

## LOCAL SPATIAL DATA INFRASTRUCTURES FOR MEDIUM SIZED DEVELOPING CITIES IN CHINA, TAKING XUZHOU AS AN EXAMPLE

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### ABSTRACT:

Recent years, more and more cities have planned to build “digital city”. In which the city information and its services is the core of urban plan, construction and management. of all the city informations, the spatial information plays an important role, compared with the other informations,there are some specialities in the urban spatial information, such as large scale, high resolving power,bulky,been changed quickly, hard to access and renew. The value-added and benefits of urban spatial information is lower or minus. How to use the urban spatial data efficiently is an important issue. In our opinion, The SDI at city level, namely LSDI(Local Spatial Data Infrastructures) should be put forth as soon as possible, in which something is necessary to do, such as establishing the standards to instruct the construction of LSDI,Initiating the primary research on LSDI, developing and advancing the applications and services on LSDI. The city of Xuzhou, the center city of the Huai-hai economic region, also the locomotive city of the third city zone of Jiangsu province, is a developing city compared with the cities in the south of Jiangsu, a Medium sized city according to its scale and population. In our country, most cities have the same status of Xuzhou; the paper takes Xuzhou as an example to represent the LSDI, which is realistic and useful for other cities. In the paper, the functions and importance of LSDI is discussed, the shortage for Xuzhou to construct LSDI is analysed, based on the demands and present conditions of “Digital xuzhou”. Several policies are put forward to instruct the building of LSDI.

### 1. CURRENT STATUS AND PROBLEMS

#### 1.1 Lag behind the Most Developed Cities

The building of LSDI is a costly project, which needs not only funds but also policies, technologies, skilled personnel, times, etc. Compared with the developed cities, large investments to LSDI are not feasible due to a lower municipal budget in developing cities such as Xuzhou. Moreover, there is a even lower demand for the applications and services of LSDI, which results in a gap to the developed cities, especially Beijing, Shanghai, Guangzhou, etc.

Xuzhou is much larger than most developed cities in population and area, is rapidly expanding and hence is very anxious to adopt any technologies which promise to make the management of the city more effective and efficient. But the large-scale digital urban base maps is absence or with a low quality, which is not available for the urban management, decision making and planning.

The LSDI encompasses policies, fundamental data sets, technical standards, access network (technologies),and human resources (including users, providers, and value adding sectors) necessary for the effective collection, management, access, delivery, and utilization of spatial data for different administrative aims. The design and implementation of the LSDI is not only a matter of technology but also one of designing institutions, the legislative and regulatory frameworks and acquiring new types of skills. However, it is deficient in the

institutional environment of Xuzhou to allow the adoption of GIS or LSDI compared with the developed cities.

#### 1.2 Have a not So Bad Foundation

Some bureaus of Xuzhou have already constructed some GIS projects, which still in use now. Through the projects, rich experience accumulated, skilled personnel brought up, which laid a solid foundation for the construction of LSDI of Xuzhou. The Bureau of Urban Planning of xuzhou Municipality developed a urban planning information system using Arc /Info in 1994, the scale of the digital map is 1:500 and 1:1000.

Since 1997, the Bureau of Water Resources of Xuzhou Municipality has developed a resources supervision GIS project, the digital map with a scale of 1:50,000.

Since September, 2000 the corp of water supply of Xuzhou has invested more than 1,000,000 Yuan to setup the water Pipelines Information System based on GIS, with Spatial Decision Support function and comprehensive analysis capability supported by Expert System. The system is established by combining overall surveying and mapping with supervision and database building, combining overall general survey with completion survey and combining planning approval with current information.

The Land and Resources Bureau of xuzhou prepared the construction of land information system in 1995, launched since june,1998, till now ,has invested more than 20,000,000

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Yuan, resulting in the Establishment of Urban and Rural Integrative cadastral information management +OA(Office Autoimmunization) system with a map scale of 1:500, which was awarded a gold medal in the 10th symposium of CCGIS.

### 1.3 Show a Promising Prospect

Though the gap of LSDI to the developed cities, a positive sign is that there is an increasing awareness among the government and relative bureaus, showing a warm spirits to embrace GIS and LSDI. Xuzhou is making a long-term project build the LSDI and make full use of it. The investments in the development of digital spatial data sets are augmented year by year. In order to increase the efficiency and effectiveness of this project, the standards and policies have been established and perfected. At the same time, the land GIS has been setup which acts as an example of other Projects based on LSDI.

In 2004, the DOM and DLG of xuzhou urban area was built by the Geomatics Center of jiangsu, the map no. is S(2004)046 and S(2004)094. more spatial data sets will be built in the nearly future, which could be the frame of LSDI of xuzhou.

In recent years, Xuzhou has paid a great attention to technological accumulation and innovation, on one hand, Xuzhou has actively pushed forward the construction of fundamental geographic information database, on the other hand, strengthened the value-added application development.

### 1.4 Main Problems

The biggest single barrier stopping the construction of LSDI of Xuzhou is the lack of data. The collection of base data sets lags behind the requirement of application and service. Other limitations include inefficient processes for spatial information or GIS technology; lack of skilled personnel to establish and manage the infrastructure; and lack of funding or political will to support the construction of the LSDI. Therefore, the applications and services is impossible or very difficult and time consuming.

The national mapping agencies are not able to provide large-scale digital urban base maps for such a city as Xuzhou, not to say the thematic maps. Moreover, the maintenance of the maps is so troublesome that can lead to the failure of the projects based on LSDI. The large-scale digital map is the most important data sets for the construction and application of LSDI, at present mainly built by the data consumers themselves, which bring a lot of problems. The formats of the digital maps are different from each other, and belong to different departments or bureaus; such status increases the difficulties for the data to be shared.

All types of GIS use the large-scale digital urban base maps as the basic data sets, then add the thematic features on. The basic data set is just the same, but produced by different users repeatedly, the duplicated construction results in a resources waste.

Another problem must be put up, that is how we can get benefits from the LSDI. such a costly project, if we couldn't use it economically, it would be a heavy burden on municipality, especially a developing city.

## 2. THE OPPORTUNITIES FOR THE DEVELOPING CITIES

In spite of many defects, there are some opportunities for the developing cities to narrow the gap in the construction of LSDI.

### 2.1 Learn from Others

At present, the most valuable opportunity for the developing cities to construct LSDI is the experience accumulated by other cities whose construction of LSDI is on an advanced step. some cities take the lead in the construction of LSDI, their success and failure are all good lessons to the followers, which could help the developing cities find a shortcut or even more beneficial way, avoiding unnecessary spending, saving the time, even skipping to a higher step.

As to xuzhou city, on the one hand, must look around at the cities whose LSDI is deeply developed, learning from them, on the other hand, should make practicable policies and methods to realize it step by step, combining the experience and practice together.

### 2.2 Advantage of Backwardness

The later developed cities, should take the advantage of backwardness. Now, the science and technology updated quickly, so the cities later to construct LSDI could adopt a new and suitable technology, locating the LSDI on a high standard, making the LSDI for a long time run.

The advantage of backwardness means a lower investment, less risk, but a high standard. There is often a lower annual budget for the developing cities to construct LSDI, thus making full use of the advantage of backwardness may be a good choice.

### 2.3 Opportunity Coming From Urban Expansion

Recent years, as accelerating economic growth, rapid urban expansion and dramatic change became an important issue. Especially the developing city, the inhibited potential releases suddenly, which bring a lot of urban problems. The core of the problems is to plan, manage, and regulate the city efficiently and effectively.

RS and GIS techniques are applied more and more in urban management, which is proved efficient, so more and more cities place the RS&GIS services on the agenda. It is a good chance for a developing city to construct LSDI along with the urban expansion, which could bring LSDI into the real applications, moreover, guarantee the fund support.

The viewpoint above is supported by Xuzhou city, the city is setting up a new urban area on the southeast to the old urban area. The planning of new area is just on the base of Xuzhou LSDI which constructed newly and served for the urban administration.

## 3. CORRECT SOME WRONG IDEAS

As to the developing cities, there always a lower informationization level and a deeper absence of financial and technology support. Some incorrect ideas would be put forward, such as "the LSDI is the privilege of developed cities", "the LSDI just a white elephant", "too expensive to earn any

benefits”, etc. Speak frankly, such ideas is correct under some conditions, also proved true by some cities, including a few developed cities with a good foundation of LSDI.

Judged in a long term, the ideas above are wrong, firstly, the informationization is a tide which could not be stopped. The LSDI is a chance for developing cities to catch up with the developed cities. if lose the chance, the gap of information would be widen, then the city would be isolated. Secondly, though the LSDI is a expensive and time taking project, its benefits is considerable. we must know how to assess the LSDI, its value lies in two parts, one part could be valued directly, the other more important part couldn’t be valued, For example, identify positive planning-related benefits in administration, decision-making, operations management, and service delivery. Those benefits have been derived primarily through the collaboration of LSDI activities. Thirdly, the key of LSDI is not the fund and technology, but the policies and strategy, there are a lot of successful GIS projects built by the cities with a lower finance support.

Of cause, how and whether to construct the LSDI could be judged by the facts of each city, which is related to the Orientation and functionality of the city.

#### 4. THE KEY POINTS

The successful development of a LSDI is not a product but a incremental development process that will progress only in case that a process is simple, cost effective, user-friendly, and flexible with clear products. Political interest and institutional stability and genuine interest for inter-institutional cooperation will add much to the success of this process.

In order to implement an effective development of LSDI, the following points must be paid more attention to.

##### 4.1 Know What LSDI Should Do

The LSDI would aim to:

1. Develop and maintain Standard digital collections of local spatial data;
2. Develop common solutions for discovery, access, and use of spatial data in response to the needs of local user groups;
3. Build relationships among local organizations to support the continuing development of the LSDI;
4. Increase the awareness and understanding of the vision, concepts, and benefits of the LSDI;
5. The LSDI will be an over-arching framework over existing agency-efforts at spatial information generation and format conversion. LSDI will bring about standardization to the total process of format conversion, access and interoperability. LSDI must have the authority to bring about newer data generation, as and when need is felt.

All in all, the LSDI should be a part of NSDI; its work should be guided by the NSDI, referring to the NSDI or the SDI at state level.

##### 4.2 Design a Long Term Development Plan

Xuzhou and many other municipalities in china have developed local-integrated development programs, including LSDI. So a

long term plan for the development of LSDI of Xuzhou should be put forward.

The construction of LSDI needs not only fund and technology, but also sustaining policies and institutional support. Without a long term plan, the LSDI would not keep up with the development of the city. As the expansion of urban area, the development of economy, there should be new requirement to the LSDI, which need to be prepared and planned earlier.

##### 4.3 Establish a Department Guaranteeing the Implement

Compared with the National SDI and State SDI, there is no special department to supervise the construction of LSDI, no explicit directions and policies to instruct the LSDI, and no an agency to deal with the collection and processing, construction and maintenance, dissemination and service, and application research development of the local fundamental geographical information, as well as the planning, design and execution of the urban large-scale base map projects.

So, it is urgent to establish a special department in charge of the LSDI when a city want to be a “digital city”, in addition, it is feasible. Many cities setup the Institute Of Surveying and Mapping which usually belong to The Bureau of Urban Planning, which could in charge of collecting and maintaining the spatial data. The Bureaux of Information or another new department could manage the data sets, such as dissemination and service. The Organization of LSDI described as figure 1.

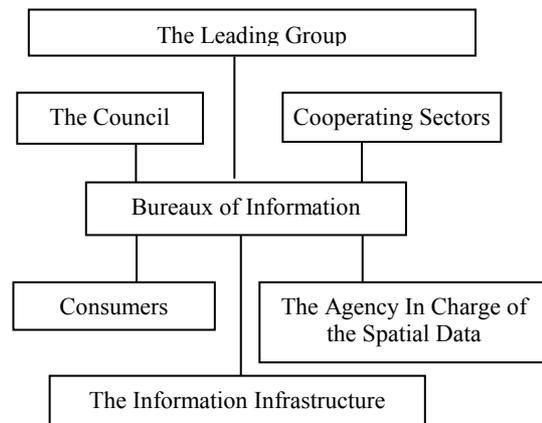


Figure 1. The Organization for LSDI

##### 4.4 Be Practical and Realistic

The state governments assume a key role in building LSDIs and in initiating programs for enabling and coordinating developments at the local government level. A developing city should not overestimate oneself, be aware of the difference to the advanced cities, and be practical and realistic, making a feasible development plan of LSDI with a view to local environment.

If unrealistic, it should be a heavy burden on the municipality, then impacting the economy and others.

## 5. SOME ADVICES TO XUZHOU

As to xuzhou city, the following ideas may do some work.(1) the LSDI should provide users with a uniform geographic space, direct and indirect space reference system .the construction of unified multi-scale irregular and seamless grids is the key to integrate urban social and economic data, and should be attached more importance on.(2) the numerous SDI-related activities at the national, state, and local levels share similar core objectives to stimulate coordinated collection, dissemination, and use of spatial data by public and private entities. This coordination is to result in digital databases that would be easily accessible and seamless across administrative and organizational boundaries and that would contribute social, environmental, and economic benefits to the involved communities. Improved information resources, at the local level.(3) It is necessary to merge geo-information fully into the it-processes of a municipality. so the building-up of the LSDI is aimed at a complete integration of geo-data providers and geo-information users in a comprising GI-network.(4)the institutional and political support is so important for the successful development of a LSDI. Such an infrastructure as xuzhou LSDI should not be a product but an incremental development process. (5) Xuzhou faces major problems in managing growth and their urban infrastructure. the experiences of cities in the developed area have usually proved inappropriate in developing cities and consequently new and innovative solutions are continually being explored for these cities. GIS and the underlying spatial data infrastructures appear to offer significant potential to assist in managing the city of Xuzhou. it is necessary to establish the LSDI for an efficient urban land management. Use spatial information technologies to manage the urban environment.so, the simple, low cost, project oriented, easily maintained and user-friendly spatial information technologies should play a more important role in GIS projects of Xuzhou.

Xuzhou city has always begun the establishment of Land GIS, the newly completed project,” Urban and Rural Integrative cadastral information management +OA(Office Autoimmunization) system” is a specimen project which was awarded a gold medal in the 10th symposium of CCGIS.fig.2 is the interface of the system.

(6) The developing cities are expanding at a much greater rate than developed cities with resulting in major environmental and management problems. The remotely sensed data is a useful tool to resolve such problems, the RS models of urban structure including the spatial structure should be discussed.

Xuzhou has launched the RS projects to supervise the urban area, the decision making system established to instruct the urban plan. in the past, remotely sensed data has been vastly underutilized in guiding urban development in xuzhou city, but new satellite imaging and GIS analysis systems have the spatial resolution and capability to more accurately and economically acquire land use data than by any other means. The LSDI of Xuzhou should make full use of the value of these technologies and recommend their adoption in a new LSDI for Xuzhou city.

Figure3 shows the application of RS&GIS in the land management.

(7)Compared with the big and developed cities, the column of the spatial data sets of xuzhou is a little smaller, which could be saved at a concentrated workshop. so it is better to develop “Enterprise GIS” firstly, that is, the municipality make a plan to develop the urban GIS project in which all the relative departments participate, then establish the thematic GIS to satisfying different users.(8) Should develop the spatial information service for LSDI, especially the E-government. It is a important sign of the success of LSDI is whether the LSDI support the e-government and to what a degree.

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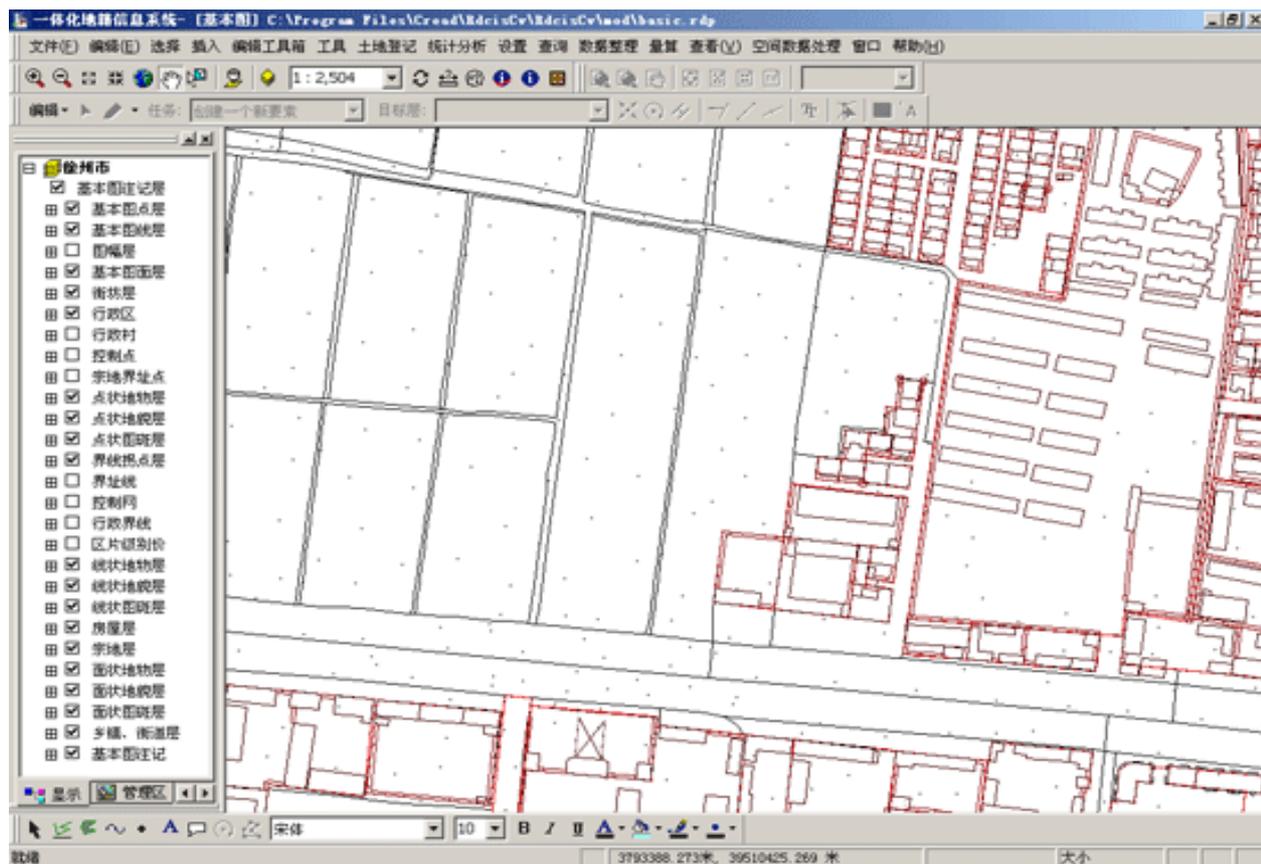


Figure 2. Urban and Rural Integrative Cadastral Information Management +OA System



Figure 3. The overlapped RS imagery of Urban Suburban Integration Area

