



# **THEORY AND PRACTICE OF STATISTICAL MONITORING ON THE SCIENCE AND TECHNOLOGY ADVANCEMENT IN CHINA**

**HE Ping**

By the Research Group for statistical monitoring and overall evaluation on  
China's science and technology advancement

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# includes

- ① the origin and background of statistics and monitoring on the science and technology advancement in China.
- ② guideline and main content on establishing a monitoring system for the index.
- ③ brief explanation of the monitoring method and standard.

# **The origin and background**

Since implementation of the Reform and Open policy, rapid development in China's economy and variety problems associated with it make people realize that science and technology advancement are the deciding factors in economic development. In the nineties of the twentieth century, both the central and local governments had put accelerating advancement of science and technology in a vital place for the economic development.

The intention is to transform economic development into a path which relies more on science and technology advancement and enhances labors' quality. To this end, how to correctly evaluate importance of science and technology advancement from statistics point of view, and how to evaluate impact of science and technology advancement on the economic development, become an interesting subject.

Regarding to this question, people will automatically think about Total Factor Productivity and Solow, as well as the equation of growth rate. Since the eighties of the twentieth century, after research on China's contribution to technology advancement done by the World Bank using TFP, there was a momentary upsurge of TFP calculation in China. However, since the limitation of the statistic data, such as the statistic data on reliable labor time is hard to come by, lacking the data on capital accumulation.

etc., the calculation results are not ideal.

Furthermore, there are some misunderstandings to TFP, which causes unrealistic comparison between regions and cities with different levels of development, resulting a great pressure to statisticians.

On the other hand, every level of the governments and science and technology departments urgently need a method which can effectively measure science and technology developments in different regions in order to assist decision process.

Therefore, starting 1993, former National Science Committee organized discussion among the experts; after extensive research and opinion polls, it is considered feasible to use multiple indexes and a combined evaluation method to monitor science and technology advancements of the nation and each province.

Since 1993, such monitoring has been going on for 14 years, comprising 3 periods:

- (1) trial period (1993-1996)
- (2) formally initiated and publicized (1997-2002)
- (3) revised new system (2003 – now)

Based on many years of practices of monitoring , it has achieved two following prominent results:

(1) it boosted the science and technology investments of every level of the governments, specially local governments, increased outputs of science and technology activities, accelerated speed of industrialization in new and high technology and put more emphasize on the transformation of the way of economic growth.

(2) it enhanced statistic skills of local branches and increased their analytical abilities and better served decision making for relevant departments.

# Guideline and Content

The guideline for monitoring of the science and technology advancement is as follows:

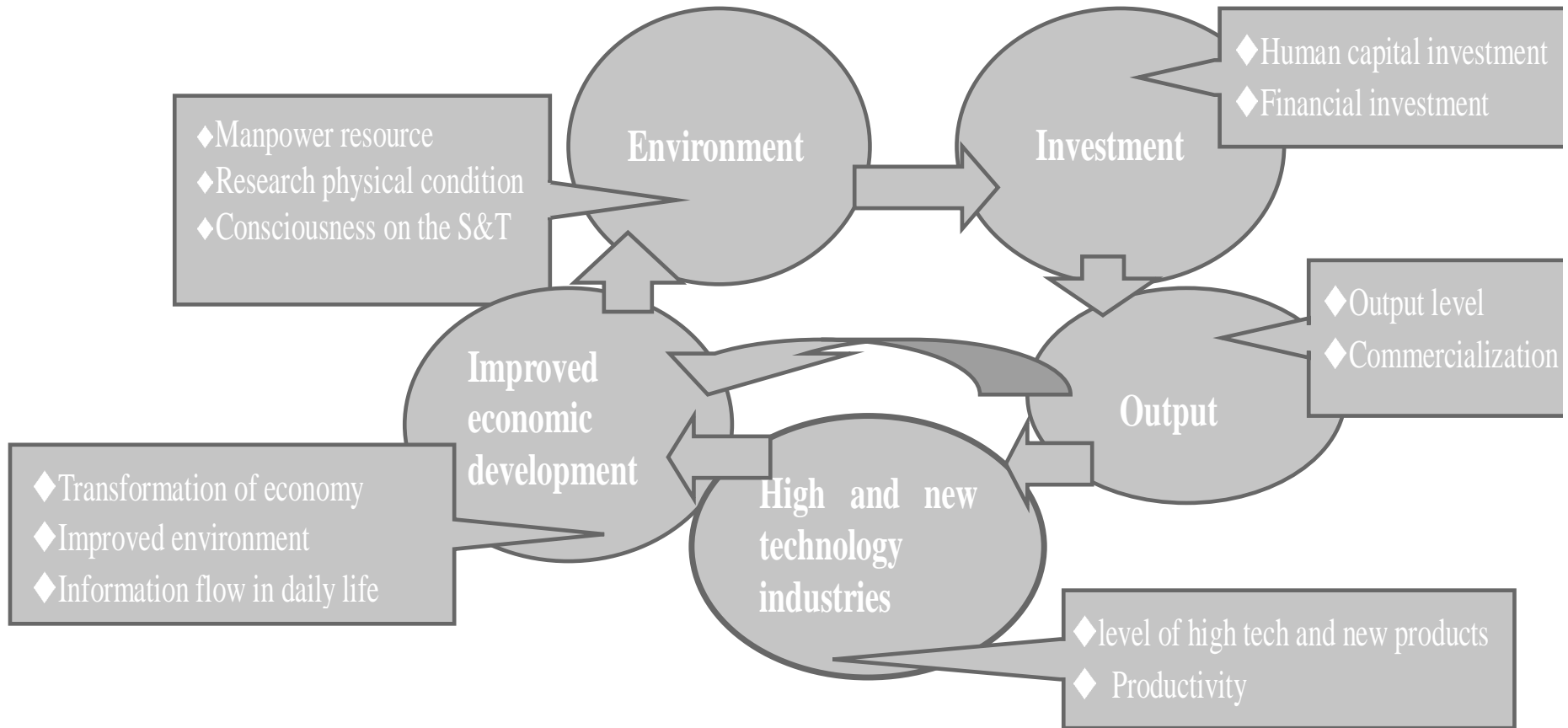
- Establish an index system which characterizes the science and technology advancements at every aspect and every level;
- Combine indexes of different levels to form an index representing the science and technology advancement at every aspect and every level, the final index is the total technology advancement index;
- Based on above index, evaluate the science and technology advancements for the nation and each region.

The key question for monitoring the science and technology advancement is to identify the subject being monitored, that is what is the science and technology advancement?

After discussion among the Research Group and consultation with many experts, the consensus is as follows:

The science and technology advancement means increased level in technology activities and technology accelerates economic development. The science and technology advancement of a country or region is embodied in 5 areas:

# Fig.1



# Fig.2 Three level indexes system

The first level index	The second level index	The third level index
Environment	Scientists and technicians	Technical personnel per ten thousand personnel
		Average years of education
	Physical condition	New equipment expenditure per R&D person
		Ratio of the increased assets due to researches and technology services to the increased assets of the society in general
	Consciousness on the science and technology	Number of patent application per ten thousand technical personnel
		Ratio of average salary of technical personnel to average salary of general public
		Money absorbed from technology trading per ten thousand

The first level index	The second level index	The third level index
Investment in the S&T	Human capital investment	Number of R&D scientists and engineers per ten thousand personnel
		Ratio of R&D scientists and engineers in the industries and corporation to that of the society in general
	Financial investment	Ratio of R&D expenditure to GDP
		Ratio between expenditure in technology and expenditure area of local Government
		Ratio between R&D expenditure in the industries/corporations and income from products sales
		Ratio between expenditure on absorbing and digesting technology and expenditure on technology import

The first level index	The second level index	The third level index
Output of the S&T	Output level	Number of theses by R&D scientists and technologists per ten thousand personnel
		Number of national scientific awards per ten thousand personnel
		Number of invention patents awarded per ten thousand personnel
	Commercialization	Cash amount achieved due to scientific and technology achievements
		Usage and permit fee for patents being exported to foreign countries by R&D personnel

The first level index	The second level index	The third level index
High and new technology industries	Level of high tech and new products	<b>Ratio between added value by high and new technology industries and added value by industries in general</b>
		<b>Ratio between exports of high tech and new products and export of products in general</b>
		<b>Ratio between from new products and from total product</b>
		<b>Ratio between technical of the high and new technology development region and overall income</b>
	Productivity	<b>Productivity of high and new technology personnel</b>
		<b>Growth rate of the high and new technology industries</b>
		<b>Ratio between growth due to the high and new technology industries and economic growth</b>
		<b>Percentage of tax income in the high and new technology development region</b>

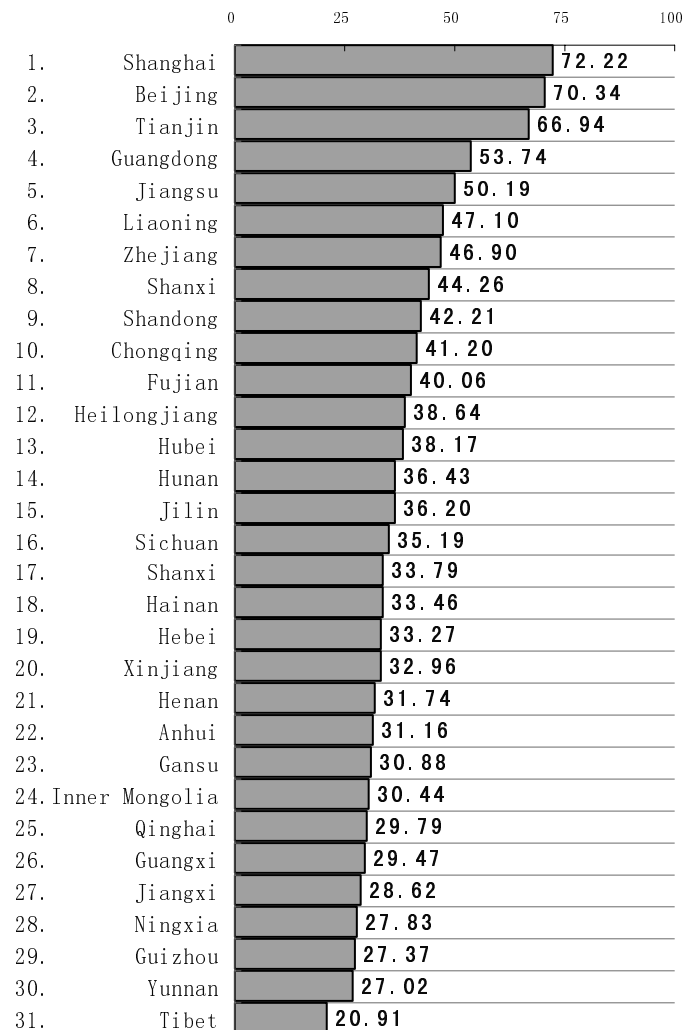
The first level index	The second level index	The third level index
Improved economy development	Transformation of economy	Labor productivity
		Increased GDP due to every hundred million Yuan
		Output/energy consumption ration
	Environmental improvement	Air quality index
		Index of treatment on environmental pollution
	Information flow in daily life	Color TV owned per million households
		Internet connections per ten thousand persons
		Number of fixed phones and mobile phones owned per hundred persons

# The monitoring methods and standard values

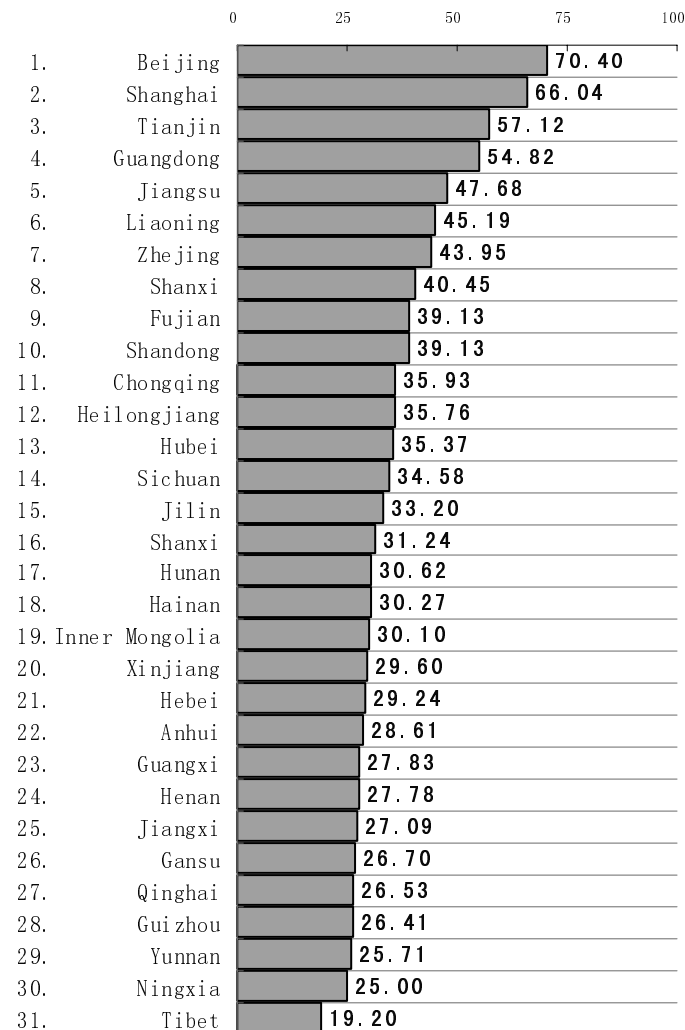
After the index system is established, these indexes are weighted by its importance through consultation with experts. Then the weighted indexes are combined to form a comprehensive index which is the measurement of science and technology advancement for provinces.

# the combined indexes for 31 provinces of 2004 and 2005

## 2005 combined indexes



## 2004 combined indexes



- Since 1997, such monitoring has been continued for ten years. Continued monitoring has accumulated relative complete statistic data, beneficial to analysis of national and regional development.
- In addition, local governments are paying more attention to the statistic monitoring on the science and technology advancement, which prompts them to increase technology investments and pay more attention to technology outputs, and it becomes one of important instruments in enhancing high and new technology progress.

- That's all my presentation.  
You comments and  
suggestions are welcome.

Thank you!