
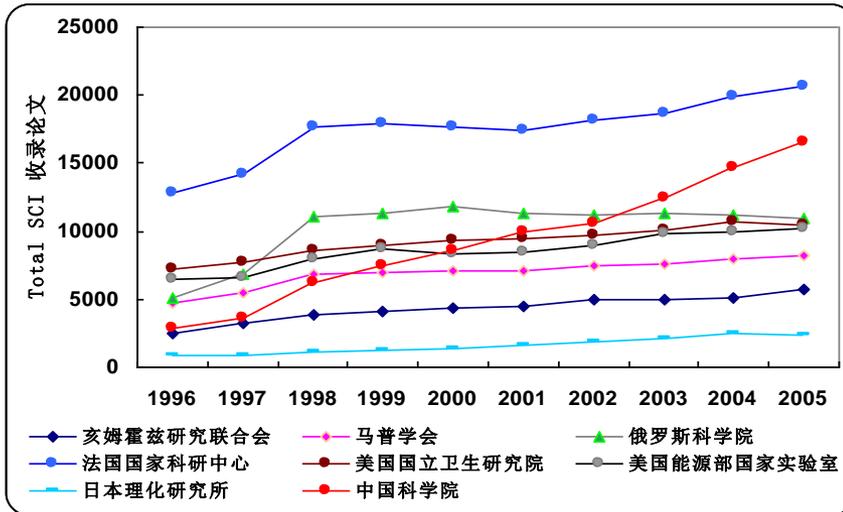
One	<ul style="list-style-type: none">⊗ One Aim indicates each CAS institute should specify its major research areas, unique features, core competitiveness, and anticipated position in international circles and should avoid homogenization with other CAS research institutes.
Three	<ul style="list-style-type: none">⊗ Three Major Breakthroughs indicate major basic, strategic and prospective S&T innovative achievements to be made in the next five to ten years; generally each institute shall raise no more than 3 breakthroughs.
Five	<ul style="list-style-type: none">⊗ Five Potential Directions indicate research priorities with unique features, a future competitive advantage and potential breakthroughs; generally each institute shall set no more than 5 priorities.

Dilemma in evaluation: Peers

- **Domestic: Peer review cannot truly realize its function In eastern culture.**
- **Abroad: There are difficulties in evaluating high-tech innovation work and to evaluate the quality of Institute's management**

- High-technology should be evaluated and examined by the market, by the society and by the user. So what's the role expert plays in high-tech evaluation?
- Evaluating the Institute is not merely to evaluate a program, nor is it just evaluation of the scientific outputs. The experts panel should include peers, management experts and stakeholders, but how can these experts to reach a consensus?

Dilemma in evaluation: indicators



- CAS used to give much emphasis on quantitative results, but now it pay more attention on quality. The number of SCI paper of CAS has already exceeded Max-Planck Institute, as well as many other research institutions. However, the frequency of citation is still at a relatively low level.
- In the recent years, the total number of papers of many high-quality Institute have tended to stabilize. Taking CAS of Physics Institute for example, it publishes about 40 articles in Nature, Science, PRL a year. When will the number of CAS publication reach stabilization?

Dilemma in evaluation: segmentation and convergence

- **Convergence is an approach to problem solving that integrates expertise from originally distinct fields to form comprehensive synthetic frameworks to address specific challenges.**
- **Convergent science is now an important trend around the world, Such as energy, advanced materials, information science and technology etc.**

- How to evaluate output and impact of convergent science? Traditionally we use papers and patents indicators to evaluate output in each disciplinary. How to assess the capabilities to solving specific challenges such as curing cancer, reducing carbon emission, etc.?
- How to evaluate the competitive of a country, a research organization, or a research group in specific convergent science fields such as life science, new energy, etc.?
- What are the effect measures to encourage scientists to address national or social need in convergent approach? As is known to us, scientists normally care about papers and addressing specific challenges is much harder than writing papers.