

SDI IN CHINA: PROGRESS AND ISSUES

Dr. Pengde Li^{a,*}, Lan Wu^b, Dr. Xuenian Xiao^a

^aShaanxi Bureau of Surveying and Mapping, 334 Youyi East Road, Xi'an, Shaanxi Province, 710054, China - lipd@shasm.gov.cn, xiaoxuenian@126.com

^bState Bureau of Surveying and Mapping of China, 9 Sanlihe Road, Beijing 100830, China - wulan@sbsm.gov.cn

Commission IV, WG IV/1

KEY WORDS: SDI, NSDI, Digital China, Digital Region, Digital City, Data Clearinghouse, Geospatial Data

ABSTRACT:

Spatial Data Infrastructure acts as a fundamental platform to make geospatial data exchangeable to supply geospatial information service widely. China has paid great attention to construct the Digital China Geospatial Framework (DCGF). This NSDI has four layers at National, Provincial, Municipal and County level. DCGF has five components: data sets, technology, legal support and standards, coordination mechanism and facility. The legal system consists of the *Law of Surveying and Mapping* and some other government statutes. The dataset has been defined in standards from 1:1 million to 1:500 at four administrative levels. A series of fundamental geospatial database has been completed as the kernel of DCGF. A full digital geospatial data production system has been widely established nationwide. The national coordinating mechanism is in action to strengthen the cooperation and data sharing. The national standards are getting more complete to support the DCGF. All the provinces and most municipals have established geomatics centres to carry out the DCGF construction. A lot of experiences have been achieved and the DCGF have been widely used in governments. There are still some issues blocking the establishment of DCGF, such as low frequent data updating, lack of data exchanging and strict classification system. There will be more and more public oriented geospatial product derived from DCGF to speed up the geospatial information industry. DCGF will play an actively role in the harmonious society in China. The author gives a review of DCGF construction according to the components and points out the key issues.

1. INTRODUCTION

The Chinese Government has been well aware of the importance of geospatial information to sustainable development. Geospatial information has been considered as one integral component of the e-Government of China. More and more citizens are willing to get geospatial information service via Internet and mobile digital personnel assistant (PDA). Chinese Government and relevant companies have been trying to make geospatial information resources distributed geographically with various formats available for public needs as handy as possible. The concept and mechanism of National Spatial Data Infrastructure (NSDI) has been adopted by the State Bureau of Surveying and Mapping of China (SBSM) to reflect the trend of geomatics.

The term NSDI has been created for ten years. Many countries have paid high attention to build NSDI. The Chinese Government has been pushing forwards the activities of NSDI as well. There are not many people being able to describe NSDI concept and definition clearly now in China. SBSM is the only government agency responsible for fundamental geospatial information resources in China. The Chinese version of NSDI is called *Digital China Geospatial Framework (DCGF)*. As a base of the national information infrastructure, the DCGF is currently undergoing with a much further step. The DCGF is being implemented at national, provincial, municipal and county level. SBSM is stimulating the establishment of a modern geomatics featured in geospatial data infrastructure (SDI) and geospatial information services. DCGF is consists of five components: policy, laws and standards; institution and

coordination; geospatial framework datasets; catalog and clearinghouse; as well as public service systems (Figure 1) .

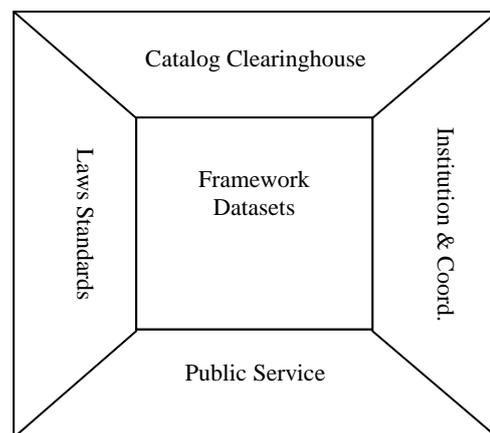


Figure 1. DCGF Components

2. OUTLINES OF THE NATIONAL POLICY, LAWS AND STANDARDS

As information technology (IT) is a key factor to influence every aspect of social live, the central government decided to develop information industry to promote industrialization. Chinese President Hu Jintao pointed out the Surveying and Mapping agencies at all levels to speed up the construction of Digital China Geospatial Framework to deliver proper service

for the development of country. Geospatial information resources and utilization have been included in the national five-year plan. DCGF, as one of four key backbone of surveying and mapping, has been paid high attention in *the Opinions of the State Council on Strengthening Surveying and Mapping Work* issued by the State Council in 2007.

The General Office of CPC and the General Office of the State Council issued *Some Opinions for Strengthening Development and Utilization of Information Resources* which points out the construction of geospatial information resources and applications. The State Council has released a new *regulation on the publication of government information* on its working procedures and many matters of public concern, which will also push forward the information sharing in China.

SBSM is the national authority to supervise surveying, mapping and geospatial industry. It is also the provider for fundamental geospatial information at national level. *The Law of Surveying and Mapping of the People's Republic of China* has been revised in 2002. There are a set of legal regulations related to NSDI construction in China. SBSM and the former Informatization Office of the State Council (now integrated into the Ministry of Industry and Information) issued *a Guideline for Strengthening the Construction and Application of Digital China Geospatial Framework* in 2006. It describes the components of DCGF and main tasks in detail.

China has noticed the importance of geospatial information standards to economic construction and social development. There exists a standard system for traditional surveying and mapping technology and production. Amendment for the standard system has been carried out to adapt the digital surveying and mapping technology and production since late 1980's. A series of new standards have been formalized recently to meet the urgent need of the DCGF construction. China has three types of technical standards on surveying and mapping, namely GB for Enforced National Standards, GB/T for Suggested National Standards, CH for SBSM drafted standards. The Government is encouraging to use more and more ISO standards directly or adapted. As China is one of the 29 P-members of ISO/TC211, SBSM is actively to take part in its professional activities. China is also very active in various affairs of international organizations such as GSDI, PCGIAP, Global Mapping, Digital Earth, ISPRS, ICA etc.

SBSM is leading the National Technical Committee of Geospatial Information Standardization (TC230) which consists of representatives and experts from relevant authorities and organizations. SBSM has drafted technical standards for geospatial datasets such as Digital Raster Maps (DRM or DRG), Digital Elevation Maps (DEM), Digital Orthophoto Maps (DOM), Digital Vector Maps (DVM or DLG). The geospatial framework data standard is still under development. China has released three versions of the national metadata standard according to fundamental geospatial data products, fundamental geospatial information and geospatial information. All these standard drafts are subsets of the ISO 19115 (Geographic Information--Metadata). The Chinese version of ISO 19115 has been adapted. There are 11 scales for base maps in China, i.e., 1:500, 1:1000, 1:2000, 1:5000, 1:10000, 1:25000, 1:50000, 1:100000, 1:250000, 1:500000 and 1:1000000. In order to establish DCGF, three map scale ranges have been used, namely Small, Medium, Large scale maps. Digital data of these base maps as well as orthophoto data will be the fundamental to the DCGF. The geospatial information standards hierarchy will be completely formed in a few years.

3. INSTITUTION AND COORDINATION MECHANISM

According to the Chinese government hierarchy, surveying and mapping and geospatial service are responsibilities of governments at National, Provincial, Municipal and County levels. The base mapping is also divided into four layers at National, Provincial, Municipal and County level. Each province has a provincial bureau of surveying and mapping. SBSM has four bureaus under its direct supervision in Shaanxi, Sichuan, Heilongjiang, Hainan. Most cities have their own institute of surveying and mapping as well. Mapping agencies are the main players for geospatial framework construction. China has found a good infrastructure of science and technology to support NSDI activities. The Chinese made digital photogrammetric systems have been equipped more than 1000 sets and exported to many countries, i.e., JX-4A and Virtuozo. There are several key GIS software being widely used in China also, such as GeoStar, MAPGIS, SuperMap, VRMap, etc. Most mapping agencies are using Chinese made software such as Geoway, MapStar to collect geospatial information. There are many websites based on Chinese developed WEBGIS. China has also developed a few 3D geospatial data visualization systems based on geospatial database support.

As geospatial information is widely distributed, the integration will require strong coordinating mechanism. Most government agencies hold thematic geospatial information in many forms. There is a great need for a strong governmental coordination. The National Geospatial Information Coordinating Committee (NGICC) has been formally set up in 2001. It is run under the leadership of the National Development and Reform Commission (NDRC). SBSM is one of the main members of the Committee and playing a very important role in establishing DCGF. As NDRC is the supervision and coordination authority for the national economy and social development, it holds the chair position in NGICC which has eleven major members, such as SBSM, Chinese Academy of Science (CAS), Ministry of Science and Technology, Ministry of Industry and Information, Ministry of Land and Resources (MLR), Ministry of Housing and Urban-Rural Construction, Ministry of Agriculture, Ministry of Finance, etc. All government agencies need geospatial information and local SDI support. Therefore, each provincial and municipal government should set up the local Geospatial Information Coordinating Committee. The local coordinating committees have been established in more than ten provinces, such as Shaanxi, Heilongjiang, Henan, Zhejiang, etc.

The establishment of DCGF has been officially approved by the central government, and the project is funded by the State budget. DCGF has a close relation to China's E-Government which has been carried out to promote efficient governance as scheduled. The first phase of the e-Government program has 12 application systems and four main databases including the natural resources and geographical information database (NRGID). NGICC is responsible for the coordination of the NRGID construction which is participated by NDRC, MLR, CAS, SBSM and relevant authorities. SBSM are playing an important role in the establishment of the national data node of fundamental geographical information. DCGF will give strong support to this node.

4. GEOSPATIAL FRAMEWORK DATASETS

As a large key project, the National Fundamental Geographical Information System (NFGIS) has been worked for more than ten years. The concept of Digital China has been invented only a few years ago, and the NFGIS is playing a kernel role. The NFGIS consists of 1:1 million, 1:250k, 1:50k topographic databases and information service system. All provinces are establishing the local fundamental GIS served as components of the NFGIS. At this moment, the 1:1 million and 1:250k databases have been established and revised twice. The 1:50k database has been completed in 2005. This database contains more than 24000 map sheets of DRG, DEM, DOM, DLG and other datasets. The DEM has 25 meters by 25 meter grid. The DOM has 1 meter resolution derived from black/white aerial photo and remote sensed images derived from SPOT and LandSat. The DLG consists of geodetic control points, hydrographic features, transportation network and facilities, boundaries, built up area and construction, elevation, land cover, geographic names and annotations. All the datasets have metadata captured and managed. The full revision of the 1:50K database is undergoing to be finished in 2010. There are about 2 million KM² land not covered by 1:50k topographic maps yet. SBSM is carrying out the West China Mapping Project to be finished in 2010. China will be fully covered by 1:50k fundamental geographical information to complete the national level geospatial framework datasets.

Most provincial surveying and mapping bureaus are establishing 1:10k topographic databases as the kernel components of the local FGIS as the core part of the local SDI program. SBSM has drafted the technical guide book for 1:10k fundamental GIS construction. The geospatial data sets have the similar contents as the national 1:50k geospatial data. SBSM will release *A Technical Outline for the Construction of Digital Region Geospatial Framework* very soon.

Most municipal FGIS are focusing on urban planning, land administration and precise municipal management. This type of FGIS uses 1:500, 1:1000, 1:2000 map scales and includes more urban facilities. The standards related to municipal FGIS are not fully compatible with the national ones. SBSM is performing its best to uniform all the standards for geospatial information in the future.

5. CATALOG AND DATA CLEARINGHOUSE

Similar to the traditional maps, geographical information has been widely used in land administration, forestry, statistics, municipal management, communication and disaster monitoring etc. Governments have made a great deal of investment to acquire geographical information. There are more than 10000 organizations and firms doing business on geospatial industry. All digital geospatial datasets have metadata collected. GISs have been established in many domains such as urban planning, land resources, forestry management, police, statistics, transportation, etc. However, they are still isolated according to the security classification for data sharing via Internet/Intranet. Most GISs are for internal use not accessible to public. There are several companies offering Web Map service to public but not approved by SBSM. There are many people browsing Google Earth and Microsoft Virtual World.

SBSM has organized the implementation of the National Project of Surveying and Mapping Infrastructure Project for 4 years. Every provincial bureau of surveying and mapping has

setup the systems for geospatial data acquisition, management and distribution. The project costed 240 million Chinese Yuan for establishing the geospatial information network, data processing bases and information distribution systems. The China National Network of Surveying and Mapping has been already operated for several years. It will run as the information exchanging framework for DCGF. Its coverage will be extended to connect all provinces in near future.

The e-Government Program has outlined the catalog and data clearinghouse for non-geospatial data. There is a great need for catalog and clearinghouse to be set up for geospatial data. The establishment of NRGID will change the current situation. SBSM has made the plan to establish the catalog and data clearinghouse nationwide. The National Fundamental Geospatial Information Gateway or Clearinghouse is under construction in the National Geomatics Center (NGC), a non-government agency of the SBSM. All the provincial mapping agencies are establishing the Geospatial Data Catalog Service Systems to cope with the national geospatial data cataloging system.

6. PUBLIC SERVICE SYSTEM

China has established the digital system for surveying and mapping in the last decade. According to the popularity of ICT and a great mass of internet users and mobile phone holders, the public needs for geospatial information are increasing dramatically. Geospatial information services are moving to the mainstream of IT. Nowadays the governmental mapping agencies are mainly offering geospatial information service to government and non-governmental organizations. The services to enterprises are limited. The services to public community are still quite rare and with poor resolution.

According to the latest governance structure reform, all governments are focused on economic adjustment, market supervision, social administration and public service. Mapping agencies are requested to give good service of geospatial information to the public. SBSM has decided to establish the informatizational system of surveying and mapping to promote smart geospatial information services to various customers. The public service system of DCGF will be established step by step in the process to achieve the objective mentioned above.

SBSM will speed up the process to produce more public geospatial data products. The public service system would consist of several platforms. The first one is the governmental geospatial information service platform connected to the Intranet. All relevant authorities could share geospatial data through this platform. The second one is the national geospatial analysis and statistics platform to assist economic adjustment. The third one is the common geospatial information environment for value-added companies to tailor and add thematic information for various purposes. The fourth one is the public geospatial information service network. There is no limit to have more featured platforms. The most critical issue is how to make classified geospatial information declassified for public accessible.

7. PRACTICES AND PILOT PROJECTS

The construction of DCGF has been listed with high priority at SBSM. There are two of third provinces or autonomous regions planned the Digital Region Geospatial Framework as local

government task, such as Beijing, Shanghai, Guangdong, Hainan, Shaanxi, Shanxi, Jiangsu, Zhejiang, Xinjiang, Henan, Shandong, etc. These provinces paid more attentions on fundamental geospatial data resources and applications. For instance, Digital Shaanxi Geospatial Information Fundamental Framework (DSGIFF) was approved in 2001 by the Shaanxi Provincial Government. It consists of 8 components: geospatial data acquisition and database construction, GPS applications, remote sensing facilities, standards drafting, legal system, coordination mechanism, research and development and pilot applications.

There are more than 30 cities commencing the construction of Digital City Geospatial Framework sponsored by SBSM, such as Weihai, Wenzhou, Jiaying, Xi'an, Qianjiang, Taiyuan, Kuitun, etc. They are focused on large scale geospatial data sets including 3D city models, utilities and more daily life information to support more Location Based Service (LBS) applications. Digital City Geospatial Framework is still mainly focused on the city itself similar to the concept of cybercity. The whole area of its administration is not yet covered to include the townships and countryside. There are also some counties starting digital region geospatial framework to support integrated urban and rural development. Digital Beijing Geospatial Framework has been implementing to play a very important role in the 2008 Olympic Games in Beijing.

8. CONCLUSION REMARKS

SDI and Digital Region are new matters to China and the world. China is pushing forwards the construction of DCGF, however this is still lack of matured technology, standards system, updated datasets and effective coordination mechanism. The

user needs are great but the service capacity is not yet suitable enough. The situation of isolated information islands has to be overcome so as to supply the society with rich accessible geospatial information resources.

There are still some key issues to be solved accordingly. The first issue is the effective coordinating mechanism to promote the information resources sharing. The second issue is the small amount of financial input to be increased. All the technology, data and human resources development needs huge input. The third issue is the standards needed to be revised and ISO standards to be adapted. The fourth issue is the applications to be widened to cover all social and economic sectors.

Besides the *Law of Surveying and Mapping* and related regulations, a legal system should be strengthened to reflect the geospatial sharing. The legal state of Digital China Geospatial Framework must be erected to avoid replication and. Much more international cooperation and technical exchange should be sought and encouraged to promote the development of DCGF. The achievements of DCGF will not only benefit the government but also the community to serve as the unique geospatial information reference.

REFERENCES

NPC, 2002, *The Law of Surveying and Mapping of People's Republic of China*, China Democratic and Legal Press, Beijing

SBSM, 2006, *A Guideline for Strengthening the Construction and Application of Digital China Geospatial Framework*, guoceguozi[2006]35