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Policy Direction for Promoting the Satellite Data Use in Public Sector

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Abstract : With the ready access to the high resolution satellite image data, users of and areas covered by satellite image data are constantly on the rise world-widely. Korea will also be able to take full advantage of the satellite data once the Korea Multi-Purpose Satellite 1 (KOMPSAT-1) is successfully launched. Harmonizing satellite data production and application technology and users' needs, along with the guiding policy is essential for promoting satellite data use. Up to now, the Korean government has mainly concentrated on developing production technology for the satellite instruments. However, the imminent task of independent satellite data production demands a promotion policy for satellite data use. In this context, the policy is defined as an important medium for identifying the role and status of satellite image information at the national level and also preparing the legal as well as systematic foundation for producing, building, distributing, and packaging satellite data. The present paper aims to examine the role and status of the satellite data as well as their current status and problems in Korea in reference to the National Spatial Data Infrastructure, and finally to provide the policy directions to promote the satellite data use in public sector on the basis of the preceding analyses.

Key Words : KOMPSAT-1, policy, satellite data

1. Background

Drastic development of the remote sensing technology has greatly improved the high-quality resolution satellite data, depending upon the respective purposes. Satellite data allow speedy and periodic collection of information covering wide geographic area. As satellite data increasingly expand the range of its use, the systematic utilization devices must be explored at the national level.

The U. S., Canada, and Australia established the Remote Sensing Centers for the purpose of designing and implementing the comprehensive plans for the remote sensing areas; satellite data collection and distribution, image processing technology development, and development of the prospective areas for the satellite data use (Kim and Park, 1998). When compared to these advanced countries, however, Korea seriously lacks the applicable areas as well as technology for remote sensing, revealing disadvantageous status in national competitiveness-building.

Satellite image data with great potential should be actively utilized in the private sector and shared as the high-quality information, which can

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be actualized in setting up the policies.

2. NSDI and Satellite Data

1) National Spatial Data Infrastructure (NSDI)

National Spatial Data Infrastructure (NSDI) is the concept encompassing the policy, technology, and manpower in the process of collecting, processing, storing, and distributing the spatial information (MSC, 1995). It also includes the physical facilities for transmitting, processing, and dispensing information such as voice, text, and imagery as well as part of the National Information Infrastructure (NII) where they are organically integrated and interconnected (Choe *et al.*, 1997).

With the development of the information technology, demand for the digital spatial information rapidly increased. It necessitated information sharing and integration between and among various government branches for the scientific spatial analyses and rational decision making. In this context, it is essential to have plans to systematically execute the data collection, organization, search, and sharing process. NSDI is a policy concept borne out of these circumstances (Chung *et al.*, 1997).

NSDI consists of standardization procedure, distribution system, collaboration system, and geospatial database. The pivotal element among them is the geospatial database, the nationally manufactured, maintained/managed, and distributed data. National geospatial database can be divided into framework data and metadata. Framework data is the fundamental database as a base map and reference map to which specific information can be added for the respective purposes of diverse areas. As descriptive information carrying data content, quality, and usage conditions, there are two kinds of metadata; outside metadata for the data usage and inside metadata for management (Choe *et al.*, 1997).

2) National Framework Data

With drastic increase of production and use of spatial information in foreign countries such as the U. S., the U. K., and Australia, the need for the system to maintain and manage the commonly utilized information emerged. Since the early 90's, geospatial database has been established through standardizing the framework data and metadata.

In Korea, the current digital topographic map consists of about 700 items. However, as the NGIS base map, it needs revision due to excessive inclusion of unnecessary items as well as omission of the indispensible items (NGI, 1997). Therefore, as a new concept for the NGIS base map, it is urgent to build the National Framework Data. The National Framework Data is the skeleton of diverse spatial information capable of overlapping and adding spatial data, both schematically and spatially upon need basis.

The National Framework Data plan was presented by Ministry of Construction and Transportation (MOCT) and Korea Research Institute for Human Settlements (KRIHS); it consists of geodetic standards, elevation, digital ortho image, main buildings, drainage, roads, administration boundaries, and cadastral data (Choe *et al.*, 1997; Hong and Shin, 1998). In order to build the National Framework the Data, a cooperative system between and among the related agencies should be organized and pilot projects in the areas of framework data should be carried out.

3) Role of Satellite Data in National Framework Data

In the countries with the advanced satellite technology, such as the U. S., the U. K., and Australia, government agencies in charge of producing national geographic data are responsible for the spatial information distribution. For this purpose, separate organization or agency was created to handle satellite data and to make distribution system easily accessible by users with the understanding that satellite data is an important area of the national spatial information (Kim and Park, 1998).

In the U. S., U. S. Geological Survey (USGS) under the Department of the Interior regularly collects satellite data and dispenses processed spatial imagery data to general public. In Canada, Geomatics Canada under the Ministry of Natural Resources is responsible for the GIS-related functions, such as production, management, distribution, and final use of the spatial information. In particular, the Canada Centre for Remote Sensing (CCRS) was established, specializing in remote sensing area which provides processed spatial imagery data. Also in Australia, Australian Surveying and Land Information Group (AUSLIG) runs the Australian Centre for Remote Sensing (ACRES) and distributes the spatial imagery data.

The above-mentioned foreign cases clearly illustrate the framework data production and distribution activities as a part of the NSDI. Among the National Framework Data plans prepared by MOCT and KRIHS, the Digital Elevation Model (DEM) of the elevation data or the digital ortho image is closely related to the satellite data.

So far, the importance of the satellite data was relatively underestimated in the spatial information area. Each country was not fully equipped to capitalize on the potential of the satellite data in building of the national geospatial database. This is because the satellite technology could not sufficiently satisfy the users' needs in terms of its accuracy and credibility. That is, despite several advantages, the satellite data experienced various difficulties because its spatial resolution was far inferior than that of the aerial photographs.

However, with the introduction of the high-resolution commercial satellite data (under 2m), the quality of the image data caught up with that of the aerial photographs, thus considerably expanding its usability. Along with continuously advancing satellite technology, satellite data should be more extensively utilized. At the same time, the utility of the satellite data as an important production apparatus of the spatial information should be fully examined.

Although clear definition and building plans of the framework data are not completed yet, substantial investment to various sectors are being made to raise the accessibility to the widely useful spatial information in the public sector. In producing the essential information, how the original data is processed with what kind of methods more or less determines total expense and the answer lies in satellite data.

3. Current Status of Domestic Remote Sensing

1) Satellite Launch and Data Status

Korea began its satellite research in 1989: KITSAT-1 and 2 were developed and subsequently

launched, passing the experimental stage (Park *et al.*, 1996); with the launch of the multi-purpose satellite, domestic satellite data is currently being tested for its usability. In May of 1999, KITSAT-3 with 3 spectral band of 15m space resolution was successfully launched (SaTReC, 1999) at Satellite Technology Research Center (SaTReC) of Korea Advanced Institute of Science & Technology (KAIST). In addition, another launch is planned by Korea Aerospace Research Institute (KARI) for December, 1999; Korea Multi-Purpose Satellite I (KOMPSAT-1) for the 6.6m spatial resolution panchromatic stereo image and meterological/ ocean scanning multi-spectral image (Paik *et al.*, 1998).

Substantial amount of investment is being made in the area of satellite unit development in order to obtain useful domestic satellite data for ortho image collection and ocean/outer space environment analyses. Maybe, it is expected that domestic remote sensing market will grow rapidly with successful launch of the KOMPSAT-1. The investment plan is fundamental to promote the use of domestic satellite data along with foreign satellite data by way of processing them into useful spatial imagery information to add value and systematic distribution process.

Review of the current supply of the satellite data in Korea indicates that the majority of the satellite data used in Korea is supplied by foreign buyers. There are also several agencies which collect and distribute the satellite data directly. Korea Meteorological Administration (KMA), National Fisheries Research & Development Agency (NFRDA), Korea Ocean research & Development Institute (KORDI), and Seoul National University (SNU) are the representative institutions which receive the meteorological and oceanic satellite data from NOAA and GMS for research purposes. SaTReC receives satellite data from SPOT and JERS and sell them for the discounted price (e.g., 20~50%) compared to foreign buyers.

Not only simple data storing and management but also the data supply system for the received satellite data and useful spatial imagery information are crucial in taking full advantage of these institutions.

2) Satellite Data Distribution and Use

Domestically, satellite data is widely used in national defense, environmental conservation, weather forecasting, and water resource management. However, up to now they were mainly temporary application studies and there do not exist any permanent programs or application systems. Although KMA and KORDI provide the meteorological/ocean information with pictures derived from satellite data through internet, actual production and distribution of the spatial imagery information for the analysis purpose are not available yet. In the land analysis area, only the Ministry of Environment (MOE) provides Landsat images, landcover and several data which used for producing them. Therefore, new conceptual framework for information sharing and distribution which can be collaboratively utilized by various agencies, rather than individually used satellite data, should be introduced in near future.

3) Systematic Foundation and R&D

With the establishment of the "Land Remote Sensing Policy Act of 1992" of the U. S. in 1992 granting permits for commercial satellite launch and data collection for earth observation, investment outcomes became visible in diverse sectors thanks to technology development in the

satellite sector and free and active distribution and use of the satellite data. Canada and Japan also developed their own satellites. For the active satellite data use, they also built the systematic distribution foundation for the spatial imagery information as one of the main elements in the NSDI.

In case of Korea, although the legislation for the systematic establishment and distribution of the spatial information as the NII is still under way, remote sensing area is not included in this effort. In addition, lack of clear understanding on the current status and problems regarding collection, distribution, and utilization of the satellite data poses enormous difficulties in reality. In this context, the comprehensive legal review is in order, taking the unique circumstances of Korea which is distinctively different from other countries into account. In order to secure the satellite data supply and demand, revision plan for the legal system properly accommodating the need for confidentiality and disclosure should be prepared.

In terms of software technology development, it has mainly focused on softwares for adjusting and analyzing the 10 to 30m color satellite image. However, with the development of the sensor technology and rising interests in many application sectors, processing and analytic functions for the high resolution satellite image are increasingly getting more attention. Recently, digital photogrammetry function, which has been exclusively used for the aerial photographs, is applied to satellite image by performing basic processing functions on the basic satellite image as well as providing additional ortho image.

The majority of the domestically developed, commercially utilized spatial information analysis softwares is GIS-related softwares. The commercial use of the satellite image processing softwares or softwares combining GIS and remote sensing is almost non-existent, except for research purposes (Kim *et al.*, 1998; Chi *et al.*, 1998). At present, drastic increase of domestic demand for the spatial imagery information in the areas of national defense, environment, GIS, and telecommunication urgently calls for the commercialization of the domestic softwares.

4. Satellite Data Use Promotion Strategies in Public Sector

The successful National Geographic Information System (NGIS) project since 1995 provided an effective role model for the government-initiated Spatial Imagery Information System (SIIS). Therefore, in the present section, efficient policy directions and strategies will be explored based on the review of the NGIS project process.

1) Establishment of the National Project Plans

The NGIS Project was established and subsequently announced in May 19, 1995 under the grand theme of establishing the national informatization foundation for the 21st century. Eleven government branches including the Ministry of Information and Communication (MIC) and MOCT participated in the project (The Steering Committee of NGIS, 1997).

In order for the spatial imagery information to play the major role in the NII, such as National Framework Data, the master plan at the government level is essential both at the planning and execution stages. The master plan covering national policy directions, goals, and implementation body and strategies is

indispensible in laying the groundwork for the satellite image utilization. Social demand for the satellite data use and clear understanding of the satellite data as the important element of the NSDI are critical in setting up the government-initiated master plan. Therefore, professionals in the field should actively put much effort in technology development to raise the usability of the satellite data and estimate public as well as private demand for the satellite data.

2) Formation of the Execution Body

The Steering Committee of NGIS operates 5 subcommittees under its jurisdiction; Administrative Subcommittee, Geographic Information Subcommittee, GIS Technology Subcommittee, GIS Standard Subcommittee, and Cadastral Information Subcommittee. The Advisory Board is also in gear, comprising of professionals in industrial, academic, and research arenas.

In order to promote satellite data use, process to understand the current status of the pertinent works scattered around in various government agencies and to analyze and classify the surfaced problems in the actual implementation stages should be done beforehand. The results of this process should be coordinated with the Execution Committee and the future establishment of the spatial information network should include the integration of the GIS and SIIS. The Preliminary Committee comprised of the policy makers and professionals in the field should systematically implement the project until the Execution Committee designated by the government-initiated master plan is formed.

3) Major Project Selection and Implementation

The Steering Committee of NGIS selected and implemented 10 major projects so far. They can be classified into 6 categories; computerization projects, GIS-assisting research, pilot project for GIS system establishment, related technology development, professional manpower training, and standardization projects.

For the immediate use of satellite data, well-planned and systematic implementation of the projects is essential. That is, projects in the areas of building and utilizing the SIIS(Fig. 1) should be objectively selected and systematic implementation by the respective agencies should be pursued, depending on the project priorities. In particular, several items in the initial stage of data building, such as data format, metadata standard, and coordination system, should be arranged beforehand. The guideline specifying the method and procedures of the spatial information database-building especially for the ortho image and DEM should be available as well.

4) Preparation of the Relevant Laws and Regulations

In order to build database through systematic collection of the satellite data and to efficiently distribute the processed information, revision of the relevant laws and regulations is critical. Presently, "the Construction and the Use of NGIS Act" is being legislated in order to provide the legal basis for the NGIS Project.

Although GIS and SIIS had different beginnings, the two should be ultimately integrated into one for the benefit of the national spatial information and thus, considered equally in preparing the laws and regulations. Agency in charge of the spatial information distribution should also be established to promote the distribution and utilization of the GIS and spatial imagery information.

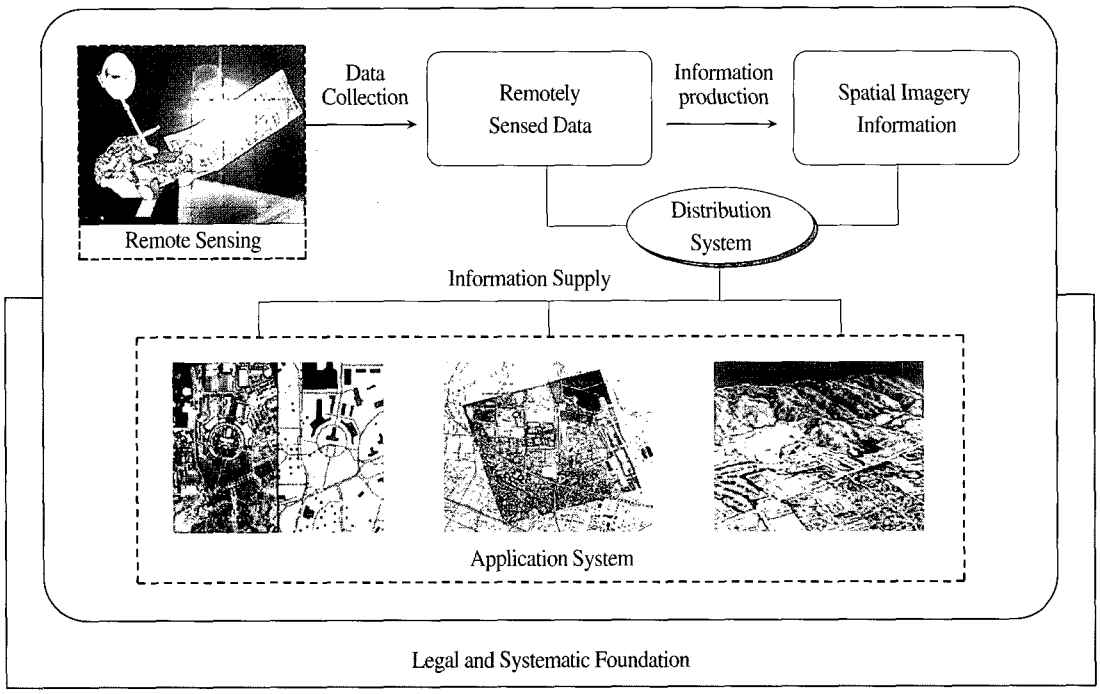

Fig. 1. The Structure of the Spatial Imagery Information System (SIIS)

5) Establishment of the Utility System for the Spatial Imagery Information

The First Phase of the NGIS Establishment Project (1999~2000) mainly focused on building the foundations and circumstances for the GIS use such as spatial information building. The Second Phase (2001~2003) aims to maximize the investment outcomes by utilizing the already established spatial information.

The series of process in systematically collecting, processing, and building the satellite data can be regarded as the preceding steps for their future use in the business and research sectors. Thus, satellite data should be tailored to fulfill the users' needs rather than manufacturers'. For this purpose, demand survey to examine the formats and kinds of data that the users want should be conducted periodically. At the same time, the satellite data application technology and its range of use should be expanded through the back-up research and pilot projects. Particularly, with the expansion of the range of the satellite data use in the public sector, financial resource to propel the GIS projects will be more readily available.

6) Consolidation of the Organization and Division of Roles

The satellite-related projects can be divided into two kinds: One, from the suppliers' point of view, satellite manufacturing project; the other, from the users' viewpoint, projects to receive, process, and distribute the satellite image. Currently, the satellite-related project is in general in its infancy in Korea due to lack of coordination and overlapping responsibility between and among relevant public agencies. In order to efficiently implement the SIIS, reorganizing the functions and roles of each involved agency should be

accomplished and the organizational system should be arranged to allow the mutual cooperation. In addition, reasonable division of role is required; that is, public sector should be in charge of building information infrastructure and development of core technology by domestic professionals, while private sector should be responsible for part of technology development and designing marketable systems.

7) Professional Manpower Training

The main elements in promoting the satellite data use are manufacturing/application technology, users, and the policy. Among them, expanding the user population will greatly contribute to form the national consensus for these projects. It will also stimulate demand accordingly, thus, activating supply. With the success of the high resolution satellites such as IKONOS of U.S., the satellite-related industry is expected to blossom, which will in turn dramatically boost the demand for the trained professionals in the satellite-related projects. Again, the proper division of role is essential for the desirable outcomes in that basic educational framework, such as educational methods and standardized textbook development, should be prepared by the government, while the actual training is provided by the respective universities, research institutes, and industries depending on training levels and areas.

5. Conclusions

In this study, we examine the current status and problems of remote sensing area in Korea, and provide the policy directions to promote the satellite data use in public sector. The urgent tasks in utilizing satellite image data; Firstly, the investment plan is fundamental to promote the use of domestic satellite data and the value added information from them. In the second place, the setting up conceptual directions and policy strategies for SIIS, which will be able to easily understand and access to information by people and to greatly contribute to the overall improvement in various sectors, such as industry and public welfare, through GIS applied in everyday life, are crucial in NII and NSDI.

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