# ENVIRONMENTAL STATISTICS IN CHINA

## Improving the Institutional Framework

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# Forword »

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Since its opening-up and reform, China has been in the process of rapid economic development with its people enjoying an increasingly improved standard of life. Meanwhile accompanying this dramatic economic growth is the degradation of environment which has, to some extent, damaged the gains of the opening-up and reform and prevented the economy from a healthy and sustainable development. The Chinese government is increasingly aware of that without addressing the environmental issues it is facing now will jeopardize its long term goal of the great rejuvenation of the Chinese nation. Given the magnitude and complexity of the environmental issues in China, there is no easy way in addressing them and the solution to them entails an equal priority being given to environmental protection, ecological conservation and economic development or even higher than the latter by mainstreaming the former into the overall socio-economic decision-making process. As a matter of fact, China has been in the struggle against environmental pollution since the very beginning of its economic take-off and trying to explore a pathway that could help address China's environmental issues in the way most suitable to China's specific circumstances.

In recent years, especially since the 12th Five-Year Plan period, the enhanced measures including legislation, policy, regulatory and economic means have been taken by the Chinese government in dealing with environmental problems, of which environmental policies have played an important role in this regard. Corresponding to this situation and in meeting the demand of governments at different levels for environmental policy tools, the environmental policy research projects on topics of a wide range have been conducted by some Chinese environmental research institutions including the Chinese Academy for Environmental Planning (CAEP).

CAEP founded in 2001 is a research advisory body supporting governments in the

development of key environmental planning, national environmental policies, and major environmental engineering projects. In the past more than 10 years, CAEP accomplished the development of the overall planning of national environmental protection for the 10th, 11th and 12th Five-Year Plan periods; water pollution prevention and control planning for key river basins; air pollution prevention and control planning for key regions; soil pollution prevention and control planning; and some regional environmental protection plans. In the same period of time, CAEP also actively engaged in research on such topics as green GDP, environmental taxation, emission trading, ecological compensation, green financing, etc. By so doing, CAEP has become an indispensable advisory body in the environmental decision-making in mainland China. According to *2013 Global Go To Think Tanks Report and Policy Advice* published by University of Pennsylvania, CAEP was ranked 31 in the field of environment in the world. Many of CAEP's research results and project outcomes regarding environmental policies have drawn great attention of decision makers and international institutions, and have been utilized to contribute to the formulation of national environmental policies concerned.

*The Chinese Environmental Policy Research Working Paper (CEPRWP)* is a new internal publication produced by CAEP for the purpose of facilitating the academic exchange with foreign colleagues in this field, in which the selected research papers on environmental policies from CAEP are set out on the irregular basis. It is expected that this publication will not only make CAEP's research results on environmental policies be known by foreign colleagues but also serve as a catalyst for creating opportunity of international cooperation in the field of environmental policies, and environmental economics in particular, with a view of both the academic research and practical policy needs.

This working paper is based on The Final Report of ADB's Technical Assistant Project (TA-8175 PRC: Improving China´s Environmental Statistics Institutional Framework) carried out by Chinese Academy for Environmental Planning in collaboration with the experts from Inter-Governmental Organizations (e.g. OECD) and national institutes (e.g. China's National Environmental Monitoring Center and South China Institute of Environmental Science). This project aims at reviewing the shortcomings of current environmental statistics institutional framework and draw on international experiences for reshaping the framework by proposing development roadmap and its implementation plan.

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# 1. PROJECT OVERVIEW

The Asian Development Bank (ADB) and the Ministry of Environmental Protection (MEP) of the People's Republic of China (PRC) have implemented a Technical Assistance (TA) project on improving the institutional framework for environmental statistics in the PRC[1]. Managed by ADB, a project team[2] consisting of national and international experts was set up to work over the period April 2013-July 2015.

The project team organized three workshops in Beijing (in July 2013, January 2014 and November 2014), as well as field visits within the PRC and in Europe[3]. It further produced three technical output reports:

- a review of international experience with environmental statistics systems;

- a survey and an implementation road map to reform the environmental statistics institutional framework in China;

- technical guidelines on accounting methods for livestock-related pollutants in China[4].

The project team finally prepared a road map for reform and a 'policy brief' offering conclusions and recommendations for China to reform its institutional framework for environmental statistics, taking into account

(i) the views of a number of national experts, including those participating in the multi-stakeholder consultation workshops;

(ii) the feedback and suggestions from officials from MEP and other relevant ministries or agencies (e.g. the National Bureau of Statistics);

(iii) international developments and experience on environmental statistics.



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# 2. INTERNATIONAL TRENDS, AND OPPORTUNITIES FOR THE PRC

Chinese environmental statistics are facing severe challenges. They have to meet three major evolving functions. First, decisions part of environmental policy and environmental management depend increasingly on quality environmental data support. Secondly, along with improved living conditions and environmental awareness, timely environmental information is needed to support public involvement in environmental matters. Thirdly, international responses to global and regional environmental problems require harmonized data, standards and methodology.

To meet these three functions, Chinese current environmental statistics need a very significant reform, as anticipated in the 2014 revision of the Environmental Protection Law, at working and technical levels and also at management and institutional levels. This was established by the project team on the basis of a careful review of Chinese environmental statistics: the actual progress already achieved and the opportunities for further progress. This was also established on the basis of a comprehensive survey of international environmental statistical developments in several countries (e.g. USA, Japan, Germany, France, Brazil, Russia, Canada, Mexico, the Netherlands, Turkey, Hungary) and in major international organizations (United Nations, World Bank, European Union and OECD), reviewing legal and institutional frameworks, management frameworks, conceptual and methodological frameworks.

The project has put forward a road map for reform and development of Chinese environmental statistics and a policy brief (including conclusions and recommendations).

## 2.1 Trends: an increasing demand for integrated environmental and economic information

With increasing interdependencies between environmental and economic issues, governments and enterprises increasingly integrate environmental and economic decisions. They need accordingly to rely on environmental and economic information at international, national and territorial levels, and to extend the scope of environmental statistics to relate to resource, energy and economic statistics.

1. At international, national and territorial levels, the range and depth of environmental statistical co-operation has greatly expanded, for instance to address global environmental issues, or to implement relevant international conventions and agreements (e.g. climate change, biodiversity conservation, trade). The UN Framework for the Development of Environmental Statistics (revised in 2014) provides a common basis

for the collection and release of harmonized environmental statistics.

2. Apart from supporting environmental policy and management decisions, the use of environmental statistics extends now to supporting sustainable development and green growth related decisions.

3. Environmental accounting has developed in liaison with economic accounting, in most developed countries and in some developing ones. Although this will produce operational results in the longer term, concrete results are available for selected accounts (e.g. water, forests, and expenditure accounts).

## 2.2 Trends: a modernization of the supply of environmental statistics

Along with other statistics, environmental statistics experience a modernization of their supply, due principally to more efficient management methods, to technological progress and to a growing provision of statistical services to users from civil society (enterprises, associations, citizens and academia).

1. Enterprise reporting methods are evolving: with direct reporting to public authorities for environmental statistical data, or with voluntarily reporting to the public (e.g. as part of enterprises environmental and social responsibility). This improves data timeliness and collection efficiency, by use of protected information networks or by use of internet. For some themes (e.g. agricultural environmental problems) information is obtained by general survey methods.

2. The remote sensing technology is widely used to acquire data relating to pollution and risk sources, land coverage and land use (e.g. agricultural and forested land). Geographic information systems and visualization software are more commonly in use. Information based on internet has exploded, including information competing with official environmental statistics. Recent concepts (e.g. big data thinking, 'Internet of Things') are emerging in the area of environmental data.

3. With the increasing orientation to user needs, visualized environmental information services and applications for use on smart-phones are expanding greatly, benefiting of these various technological developments.

## 2.3 Trends: institutional progress is driven by the policy demand side

Concerning the management and institutional frameworks for environmental statistics, have official environmental statistics are produced in the countries surveyed, either by the environmental administration as the lead national administration, or jointly by the environmental administration and the general statistical administration. In all cases, an independent body has been established inside or related to the environmental administration to deal with environmental data acquisition, management, analysis, release and applications. After data acquisition, this body usually co-operates with other relevant statistical bodies of other administrations (e.g. health, energy, transport, agriculture, statistics) to contribute to improved data quality and consistency among different data sources. Environmental statistics production is thus driven nationally by the data demand side. Over the last decades, co-operation on environmental statistics within international organizations has accompanied these national managerial and institutional developments.

## 2.4 Opportunities for China

The present study asserts that important opportunities can be seized by China, through an environmental statistics reform. First, important benefits can be derived from evidence based and more efficient environmental decisions, using improved environmental information and related analysis (e.g. physical and economic modeling, cost-benefit analysis). Indeed,

the environmental challenges faced by China are considerable, and recognized as such by Chinese authorities. Reducing air pollution can bring large health benefits (with increased labor productivity, reduced health costs, improved well-being). Reducing water pollution can lead to important health and ecosystem benefits. Improving waste management and developing a 'circular economy' can generate benefits from reduced consumption and decreased imports of raw material. Improving the protection of nature may lead to higher benefits from ecosystem services (e.g. reduced climate change and reduced flooding impacts). Improved prevention of technological and ecological risks should lead to reduced damage.

Secondly, the environmental protection law (revised in 2014) includes a chapter on "environmental information disclosure and public participation". Civilians, legal entities and other organizations are entitled to the right of access to environmental information and to increased participation in environmental protection processes. Accordingly, environmental protection administrations and other administrations with environmental protection and supervision responsibilities have (at all levels of governance) to disclose environmental information and improve public participation. Key pollution discharging units (e.g. of enterprises or municipalities) shall also disclose to the public: the name of major pollutants, the type of discharges, pollutant concentrations in effluents and emissions, total discharges and those in excess of regulatory standards, notwithstanding the

construction and actual operation of pollution prevention and control facilities. Such legal requirements will, once implemented, increase environmental statistical work and contribute to improved quality, timeliness and efficiency of environmental information.

In addition, there are important opportunities to be seized by the PRC in responding to: i) an expanding scope of environmental data needs with the unfinished and emerging national environmental agendas, ii) an expanding scope of international co-operation on environmental data, including a proactive PRC role regionally and globally, iii) the need to anticipate on future environmental data needs, iv) the need for a quantum change in resources to support environmental data developments and to harvest related technological advances and efficiency gains.

# 3. FRAMEWORK FOR THE ENVIRONMENTAL STATISTICS SYSTEM OF THE PRC

## 3.1 Demands analysis

Government departments are the subject of environmental statistics activities and also the key objects of service of environmental statistics data. They are mainly responsible for developing statistics systems, organizing statistical activities and carrying out analysis of statistics data and publication of statistical results in the environmental statistical process. This means that the government departments carry the double identities of both a data producer and a data user in the environmental statistical activities. The central government department (Ministry of Environmental Protection) is the producer and user of environmental statistics data at the highest level and plays its role in organizing the local environmental protection departments to carry out the environmental statistics activities following its requirements. In addition, the central government department is also a key developer of the national macroscopic policies. Therefore, the government departments as a user will be divided into central government departments and local government departments to separately discuss the pursuit of environmental statistics data of the two types of government departments.

In the current environmental statistics system, enterprises, as the grass root users of environmental statistics data, prepare and report environmental statistics data according to the requirements of the government departments. If the central government departments are the senior producers of environmental statistics data and the local government departments are the secondary producers, then enterprises are the primary producers of environmental data, which decide the success or failure of the entire pyramid of the environmental statistics system although they are located at the bottom level.

In the current environmental statistics system, the public is only reflected as a system user in the data publication process. After the environmental statistics activities are carried out by the government departments, the data is published and the public can have access to the environmental statistics data and are thus a beneficiary of the statistics system and also a consumer of the statistics data. In the social public, except the residents who are concerned about the environmental statistics data, there are also the news media, environmentalists and their environmental organizations providing environmental information to the public. They are also consumers of the environmental statistics data and use and disseminate the environmental statistics data by diversified means.

Environmental statistics data can provide quality service to the macroscopic decision-making at the national level while the prerequisite to quality data service is high quality environmental statistics data. Compared with the other users, the

governments are more demanding for high quality environmental statistics data, which, on one hand, provides powerful data supports to the governments' macroscopic decisions, and objectively reflects, on the other hand, the benefits of environmental management. Prior to the establishment of a policy, for example, the environmental statistics data can provide the governments with valid data references while, after the policy is implemented, environmental statistics data may become the basis for evaluating the policy benefits. Therefore, the quality of environmental statistics data is extremely important to government departments.

## 3.2 Analysis of statistics system

Environmental statistics activities should be carried out first under the restrictions of the Environmental Law, the Statistical Law and the relevant laws and regulations. In addition, environmental statistics activities also rely on assurances by environmental laws. Environmental laws or standards regulate the enterprises' behaviors of environmental protection, guaranteeing, to a certain extent, the standardization of the enterprises' production processes and facilitating the use of environmental statistics models for precise and convenient calculation of the pollutant emissions at the pollution sources.

The government departments bear the responsibilities for establishing economic policies, conducting macroeconomic control and allocating social resources. Therefore, it is necessary for the government departments to first identify their responsibilities in

environmental statistics activities and then develop corresponding management methods or policies based on their responsibilities. Then, based on their own needs for environmental statistics data, the government departments should develop the corresponding management system to assure smooth implementation of the environmental statistics activities.

In China, for example, a management system of "unified leadership and leveled responsibilities" is adopted. The Ministry of Environmental Protection, under the professional guidance of the statistics administrative department of the State Council, is responsible for unified management of the national environmental statistics activities, development of rules and regulations, standards and codes and work plans of environmental statistics, organization and implementation of scientific research of environmental statistics, planning and guidance of national environmental statistics activities and summarization, management and publishing of national environmental statistics. The specific activities are mainly carried out by the Statistics Division of the Emission Control Department of the Ministry of Environmental Protection and China National Environment Monitoring Center. The Statistics Division of the Emission Control Department of the Ministry of Environmental Protection is an environmental statistics management agency responsible for developing environmental statistics management regulations and organizing the development and supervises the implementation of environmental statistics

plans and programs. The Statistics Office of China National Environment Monitoring Center is an agency providing technical supports to the national environmental statistics activities and responsible for studying the national environmental statistics reporting system, designing reports and carrying out environmental statistics training, data collection and review among other activities.

In the implementation process, in order to assure the government departments' requirements of data quality, the implementation subproject will be defined first. The environmental protection departments should take the role and define and actually their own responsibilities in the environmental statistics activities and review and assure the quality of the data. Since the enterprises are both participants in environmental statistics activities and producers of data, the enterprises' responsibilities and obligations should also be defined in the implementation process in addition to the responsibilities of the environmental protection departments. Corresponding standards and regulations should be established and enterprise reports should be improved to regulate the enterprises' behavior in the environmental statistics activities and control data quality in the implementation process. Secondly, the environmental statistics procedure should be standardized. Environmental statistics is a complex activity and also an activity required to follow certain technical standards. Data comparability can be assured only if the data is acquired according to the same

technical method. Every step from data preparation, calculation and input to data summarization, submission and analysis must follow environmental statistics standard. Therefore, technical procedures covering the scope, objects and method of environmental statistics surveys and processing, review and submission and publication and analysis of environmental statistics data should be developed to implement process control over the environmental statistics activities. In addition, the government departments also need to consider the data checking methods and tools and establish a complete and effective data quality control system to review and evaluate enterprise data and realize the supervision of enterprise data quality.

## 3.3 Statistics framework design based on different statistics systems

### 3.3.1 The current framework

The environmental statistics system is currently conducted by NBS, MEP, in coordination with research institutes. MEP is mainly responsible for financing and defining the environmental data and application needs. NBS performs unified management of the national environmental statistical activities, development of rules and regulations, standards and codes and work plans, as well as organization of analyses, scientific research and planning, and aggregation, management and publication of national environmental statistics data. NBS, MEP and relevant universities and research institutes

assign technical experts, and establish a relatively stable Environmental Statistics Technical Expert Panel responsible for research in report systems, indicator systems and pollution emission calculation methods, and for carrying out specific tasks of data review and database management.

There should not only be clearly divided duties but also highly recognized cooperation among the three environmental statistics bodies. NBS, as the principal body, is responsible for collecting, processing and publishing data of all varieties and allowing the database to be shared by MEP after data review. MEP will use the database in analysis and application and its main function is to provide service for development, execution and evaluation of the environmental policies. The Environmental Statistics Technical Expert Panel is not only responsible for research in the statistics and statistical analysis theories and methodologies, but also focuses on analysis and study of

environmental data and provides support for general environmental statistics activities.

NBS includes two parallel administrative bodies, namely the Bureau of Statistics and the Statistical Survey Teams, which for one single operation system work jointly. The environmental surveys may be partly integrated with the economic surveys to have one single set of tables distributed to and prepared by enterprises where possible, with multiple statistical objectives.

After environmental statistics data are collected, the environmental statistics technical expert panel uses unified methods and principles to review the environmental data. This data must be reviewed level by level and in a strict way and is subject to mutual acceptance by the Environmental Statistics Technical Expert Panel and NBS before being finalized and allowed to be used. The national environmental statistics database is administered by NBS.

■ **Fig. 1   Structure of National Statistics Bureau**
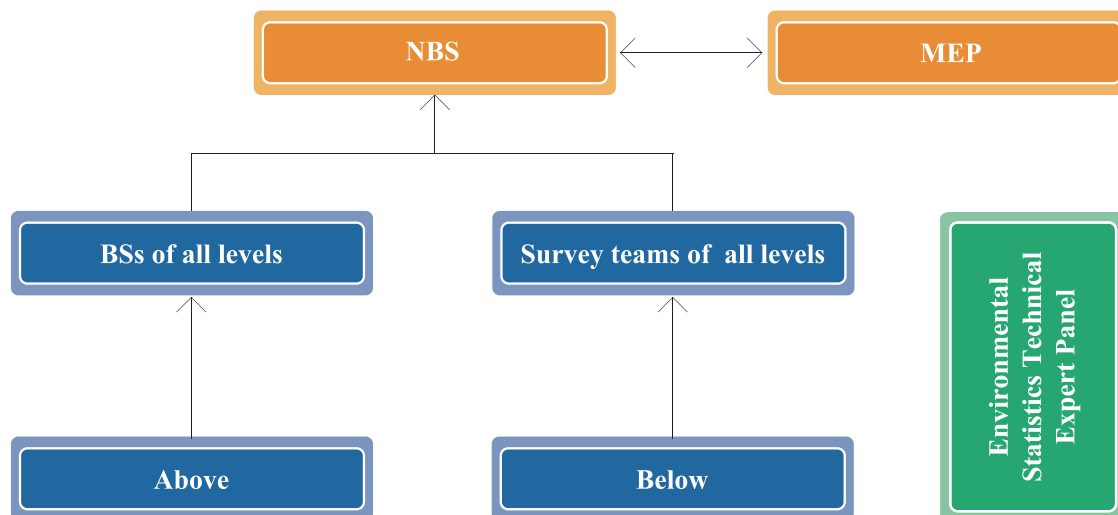
After the environmental statistics database is established, NBS will allow the database to be shared by MEP and the Environmental Statistics Technical Expert Panel. MEP is responsible for providing technical support to environmental management and environmental decision-making using the environmental statistics data. Therefore it proposes the scope, indicators and methods of environmental statistics to NBS. The Environmental Statistics Technical Expert Panel is responsible for applying the environmental statistics data in pollution source interpretation, environmental performance, environmental calculations and other scientific research activities. It brings continuous improvements and revisions to the environmental statistics report system, indicator system and review methods based on the needs of NBS, MEP and the public.

### 3.3.2 Three framework options for the environmental statistics reform of the PRC

Three framework options have been considered in detail to restructure the acquisition, processing and dissemination of environmental statistics, independently from the intervention of authorities (e.g. local authorities).

- A first option is to designate the National Bureau of Statistics (NBS) to develop the environmental statistics work, in co-operation with the environmental administrations (e.g. specifying the demands for data, offering technical support).

- A second option is to set up, within the MEP, a horizontal environmental statistics office to (i) develop environmental statistics, indicators and reporting; (ii) better coordinate the national and territorial environmental statistics works and (iii) co-operate with other administrations (e.g. NBS, Health, Water, Agriculture) as needed.

- A third option is to establish an Environmental Statistics Center associated to MEP, consolidating several existing environmental statistics functions in academies and relevant bodies. The Center should be responsible for environmental data acquisition, processing, management, dissemination, their use in analysis, secondary development of data and indicators, and capitalize on technology innovation. The Center should work as necessary with public partners such as NBS, and private partners such as enterprises. The Center should also improve the capacity and provide technical support for environmental statistics, as well as conceptual developments for environmental indicators.

In all three options, NBS would lead on environmental accounting (in the sense of national economic accounts and SEEA). Concerning the choice among the three options, it is important: i) to ensure

independence and credibility of the statistics, statistical products and services; ii) to ensure both efficiency as well as enhanced and varied sources of financing; iii) to modernize the pollution monitoring system for both physical and economic data; iv) to capture the benefits of ever changing technology; v) to provide leadership in capacity building within the environmental statistics community and beyond; vi) to give attention to data for present purposes as well as for future needs and for disclosure towards multiple user needs. On the basis of these criteria and international experience, the project team prefers the second framework option.

# 4 REFORM ROAD MAP AND REFORM OBJECTIVES

## 4.1 Reform objectives

On the basis of the analysis of the international trends and the situation and opportunities concerning environmental statistics in the PRC, the study proposes the following reform objectives for an environmental statistics reform in the PRC:

- 1. Safeguard the independence of environmental statistical activities;

- 2. Accelerate the modernization of environmental statistical means;

- 3. Promote the specialization of environmental statistical business;

- 4. Ensure high efficiency in environmental statistical work;

- 5. Improve the timeliness of environmental statistical services.

### 4.1.1 Environment statistical independence

Environment statistical independence refers to the production of useful and high-quality statistics at each level, without any hindrance or manipulation due to political purposes, or any interest group; similarly the means and schedule for publication should not encounter any interference.

This requires first to apply the legislative and regulatory means to enhance environmental statistical independence, and specifically to: (1) incorporate the environment statistics into the Environmental Protection Law: as a basic task during environmental protection, without government intervention in environmental statistics activities; with expanded legal responsibilities for counterfeiting or tampering environmental statistics; (2) formulate and implement 'Regulations on Environmental Statistics', to further define the status and independence of environmental statistics, to strengthen the authority of environmental statistical investigation, and to specify responsibilities for environment data quality, as well as sanctions for falsification; and (3) strengthen the enforcement of the Statistics Law, and intensify the responsibilities and sanctions for undue interventions in the data production process.

This requires secondly to build an environmental statistics system conducive to independence (e.g. from the environmental protection authority, from local governments), and specifically to: (1) form a statistical entity with high independence and comprehensiveness; and with the environmental authority mainly responsible for presenting the environmental information demands, while the statistical entity is responsible for organizing statistics work, information production and release; (2) strengthen guidance and supervision from the superior statistical department to the inferior statistical department, and build cross-regional regular and expert supervision mechanisms, based on the highest supervision centers, so as to ensure

consistency between superior and inferior environment statistics processes and data bases; and (3) strengthen external supervision and information disclosure of environmental statistics, with participatory mechanisms for social organizations; invite institutions related to environmental statistics, such as industry associations and universities to participate in the environmental statistics review and audit; establish third party reviews; strengthen environmental information disclosure and public participation in environmental statistics.

## 4.1.2 Modernization of environmental statistics means

Modernization of environmental statistics means refers to reforming and innovating environment statistical work, with advanced means from modern science and technology, making the whole process more convenient, intelligent and efficient.

### Modernization of data acquisition

Environmental statistics shall keep pace with developments of the modern information society, widely employ modern information technology, make full use of electronic tools to collect basic data, make full use of electronic records from all sources in the national economy and relevant government departments, promote the use of portable electronic terminals to collect data, establish networks and databases for basic data reporting, processing, storage and sharing.

### Modernization of data reporting

Statistics reporting means should positively use modern information technology, setting up safe, smooth, convenient and efficient on-line reporting, establishing common operation modes, so that all respondents submit directly basic data to local environment authorities on line, and statistical entities at each level share such data online, thereby guaranteeing an independent surveying, reporting and oversight from statistics institutions.

### Modernization of data review and summary

Computer technology and network technology can help: develop safe and stable online data-audit mechanisms, set and specify the review contents of the environmental statistics department at each level according to the different users, realize whole-process tracking from audit to feedback and modification at the levels of enterprise, county, city, province and state. All this is conducive to defining the responsibilities in the process, trace the history of data modifications, and provide the quantitative basis for assessing environmental statistics.

### Modernization of data release and analytic application

Data release and applications can be modernized by: enriching the contents of data transmission, broadening the channels of data transmission, and forming comprehensive transmission routes, such as news conference, statistical bulletin, network, newspaper, yearbook and magnetic products, so as to meet demands for all kinds of subjects; build the quarterly analysis system of environmental and economic situations, improve the analysis system of annual

environmental pollution situations, take advantage of abundant information resources to deepen analysis on hotspots and key issues of the economy and society according to key environmental fields and issues, strengthen the understanding of grass-root investigation units, strengthen the tracking, monitoring and analysis on global environmental issues, so as to provide valuable and specific analysis report and consulting advices for environmental management.

## Modernization of data investigation means

Full use of the spatial information technologies, such as remote sensing (RS), global positioning system (GPS) and geographic information system (GIS), can bring multiple benefits as: support the remote collection of environmental information and remote monitoring of various environmental, economic and social activities, which in turn can provide more scientific and efficient means of investigation, means for pollution census and ecological resource statistics; utilize the Internet of Things technology of the big data era and various information sensing equipment to collect economic information on sound, light, heat and electricity, automatically obtain much physical information related to industrial activities, so as to provide more reliable data for environmental statistics; take advantage of various domestic and foreign environmental and economic models to simulate pollution emissions and changes of the diffuse sources, such as agricultural and traffic sources; finally form a modern survey method combining door-to-door survey, macro accounting

models and spatial simulation.

## Modernization of database management

Cloud computing technology can be used and multiple computational entities integrated at relatively low costs into an underlying architecture with powerful computing capacity through the network, so as to achieve better allocation and full utilization of the computing resources for environment statistics. In this way, the environment statistical database can not only be shared among enterprise, government and the public, but also stored and managed in a safe and orderly manner.

### 4.1.3 Specialization of environment statistical business

Specialization of environmental statistics business refers to the standardization and normalization of the statistical process, and the professional specialization of environmental statistical staff. It mainly ensures that the work on environmental statistics is by professionals according to standards and norms, thereby ensuring confidence in environmental statistical data.

This requires first, in accordance with the Statistics Law, its 'Ordinance on Sanctions against Violations of Laws and Disciplines in the Field of Statistics' and the Environment Protection Law, to further improve the basic legal and regulatory system for environmental statistics in China. In particular to improve its inspection, investigation and sanction system against law-breaking cases; to establish an appointment system for relevant local leaders

taking into account serious problems of data quality, and to coordinate between statistics entities and environmental protection bodies during investigation and sanction about statistical violations; and to carry out various actions of information and education about the legal basis for environmental statistics.

Secondly, environment statistics standards should be improved. In particular: to establish a set of standards from data collection to reporting, audit, summary, analysis and application, and set up a directory of environmental statistics standards with dynamic updating; to formulate the Catalog of Product and Technology Classification for environmental statistics; to prepare classification codes for important indicators, such as pollution source, pollution control facilities, pollution control method and basin; prepare the meta-data for major environment indicators; to formulate the reference document for Standardization of the Environmental Statistics Capacity Building; and to ensure that environment statistical institutions, staff and expenditure meet the needs of environment statistical investigation.

Thirdly, the environment statistical workflow should be normalized. In particular: to normalize environment statistical survey and design processes; to fully listen to opinions of statistical users, grass-root statistical institutions and the respondents; to organize systematic expert reviews; to improve the investigation process for environment statistics, formulating the unified state statistics investigation procedures; to define the specific performer of each link from data acquisition to report, process, audit and summary, as well as arrangement, submission channels, working modes, schedules and quality requirements; to improve the post-responsibility system of environmental statistics for administrative institutions and the technical support unit at each level; to formulate standardized procedures and specific provisions for investigation by environmental statistics staff; to improve the specification on statistical work at the grass root level; to formulate 'Specification for Environmental Statistics Institution at Each Level'.

Fourthly, comprehensive data quality control should be strengthened. In particular: to improve the comprehensive quality control system for environment statistical data; to revise the data quality control methods for industrial sources, agricultural sources, urban living sources, motor vehicle and centralized pollution control facilities; to further environmental statistics investigation and total quality control from data collection to data review, process, aggregation and reporting; to formulate the Measures for Environmental Statistics Auditing and Assessment, scientifically assessing data quality according to logical relationships between the statements and between indicators; to establish an audit system for source data regularly checking the basic situation and main data for key enterprises, and regularly evaluating the data quality and the basic work concerning basic sectors.

Fifthly, the specialization of environmental statistical staff should be strengthened.

In particular: to establish a qualification management system for staff; to formulate Measures for the Management of Environmental Statistical Staff stipulating their required professional qualifications in detail; to encourage in some specific areas the employment of specialized statistical staff; to establish and improve incentive mechanisms for staff; to establish a relatively complete statistical training, education and scientific research system; to co-operate with a well-known universities or scientific research institutes to train specialized personnel; to establish a national environment statistical society; to establish a database of environmental statistical experts to provide overall technical guidance, to conduct thorough research on pollution and data auditing, and to put forward the orientations for reform and innovation for environment statistics.

### 4.1.4 Efficiency of environmental statistics management

Efficiency of environmental statistics management refers to mainly improve the scientific quality and the efficiency of the whole environment statistical management, through explicit responsibility definition and appropriate design of operations, recognizing the costs of operation and the different statistical activities.

First, management of the environment statistical plan should be strengthened. An effective plan can ensure continuity and standardization of the work. A scientific and reasonable annual plan (and related strict plan assessment) can promise work to proceed smoothly and to be completed on time. Medium and long-term environmental statistics planning can promote a more scientific, modern and efficient statistics development and management. Generally, such a plan consists of a range of organizational changes concerning: targets for each statistical work processes, balance of the statistical funds, staff composition, processing information technology and database development. This is conducive to improved transparency, continuity and consistency of statistical work, as well as of its explicit financing and overall efficiency.

Secondly, the statistical functions of different sectors should be defined. In particular: to clarify the responsibilities of environmental authorities and authorities of other sectors, as well as the division of responsibility between the environmental statistics sector and the environmental authority. It is suggested to realize this through preparing, revising and improving the existing laws and regulations, and in addition, to specify third party role and public participation in environmental data generation, so as to reduce interference of local governments. In addition, it is necessary to divide the scope and responsibilities of environment statistical works among statistics institutions, to avoid overlaps.

Thirdly, a sound coordination mechanism should be established, internally and externally. Internally, the coordination within the departments for environmental statistics covers the following aspects: (1) to coordinate relationships among various processes in

the environmental statistics departments, such as data collection and data analysis; (2) to coordinate the relationships between the technical support unit and the management department, with timely and clear statistical demands to the technical support unit; (3) to fill the no man's land between management and technical support units during statistical works by appropriate statistical panel and problem solving expertise.

Externally, the coordination with other departments covers the following aspects: (1) to coordinate with other departments (under the MEP), so that the statistics entities keep close contact with users, and fully play a service-oriented function. In addition to coordination in accordance with the law, the environment statistics department should establish normalized coordination mechanisms with the relevant parties; (2) to coordinate with other departments (not under MEP), such as NDRC, Agriculture, Water, Health, Public Security. On the one hand, requirements shall be coordinated among external sectors before statistical work, but on the other hand external coordination shall remain during data collection and audit, when it can shorten data collection and audit processes and thereby significantly improve efficiency. External coordination may involve data demand, statistical methods, and data sharing mechanisms, so as to reduce duplication in surveys and thus workloads.

## 4.1.5 Timeliness of environmental statistics services

Timeliness of environment statistics service refers to the need for the environmental statistics entities to report in time to the superior environment statistics entities and to release information to the public in a timely manner.

First, to improve the timeliness of data submission requires in particular: to further simplify the statistical statements, streamlining the indicator system, optimizing the pollutant calculation methods, reducing the reporting burden of the local environmental authorities and enterprises; to optimize direct on-line reporting, taking into account available hardware, software and network security; to strengthen the data-reporting responsibilities and the evaluation of the performance of different departments and enterprises.

Secondly, to ensure timeliness of information disclosure requires: to further elaborate and implement information disclosure responsibilities among different bodies; to make provisions specific to the contents, means and timeliness of information disclosure; to strengthen the administrative supervision mechanism of information disclosure, and; to ensure a full role of the third party and public participation supervisory mechanism.

Thirdly, to improve timeliness of the environment statistical services requires: to timely prepare the data analysis report, to respond to the key demands for environmental management; to strengthen the analysis on the quarterly direct reporting of environmental data and the comprehensive analysis based on environmental and

economic data; to launch secondary services of environmental data products with high visibility, particularly using environmental statistical data in combination with RS and GIS data.

## 4.2 Reform roadmap and action plan

Establishing such an independent, modernized, specialized, efficient and timely environmental statistical system will require institutional and technological innovation to meet the information needs: of environmental policy and management decision making; of other user needs from civil society; and of international co-operation on global and regional environmental issues. For each of these reform objectives the reform road map proposes immediate and subsequent sub-objectives. The road map applies to the second and third framework options described above.

– Photo by Wang Guobo

## 🍃 Proposed roadmap for China's environmental statistics reform

| REFORM OBJECTIVE | IMMEDIATE SUB-OBJECTIVES | SUBSEQUENT SUB-OBJECTIVES |
|---|---|---|
| 1.Safeguard the independence of environmental statistical activities | Propose legislation on environmental statistics and define the independence of related activities within this law<br>Draft regulations on environmental statistics<br>Draft specific regulations on disclosure of environmental statistical information under the Law of Environmental Statistics | Establish the integrated environmental statistical body with high independence<br>Promulgate and implement regulations on environmental statistics<br>Establish third-party oversight mechanisms and strengthen public participation and information disclosure |
| 2.Accelerate the modernization of environmental statistical means | Launch the network of direct reporting and the related annual report<br>Establish pollutant electronic records by source and their dynamic upgrading. Strengthen the construction of the environmental statistics "cloud management" platform<br>Initiate and intensify the study on i) the use of remote sensing, GIS and Internet technology for environmental statistical data acquisition and analysis and on ii) related applications | Make full use of remote sensing, modeling and other means. Expand the range of the survey of environmental statistics and improve the survey method<br>Build visualized environmental data management system and display platform<br>Establish environmental statistics and information service system to meet the needs of different users. |
| 3.Promote the specialization of environmental statistical business | Establish a complete set of environmental statistical standards and issue related guidance for capacity building<br>Formulate a classification code for pollution sources and key indices<br>Standardize the workflow for environmental statistics, and formulate i) the Code for the work of environmental statistical authorities (covering all levels), ii) the Methods to verify environmental statistics, and iii) the Methods to evaluate the quality of environmental statistics<br>Formulate the measures to strengthen the capacity for the administration of environmental statistics and establish the National Association of Environmental Statisticians and the Expert Consultation Committee. | Establish and improve the environmental statistics standard system<br>Establish the environmental statistics consulting system<br>Establish the environmental statistics technical specification system<br>Establish the environmental statistical data quality management system |
| 4.Ensure high efficiency in environmental statistical work | Formulate the environmental statistics development plan and annual implementation plans<br>Co-operate with other administrations (e.g. NBS, Agriculture, Water, Health, Public Security), to design an environmental statistics steering committee and environmental statistics coordination among relevant administrations<br>Specify obligations and responsibilities of investigators and respondents under the Law of Environmental Statistics<br>Establish an internal environmental statistics coordination mechanism | Form an environmental statistical development planning and programming system<br>Establish a statistical working system with clear responsibilities and efficient operation<br>Establish the environmental statistics steering committee, and strengthen environmental statistics coordination |
| 5.Improve the timeliness of environmental statistical services | Add rewards and sanctions for timely reporting under the current environmental statistics reporting system<br>Specify the relevant provisions on environmental information disclosure under the Law of Environmental Statistics<br>Intensify environmental data analysis, application and secondary data development<br>Accelerate the use of data of the direct reporting system | Build visualized environmental information management and release system<br>Build an environmental information sharing platform and achieve data sharing and real-time inquiry arrangements by use of mobile terminals and networks<br>Produce authoritative and influential statistical analytic reports and information products |

# 5 POLICY BRIEF: CONCLUSIONS AND RECOMMENDATIONS

## 5.1 Progress achieved and progress needed on environmental statistics in the PRC

### Progress achieved

Important progress has been made in the PRC since the 1990s in the development of environmental information. PRC has improved its environmental statistics, monitoring and information to better understand and assess the environmental challenges generated by (i) the high environmental pressures from rapid economic growth; (ii) the implementation issues of its overall environmental legislative and policy frameworks and (iii) its commitment to implementing its international environmental obligations.

For instance, the MEP (and its predecessor, the State Environmental Protection Agency, SEPA), have published an annual compendium of environmental statistics, an annual state of the environment report since 1991, in both Chinese and English. It has also published an annual environment yearbook (in Chinese and English). Together these three reports[5] provide comprehensive national information; only a few other countries in the world have the equivalent publications yearly. The national state of the environment report covers water, the coastal and marine environment, atmospheric and acoustic conditions, as well as waste, radiation, land resources, forests, grasslands, biodiversity, climate change, and natural disasters. It also covers selected topics changing over the years. Environmental Protection Bureaus, under the supervision of MEP at provincial and other administrative levels, do publish regular state of the environment reports and environmental information in various forms, including environmental statistics.

In addition, the National Statistics Bureau publishes in its annual 'China Statistical Yearbook' a section on environmental statistics, building on the MEP's environmental statistics and data from several other ministries and administrations. More recently, many large cities have reported on their environmental conditions (e.g. for $PM^{2.5}$). This information is increasingly available online. Overall, all this provides with a solid experience and basis for further progress with environmental statistics.

### Progress needed

However, and despite these achievements, this report and its recommendations suggests that PRC's environmental statistics urgently require a deep retrofitting of its institutional,

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**NOTE**

[5] Annual Compendium of Environmental Statistics, State of Environmental Protection Agency, 1991
Annual Environmental Yearbook, State of Environmental Protection Agency, 1991
Annual State of Environmental Report, State of Environmental Protection Agency, 1991

management and methodological frameworks to catch up with the most advanced international standards and to play efficiently their role (i) in supporting the full breadth and depth of environmental policies development, implementation and assessments; (ii) in supporting the integration of environmental policies with other policies (e.g. agriculture, energy, transport, fiscal policies), in the context of rapid economic growth; (iii) in accompanying international environmental co-operation; and (iv) in supporting, within the PRC, information and communication exchanges among authorities, enterprises, associations, citizens and the scientific community.

The report and its recommendations' also note that there is a positive policy context to implement these recommendations as appropriate, with (i) the newly revised Environmental Protection Law, (ii) the preparation of the 13th Five-Year Plan, and (iii) international developments (e.g. major international environmental conventions such as the Biodiversity and Climate Change conventions, post 2015 Sustainable Development Goals following the Rio+20 Summit[6]).

## 5.2 International developments

The following international trends have been identified by the project team, on the basis of its assessment of the experience with environmental statistics in three international organizations (i.e. the UN, the EU and the OECD), and ten countries (i.e. USA, Japan, Germany, France, Brazil, Russia, Canada, Mexico, Turkey, Hungary). This assessment considered the legal and institutional frameworks, management frameworks (co-operation among public institutions, co-operation among public and private institutions, efficiency and financial arrangements), conceptual frameworks, and methodological frameworks (relating to data quality, data interpretation and use) for environmental statistics.

**An increasing demand for environmental statistics, relating to economic, energy and resources statistics**

The increasing interdependence of environmental and economic issues leads to an expanding demand for environmental statistics at global, regional and national levels; environmental statistics are more and more interconnected with economic, energy and resources statistics.

The scope and depth of international co-operation concerning environmental statistics has grown at global, regional and national levels. This is due primarily to the increasing importance of global environmental issues (e.g. sustainable development, climate change) and the need to implement relevant international conventions and agreements with harmonized environmental information

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**NOTE**

[6] UN 1992 Convention on Biological Diversity, UN 1992 Framework Convention on Climate Change, UN post 2015 Sustainable Development Goals (under preparation).

and reporting. The 'Framework for the Development of Environment Statistics'[7] was provides for harmonizing environmental data collection, release and sharing.

The scope and use of environment statistics within countries has grown from infancy to maturity, supplementing economic and socio-demographic statistics. It not only supports management and policy decisions concerning the environment itself, but also the measurement and evaluation of sustainable development and green growth, in the context of large data thinking. It has evolved to include economic information (e.g. prices, taxes), cost of inaction, and green innovation.

Environmental data increasingly feed physical environmental accounts, which are being connected to economic accounts (e.g. SEEA[8]). In a number of developed countries, some independent accounts have been established for sectors such as water, waste, forest, expenditure, further improving the environmental information.

While core public funding of official environmental statistics is standard, there is a range of additional funding sources according to countries. Some apply the polluter pays principle for monitoring activities of private firms or local authorities. Some apply a commercial fee to their publications.

## A growing co-operation with enterprises and an increasing attention to user needs

Concerning statistical methods, enterprises play an important role in data production, acquisition, and release. This is according to their self-interest (self-monitoring, internal environmental management system, image building), their wish or duty to report to communities surrounding their plants (corporate environmental and social responsibility), or their reporting obligations (for statistical purposes, for inspection and compliance purposes, for PRTR[9]).

A network of partners of national authorities (e.g. territorial authorities, enterprises, universities and research institutions) is used for direct data reporting to national institutions in charge of environmental statistics. Direct reporting of data by enterprises often helps increase timeliness and efficiency of data collection. Some countries or regions also collect some information by means of full scale census. After completion of data acquisition, the institution in charge of environmental statistics generally co-operate with other public departments and institutions for internal/external data review and validation, to ensure data quality and consistency among data sources.

Orientation to user needs has developed with visualization technology and access to

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**NOTE**

[7] latest version released by the United Nations over 2013/2014

[8] System of Environmental-Economic Accounting revised in 2012 by the UN Statistical Division, in co-operation with the World Bank, OECD, IMF, Eurostat and the 'London group'. See also Wealth Accounting and the Valuation of Ecosystem Services (WAVES) conducted by the World Bank.

[9] Pollutants Release and Transfer Registers

environmental data. For instance, remote sensing technology has been widely applied in data acquisition of land, forest and grassland for large areas, independent of administrative boundaries, as well as quick identification of pollution sources and risk sources. Mapping and comprehensive integration and display of environmental data is through GIS[10], particularly in support of a variety of users (e.g. researchers, the public at large, specific interest groups). Legal progress has been made to ensure public access to environmental information, for example in the USA, Japan, the EU, Mexico and Brazil.

## Institutional responsibilities

The responsibility for public environmental statistics, in all the ten reviewed countries, is allocated to the national institution in charge of the environment, for environmental statistics, environmental indicators and environmental reporting. For some specific tasks, such as environmental accounting, the institutions in charge respectively of the environment and of statistics typically co-operate. Under the national environmental institution, an independent or semi-independent department operates for data acquisition, management, release, application and analysis, of course with appropriate relationship and co-ordination with other statistical bodies, as well as with enterprises, universities and research institutions.

## 5.3 A time for major changes in environmental statistics in the PRC

### The 2014 environmental protection law implies changes in environmental statistics

The major revision of the 'Environmental Protection Law'[11], includes a new chapter 5 named 'Information Disclosure and Public Participation' with six articles, which state in particular that:

Citizens, legal persons and other organizations have the right to obtain environmental information, participate in and supervise the activities of environmental protection in accordance with the law;

- Environmental authorities of the people's governments at various levels and other departments with environmental supervision responsibilities shall disseminate environmental information, improve the procedure for public participation and facilitate participation in and supervision of environmental protection work by citizens, legal persons and other organizations; and

- Key pollutant discharging units shall inform the public concerning pollutants (e.g. name, discharge method, concentration and quantity, excess emissions, availability and operation of their pollution prevention and control facilities) for social supervision purpose.

**NOTE**

[10] Geographic Information Systems
[11] Released 24 April 2014. Revised from 1979 law, and revision in 1989.

The new "Environmental Protection Law" brings additional challenges to the existing environmental statistics system of the PRC, and offers opportunities to improve it (e.g. with higher requirements in quality and effectiveness of the environmental information system). Importantly, it proposes clearer requirements for enterprises to disclose and disseminate environmental information.

## An expanded scope of present environmental data needs

In the PRC, environmental issues have recently attracted more and more attention and concern from governments and social communities, especially for smog and air pollution, water pollution, heavy metal pollution, nature and biodiversity protection, and other environmental issues and events, as well as their significance for human and ecosystem health. Energy efficiency and waste management/ circular economy have been increasingly related to trade in fossil fuels and resources. Pollution data has to be extended from pressures from industry and transport sources to agricultural sources. In turn, the demand for environmental information has become increasingly urgent. Like in several large countries, there are remaining gaps in the PRC concerning environmental data for biodiversity, marine, hazardous substances, risks, health, resource flows, economic data and some territorial data.

## The need to anticipate on future environmental data needs

Further, the environmental agenda is expanding with a range of emerging environmental issues such as hazardous chemicals and related health impacts (e.g. endocrine disruptors), or risks associated to technological and natural disasters. It is also expanding with the need to place environmental action in an economic context, with 'environmental economics' (e.g. prices, taxes and subsidies), the emergence of the 'environmental sector' and its role in the overall economy ( e.g. its expenditure, its benefits, its direct link to the health sector, its employment, its exports and macro-impacts, such as the 'cost of non-action'). a number of international issues.

Environmental statistics have thus become a forward looking tool, supporting the development of forecasts, outlooks and other modeling efforts and estimates concerning the future.

At the interface of environmental and economic accounting, environmental accounting is progressively developing and likely to bring significant benefits in the future, even though some of these benefits are already at reach (e.g. for water and forest accounts).

These data needs are those of public entities as well as those of civil society including enterprises, academia, associations and citizens.

## The need for a quantum change in resources to support environmental data development and related technology

At the time of the 'data revolution' supported by numeric developments, 'big data' and 'cloud data', there are, in the PRC like elsewhere, a range of benefits to be captured for environmental statistics from technological developments, ranging from remote sensing satellite data to visualization and mapping capacities. What is needed is the best use of the data revolution and technological developments to support the services environmental data can provide to public entities in their governance efforts, as well as to the appetite for data from citizens and their smart-phones, associations, academia, and enterprises, the latter becoming both producers and users of environmental data.

Official environmental statistics have to play their role in that context. Like they have been subject of major transformations in the last 15 years in China, they have to sustain also major transformations in the next 15 years, providing 'data for now, data for the future and data for everyone', and building on information technology. These imply a quantum change in financial and human resources, not only in volume, but also in creative mechanisms of financing beyond public budgetary sources.

## The need to increase international co-operation on environmental data for the PRC

There are a number of international co-operation efforts concerning environmental statistics. They include for instance work within the United Nations and the World Bank, or within the OECD and the EU; this work is reviewed in the present report. There are important benefits to be obtained by China in such global or regional co-operation. Such benefits can be enhanced.

Such work includes environmental data harmonization (e.g. methodology, standards nomenclatures), support for environmental data development (e.g. pressure state response framework, environmental accounting); co-operation in implementation of regional or global conventions required from signatories (e.g. Convention on climate change, Convention on the protection of biodiversity, Convention on desertification). Such work also builds on recent developments such as the measurement efforts associated to post 2015 UN Sustainable Development, Goals (e.g. report Giovanini-Ma), to Rio+20 commitments on sustainable consumption and production driven by UNEP, to inclusive green growth driven by OECD/World Bank/ UNEP, to 'beyond GDP' (e.g. report Stiglitz-Sen), to value chains associated to trade driven by OECD/WTO.

At global and regional levels (e.g. South East Asia, Central Asia), the PRC has the potential not only to increase its co-operation on environmental statistics but to play a lead role on future developments.

## 5.4 Policy recommendations

The following policy recommendations are proposed by the project team with the aim of revising and improving the environmental statistics system in the PRC.

**Improve legislation and regulation on environmental statistics**

The 'Regulation on Environmental Statistics Management' (in short the Rule) should be revised to ensure its conformity with the 2014 "Environmental Protection Law". Accordingly, the Rule should further strengthen and sub-divide the responsibilities of enterprises concerning environmental data and information disclosure.

In addition, the Rule should further clarify the environmental data quality review arrangements and the environmental data internal/external review system. The Rule should promote across all relevant government levels the management responsibilities on environmental monitoring and statistics, their use in analysis, and the standardization of these management responsibilities.

**Improve the institutional and management framework for environmental statistics, at national and other government levels**

- Establish a restructured environmental statistics management system to ensure the acquisition, processing and dissemination of environmental statistics, independent from the intervention of authorities, particularly the local governments.

- A first option is to designate the National Statistics Bureau to develop the environmental statistics work, in co-operation with the environmental administrations (these administrations specifying the demands for data, offering technical support, etc.).

- A second option is to set up a horizontal environmental statistics office within the MEP; and designate it to (i) develop environmental statistics, indicators and reporting; (ii) better coordinate the central and local environmental statistics works and (iii) co-operate with the National Statistics Bureau for environmental accounting.

- A third option is to establish an Environmental Statistics Center associated to MEP, consolidating several existing environmental statistics functions in academies and relevant bodies. The Center should be responsible for environmental data acquisition, processing, management, information dissemination, their use in analysis, secondary development of data and indicators, and capitalize on technology innovation. The Center should work as necessary with public and private partners

such as enterprises. The Center should also improve the capacity and provide technical support for environmental statistics, as well as conceptual developments for environmental indicators. Both the national government and provincial and other provincial authorities are facing problems such as inadequate environmental statistics, human resources and technical capacity.

Concerning the choice among the three options, it is important to ensure independence and credibility of the statistics and statistical products and services, to ensure both efficiency as well as enhanced and varied sources of financing, to modernize the pollution monitoring system for both physical and economic data, to ensure to capture the benefits of ever changing technology, to provide leadership in capacity building within the environment statistics community and beyond, to give attention to data for present policy and planning purposes, for future needs, for disclosure for multiple user needs.

The establishment of a Steering Committee and a Consultative Council for environmental statistics should be considered. The Steering Committee could help strengthen the environmental statistics works; the Environment Minister (or a Vice Minister) could serve as chair; and its members could come from national departments in charge of statistics, agriculture, forests, water, land; the Steering Committee could lead on co-

operation concerning the data acquisition, dissemination, and common strategies to advance environmental statistics. The Consultative Council for environmental statistics should deal with general advice for environmental statistics development planning, and statistics research work, concerning the established, unfinished and emerging environmental agendas.

In addition, consider establishing:

- a peer review mechanism to strengthen quality control of environmental statistics. Upon completion of data aggregation, some 3 to 5 provinces could be selected annually for a peer review process of data quality, and produce an evaluation report submitted to the MEP; the concept of data quality should be broad and include inter alia relevance, reliability and completeness, timeliness and periodicity, as well as appropriate definitional attributes.

- a data quality reporting system, to accompany the annual environmental data report, including data auditing, quality assessment, problems and solutions.

- an on-site verification system concerning emission reduction, environmental monitoring and other management and supervisions activities, in order to enhance data quality assurance.

## Improve technical methods and standards for environmental statistics

Strengthen the 'State-Owned Pollution Source Direct Reporting System' by reviewing its relevant functions and revising accordingly its software. This should help reduce the reporting burden. Develop sector specific technical guideline towards the operation of a 'Direct Reporting System'.

Develop data auditing rules on the basis of technical and sectoral guidelines for enterprise data reporting. Simplify data auditing processes by use of appropriate software.

Learn from the national experience with the Third National Economic Census and Outlook, and with the future Second National Pollution Census (2017) to widen services derived from environmental statistics; for instance establishing multi-dimensional data management and display systems, using integrative GIS systems, and mapping of pollution sources.

## Strengthen environmental information disclosure and data application

Develop "Guidance on Environmental Data Disclosure" and implement recently amended "Environmental Protection Law", including the definition of liability of government and enterprise on environmental information disclosure and strengthen liability of environmental information disclosure; strengthen applications on environmental statistics and secondary applications. Enhance the use of Cloud technology in the field of environmental information sharing and environmental data management. Ensure also appropriate data protection and privacy.

Mobilize the ongoing technological progress and 'data revolution' to boost environment data production and use. For instance, by use of GIS technology, develop visual platforms on environmental information management and sharing; boost the use of remote sensing and sampling survey methods in the second National Pollution Census. In this case, develop pollution maps and pollutant sources for improving environmental information services. Connect them to appropriate environmental information websites.

Requests for access to environmental data should be treated by a mechanism ensuring timely public feedback. Regulate such mechanisms of environmental information disclosure for both governments and enterprises, based on selected pilot studies, involving civil society (non-governmental entities, academia, and the philanthropic sector).

## Strengthen capacity building and resources for environmental statistics from national to local level

Release an official and legal provision for 'Standardization of Capacity Building in Environmental Statistics', to provide a formal basis for environmental statistics capacity building at all levels. It should help strengthen the qualification of environmental statistics staff, providing for staff licensing, strictly acting on the eligibility of

environmental statistics staff, and arranging for regular technical training and rotation of staff. Sufficient budget should be secured for this purpose.

Enhance participation in environmental statistics work supervision by promoting information disclosure as soon as possible. Foster the capacity development and technology use for environmental data, by training professional staff and users and increasing the environmental data literacy of citizen.

Greatly increase overall resources for environmental statistics, with a quantum jump in funding, including new and additional core public funding and support from a variety of private sources. This may include provision of data by polluting enterprises according to the polluter-pays-principle, data from secondary sources (e.g. from scientific research and studies), philanthropic sources of funds. This requires leveraging resources and creativity from the public and private sectors.

## Strengthen international co-operation

Greatly enhance international co-operation concerning environmental statistics to capture the multiple benefits of such co-operation (e.g. co-operation with the UN Statistical Division, the OECD, the EU, with South East Asia, Central Asia).

- For instance, derive lessons from the EU and individual countries experience to extend the services from environmental statistics: develop PRC's own comprehensive pollution map, by integrating GIS, demographic and economic information with environmental information for public use and for environmental management;

- For instance, develop research on nitrogen (N) pollution and reduction. Launch an inventory of national N pollution and balance, drawing from the experience of the EU and the OECD. Prepare an integrated management strategy to reduce N pollution and target potential international aspects;

- For instance, study other applications of environmental statistics drawing from the international experience (e.g. Green GDP accounting, environmental accounting, Green Growth) and develop China's own environmental indicators.

Further strengthen PRC's international co-operation on environmental statistics to provide evidence-based international co-operation on environmental issues in Asia and worldwide, in the context of UN efforts towards environmental progress, and sustainable development and poverty reduction.

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