

131. China Popularization of Science and Technology Infrastructure development and trends

Ren Fujun, Li Zhaohui and Zheng Nian

China Research Institute for Science Popularization

No. 86 South Xueyuan Road, Haidian District, Beijing, 100081, P.R. China

renfujun@cast.org.cn; lizhaohui@ cast.org.cn; nzhjx@yahoo.com.cn

Abstract. In 2009, for the first time, China Research Institute for Science Popularization (CRISP) in conjunction with other units conducted a research project of monitoring and evaluation on China's PST infrastructure development status. Firstly, the author studied and established the overall evaluation index system for China's PST infrastructure development and six separate assessment index system for each category of PST infrastructure. Secondly, by using these evaluation index, Monitoring and evaluation on PST infrastructure was carried out and abundant detailed data were collected. Through the analysis of monitoring data, a comprehensive understanding of China's PST infrastructure development status was obtained. At last, a series of further analysis on both successful case studies and reasons for major problems were conducted, and then the Author proposed several solutions on relevant issues. On The basis of this study, Report on Development of China PST infrastructures in 2009, as the first annual report, was completed and officially published. These results can not only lay a solid foundation for annual monitoring and evaluation of China's PST infrastructure project in future, but also provide policy making support for accelerating China's PST infrastructure construction. And the author believes this research will be a precious reference for other countries and regions in PST infrastructure development.

Keywords: Popularization of Science and technology (PST) Infrastructures, development status and trend, monitoring and evaluation, index system

Introductions

'The science and technology achievement can play fully use for social development, only if it was grasped and applied by the whole society'. [1] This statement is exactly a description of popularization of science and technology course itself. According to a society survey in US, formal education is the main pattern to build up people's science literacy [2]. People are bound to leave school sooner or later, while the development of science and technology is permanent, hence PST infrastructure provide an efficient platform for people's lifelong-study and promote science literacy. By the fully application of all sorts of PST infrastructure, the lay public can learn S&T knowledge, grasp S&T methodology, build up a Science belief and maintain Science faith, then enhance their own science literacy, and finally promote their capability on dealing with practical problem and participating in public issues. Moreover PST infrastructure founds an important base for PST work, being the key component in the entire public service system and construction of national PST capability. [3]

The popularization of new S&T achievement among the society and promotion of public science literacy are all depending on the national PST infrastructure's widely construction, fully application and sustained development. To get the overview of the development status in China then to provide policy-making consulting for PST infrastructure's sustained development on macro-level view, 2009 China Research Institute for Science Popularization (CRISP) in conjunction with other units conducted a research project of monitoring and evaluation on China's PST infrastructure development status. Firstly, the research group established an evaluation index system for China's PST infrastructure development. Secondly, by using this evaluation index, the research group carried out a series of monitoring and evaluation work and abundant detailed data were collected. Through the analysis of monitoring data, a comprehensive understanding of China's PST infrastructure development status, best-practice experience and shortcomings was finally obtained and relevant policy suggestions were brought out. On the basis of mentioned findings, CRISP compiled and published a formal research report: "PST blue cover book • PST infrastructure development report in China of (2009)" [4]. At last, by combinative analysis of 2009 and 2010 surveys, the author analysis the feature of each category of PST infrastructure development, summarize the main problems and predict the development trend of PST infrastructure development in near future.

PST Infrastructure Development Status in China

Currently definition for PST infrastructure in China

What is PST infrastructure? So far, there is neither a specificity research focusing on the definition in PST theory field, nor a university acknowledgement in both China and abroad on the content of PST infrastructure. The author is not to launch a discussion on the definition and content on PST infrastructure, but to extract main problems from Chinese PST infrastructure development presently on a practical view. According to "PST infrastructure development strategy, 2008-2010-2015," [3], the majority of PST categories in china is including: science museum, grass-root science facilities, online facilities and other popular science education venues (such as the popular science education base).

Science and Technology Museums are those museums that are main means for the public to carry out the main function of science education and display natural sciences and engineering sciences and agricultural sciences, medicine and science content mostly the museum. Including the Museum of Science and Technology (Science Centre), Natural Sciences Museum (Natural History Museum, Planetarium, Geological Museum, etc.), engineering (professional) S&T Museum and so on.

Online science facilities (Digital Science and Technology Museum): mainly refers to the use of modern information technology, integration, development of science-related network resources to the Internet as a platform for the public on the popular science education infrastructure. Those are including a number of science museums, science websites, science channel and other comprehensive sites.

Basic science facilities: the main means of counties (cities, districts) and towns (street) and village (community), and other science within the show, to carry out science activities science venues (by). This kind of science facilities are including the popular science activity stations (center or activity room), community school science, science parks, science bulletin boards (Science Gallery), science caravans and other facilities.

Others (PST education bases): Relying mainly refers to the teaching, research, production and service institutions, which open for society and the public with specific science and technology education functions. Including cultural centers, Youth Palace and other cultural, educational venues; Zoo, Ocean Park, forest parks, nature reserves and other natural features with S&T education, history, tourism and other public places; research institutions and universities, laboratory, showroom or research centers, astronomical and Meteorological observatories, field observation stations; enterprises, rural and other production facilities open to the public (or processes), technology parks, exhibition halls, etc.; the other S&T education organizations or facilities which open to the public.

As one of the main science infrastructure in urban area, S&T museums are the cities' service center for S&T communication. S&T museums usually has relatively large scale, obtain ambulant science education resources and hold important positions among all sorts of PST infrastructures. As for the distribution of PST in China, PST infrastructure mainly locate on the grassroots level, these so called basic science facilities, with small construction scale and huge amount, played a "moisten things silently" role at the grassroots level for science popularization work. While online science facilities as a rising star, is developing rapidly, become the new force of PST infrastructure's construction and development. Other PST facilities (such as 'science popularization education base') are helping make full use of social resources of science facilities, play an important complementary and supporting role for PST construction and development.

Development status of PST infrastructure in China

Overall, PST infrastructure experiences a good momentum of development, undergoing a new wave of construction boom. According to recently survey, the PST infrastructure emerged as a rapid development trend on both form and scale aspect, with further expanding the scale of public participation.

Science and Technology Museum has become a more reasonable communication system, with scientists, engineers and the public stand on an equal exchange and communication platform. According to incomplete investigation by the research group, there are 582 Science and Technology Museums in China currently. Among them, there are 267 comprehensive S&T Museums, 122 industrial S&T Museums and 193 Museums of Natural Science. A diversity and wide range museum system has been formed, which is including Science and Technology Museums, Museum of Natural Science, Industry Science and Technology Museum (such as transportation museum, telecommunications museum, railways museum, geological museum and agricultural museum, etc.).

On national level, China now has one national comprehensive S&T museum, 33 Industrial Science & Technology Museums, 66 Museums of Natural Science. On provincial (ministry) level, there are 29 comprehensive Science and Technology Museums, while there are only three capital cities without a comprehensive Science and Technology Museum. There are 37 Industrial Science & Technology Museums and 53 Museums of Natural Science

53 on provincial level. As for prefectural (city) level, there are totally 128 comprehensive Science and Technology Museums, 30 Industrial Science & Technology Museums and 43 Museums of Natural Science. 109 Comprehensive Science and Technology Museums, 13 Industrial Science & Technology Museums and 23 Museum of Natural Science were built on county level.

According to the introduction of the “Science and Technology Museum building standards”[5], There are

9 especially large-scale comprehensive Science and Technology Museums, 18 large-scale integrated Science and Technology Museums, and 26 medium-scale comprehensive Science and Technology Museums. In 2009, there were about 30.2 million people visited permanent exhibitions, and about 670 million visitors visited temporary exhibition. However, there is still no comprehensive industry science museum in china and the gap between construction speed of Science and Technology Museums and pace of urbanization stays obvious.

Basic science facilities are divided into two major categories as fixed and mobile science facilities, which is constructed according to local conditions, flexible development and distributed throughout urban and rural areas. Fixed science facilities including the science activity stations (center or science activity room) located through streets, communities and towns, science schools, science parks, agricultural science service stations, science information stations, popular science bulletin boards (popular gallery) and so on. According to recently statistics, there are more than 270,000 science activity stations with the site area of more than 11 million square meters; 32 million science bulletin boards (Science Gallery), with a total length of over 2.1 million linear meters; over 2000 electronic bulletin boards science (Science Gallery), which can last more than one million hours. Current science facilities included science caravans, popular science show cars and other mobile facilities for science advocacy services. So far, the existing mobile science facilities in China include more than 1,400 vehicles and 270 science popularization caravans which are dispensed by CAST.

By the end of 2008 [6], there were totally of 1899 science popularization websites were built in China. According to the findings from a consecutive 3-months real-time monitoring conducted since March 2009 by Online Science Popularization Alliance, there were 600 online science popularization websites and 90% of them were running well [4]. Online science popularization concerns to more than 50 subjects, including mainly 5 fields as: natural sciences, agricultural sciences, medical sciences, engineering and technological sciences, humanities and social science. The founders of online science facilities are mainly composed by social organizations and Associations for Science and Technology on all levels. At the meantime, individual science popular websites got rapid development, science blog has become an interactively network for public participation in science and technology.

Science education bases in China mainly refers to the ‘popular science education base’ and ‘youth science and technology education base’, a ‘pyramid’ type framework has been formed among national, provincial, and municipal and county-level. There are more than 800 state-level science education bases, around 2,000 provincial science education bases, and more than 10,000 built on prefecture-level and county-level (without double counting, only the highest level of a complex statistical). The number of the popular science education base s in eastern part has accounted for more than half of the total number in the whole country, and the vast majority of the popular science education bases were built by high-tech enterprises, universities and research institutes.

Main Problems Facing the Development of China’s Science Infrastructure

Although the PST infrastructure in China has achieved a good development, but at the same time, PST infrastructure development still can’t meet the public demands on science and culture in the whole country. PST infrastructure’s healthy development is faced with many problems and bottlenecks, such as funding, policy issues, human resource and science resources shortage. To sum up, all of those problems mainly located in the following two aspects.

Balanced development

At present, China PST infrastructure is not only faced the problem of insufficient volume, but also faced the problem of imbalanced development. Shortfall can be solved with the development ,while if imbalanced development cannot be controlled and get a overall planning, these problems will persist and may become worse, resulting in uneven distribution of resources and coursing waste.

Balanced development has two aspects: regional imbalances and imbalanced development inside PST infrastructure framework itself. Imbalanced development can be divided into a nationwide problem of regional imbalance development and an imbalanced development in local area. Imbalanced development across the country is mainly due to the impact from local economic development difference. PST infrastructure development of eastern part of China present significantly better than central and western region.

Almost half of the country's PST infrastructure was built in eastern region, for example, over half of S&T museums were built in eastern China, but in western provinces such as Tibet and Gansu even in their capital cities, there is not any comprehensive S&T museum so far. (Hainan didn't have as well).that do not have a comprehensive Science and Technology Museum (Hainan did not.) Imbalanced development within the local area is that within the administrative divisions at the provincial level, prefectural (city) and county levels, large, medium and small scale S&T museums should maintain a balanced portion with development. On the basis of "Science and Technology Museum building standards", there are some cities built several large-scale Science and Technology Museums. Among different provinces, areas with better economic development are better than areas poor economic situation, and urban areas are better than rural areas.

China Science and Technology Museum construction has been prominent imbalance. Data shows that there are more Museums about Science class, while pharmaceutical museums and agriculture related museums are less than normal. There are only 8 comprehensive National Museums of Natural Science , the 'true 'planetarium is only one, and so far there is not a comprehensive science industry museum in China can play an important role in the history of museum development in the world.

Sustainable development

Sustainable development for PST infrastructure is to concern about the problems occurred during the sustainable development of PST infrastructure, including policy, funding, human resources, PST, resources, operation strategies and management system. According to the result of investigations, almost the entire PST infrastructure is faced with a sustainable development issue.

S&T museums in China were mostly built in last century. Most of the S&T Museums in China cannot display their full effect. How to make these venues to re-revitalize and maintain sustainable development has already become a problem to carry out the work of the current science popularization problems. At the same time, Science and Technology Museums are built newly or under construction, by past experience (if you do not correct past practice), will soon follow up and face with the sustainable development issues. Among all these issues, the primary problem is the lack of fund, and then the problem of insufficient PST human resource, operation strategies, management system and public regulation also can impact the sustainable development of PST infrastructure.

Compared to museums of Science and Technology, the popular science education base, grassroots science facilities (including the science popularization caravans), online science facilities are all faced with the problem of sustainable development, and the problems are still pointing to fund, science human resources, operation strategies ,management system and regulation.

Because there is no associated financial and policy support, science education base are reluctantly or difficultly to carry out science popularization services, that cannot result in ideal effect. As for primary funding status for the operation of PST facilities, some sectors can barely maintain to carry out normal science fares, very few sector can guarantee the sustainable development of their PST facilities, which including training and supplement, exhibits designing, updating and maintenance and so on. Take western regions with poor economic situation for example, even the cost around 100,000 a year to maintain the PST caravans; it is still difficult for the science education base to guarantee. On most occasions, and it depends on the personal ability of managers to find ways to raise funds, as much as possible to carry out science activities.

PST infrastructure Development Trend in China

According to 'Popular Science Infrastructure Development Plan (2008-2010-2015)' and currently development trend, Chinese science development trend in the future of the infrastructure are as follows.

PST infrastructure construction continues growing, to reach a relatively rational layout for PST infrastructure in China as a whole The government should play a leading role in PST infrastructure construction, and an overall strategic plan on

national level need be strengthen.

First of all, the government is trying to build up a rational layout for S&T Museums in different region of China. In municipal region and some counties which already obtained necessary conditions, a number of S&T museums with specialized themes, topics, and other distinctive factors are encouraging to built by government; Some qualified research institutions, universities, enterprises and small towns ,which has vital resources or local priority conditions, were asked to construct a number of professional development (characteristics) or industrial technology museums; To take full advantage of major construction projects or idle enterprises belong to state and out of used production facilities, some industrial technology class museum will be constructed in future.

Secondly, the government will further promote Research institutions and universities open to the society to

carry out science activities, promote Youth Palace, women and children activity center, parents-schools, culture palaces to add more science popularization content during daily service, encourage qualified enterprises to open their R & D departments production facilities (process) or Exhibition Hall to the public and to establish science sites; guide aquariums, safari parks, theme parks, nature reserves, forest parks, geological parks and zoological gardens to enhance their science education functions.

Thirdly, the government will promote the construction of county-level integrated science venues, which can provide PST education, training, exhibition and other PST service, across all of the country's counties (cities, districts) . Rooted in full use and integration of existing resources, the government have the plan to make more than 60% of the streets (township), communities (villages) can obtain a science activity stations (rooms), Popular Science Gallery (bulletin boards) will cover 60% of the communities and villages, and the S&T promotional content updating more than 10 times within a year; to increase popular caravan allotted number to 1,500 vehicles, and cover all of the prefectural (city, state) and the conditions of the counties (cities, districts); to press some qualified primary and secondary schools to built more conditions to establish Youth Science studio by use of existing education and training establishments .

The service performance of PST infrastructure infrastructures increased significantly and the opportunities for the public to promote their science literacy are of significantly increased as well

Full play the leading role of the government, from national level to strengthen the infrastructure of science to run the macro guidance. In accordance with "Science and Technology Museum building standards," do not have the development of education can not be fully functional or the role of science and Technology Museum renovation necessary; research infrastructure to develop science standards, identify measures, management regulations and monitoring and evaluation system, regularly carry out monitoring and evaluation, science by strengthening the infrastructure management to enhance overall service capabilities.

A substantive-development indemnify system of PST infrastructure was established

Relevant policies, regulations, fund, organizations and implementation, are all important guarantees to mobilize all social forces devoted into the development of PST infrastructure. Government should implement the state's relevant regulations and policies accompany with the further formulation PST institution system, improve the public PST infrastructure management system and operational mechanism to strengthen the operation management of PST infrastructure. The PST construction plan should be put into the national economy and social development overall plan accompany with the increase the portion of public input on PST facilities construction and operation fund. Put efforts to concretely carry out the existing tax incentives, to encourage enterprises, social groups and individuals get involved in PST infrastructure construction and operation management.

Conclusions

- (1) Briefly introduction on currently main types of PST infrastructure in China and the definition for each type was given.
- (2) A comprehensive and detailed analysis on development status of different sorts of PST infrastructure. According to data from recently survey, PST infrastructure has made significant achievements in China.
- (3) Two subject matters are the balanced development and the sustainable development for PST infrastructure in China.
- (4) Forecast for the development trend of PST infrastructure in China.

References

- [1] Hu Jintao. In commemorates at the Chinese Science association 50th anniversary congress's speech. 2008.12. 15
 - [2] John H.Falk, Martin Storksdieck and Lynn D.Dierking. Investigating public science interest and understanding: evidence for the importance of free-choice learning. Public Understanding of Science. Vol.16 No.4, 2007.
 - [3] National Development and Reform Commission, technical department, Ministry of Finance, Chinese Science association. Popular science infrastructure development project (2008-2010-2015).
 - [4] Ren Fujun. Chinese popular science infrastructure development report (2009). Social sciences literature publishing house. 2010.
 - [5] Constructs the sign (2007)166 number. Science and technology hall construction standard.
 - [6] The Ministry of Science and Technology of China. Chinese popular science statistics (2009). Science and
-

technology literature publishing house. in 2009.