



# Exploring the Application of GIS in Urban Planning and Management

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**Abstract:** Smart city construction goals put forward for future civic planning work in China sets ahead higher requirements. Therefore, it is necessary to apply a digital management system to help carry out public planning work. GIS provides planning intuitive and rational tools, which much make up for the original urban planning pure graphics, pure text defects. In the attribute data, spatial analysis and spatial data, graphical performance has significant results, can enhance the level of urban planning carried out in China, has great application significance.

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The application of GIS in some areas has dramatically accelerated the pace of local urban-rural integration. It can be seen that the traditional urban and rural planning model still does not adapt to the requirements of the times, and the application of intelligent, digital-based GIS can be an excellent solution to the problems encountered in work.

## 1 Exploration of GIS in China's smart city planning

The application of geographic information system can help in the preparation of China's smart cities. On January 16, 2020, Iris China and China Academy of Urban Planning and Design jointly signed a cooperation plan, which is to provide advanced GIS system (later referred to as GIS system) for the industry. Among them, Iris

mainly provides its own advanced geographic information system (from now on referred to as GIS system) to accumulate experience in the industry. The goal of China Planning Academy is to promote the role of geographic information technology in China's future urban planning through the above systems. The two parties are ready to develop third-party functions, such as open map application services, decision analysis system, cloud data platform, industry information platform and other features, and through the application and promotion of new technologies, so that various new types of development results can play a more critical role in the future development of China's planning industry. Through the application of geographic information systems, China's urban planning will become more and more scientific, more and more in line with the future development needs of smart cities.

## 2 The role of GIS systems in urban planning and management

### 2.1 Contribution to the enrichment of the urban planning database

Digital urban planning cannot be carried out without comprehensive, accurate, and extensive geospatial data. Therefore, finding ways to enrich the content of the database will become the focus of urban planning work. From the current state of work, the primary need to plan, collect the following three major areas of content: planning document information, professional information, and necessary geographic information.

### 2.2 Speak in numbers - helps in the evaluation and review of planning programmes

According to the GIS system, the calculated data, for example, housing demolition, rock and soil filling and excavation balance, land price distribution and other economic analysis, and planning for comparison, compare the similarities and differences between the two, to better provide ideas for the suitability of land construction evaluation, and find out the planning in the deficiencies, based on data to better carry out the review and assessment of the planning scheme<sup>[1]</sup>.

### **2.3 Public Information Service and Daily Office Operations**

The application of the GIS system is aimed at both the internal units and the general public. And to provide it with public information services, spatial information query and other functions. Through the effective integration of visual information in the database to achieve office automation management, to facilitate the daily work of planning staff, but also to provide stable data query work like the public. Contributes to the unit of social benefits and efficiency improvement.

### **2.4 Contribute to planning for smart cities**

Real-time perception of urban spatial information can be achieved quickly using GIS technology, and the use of GPS and RS technology can achieve short-cycle, visualization, and large-scale monitoring effects<sup>[2]</sup>. By analyzing the monitored data, it can provide data basis for leadership decision making.

## **3 Application of GIS systems in urban planning**

### **3.1 Current Situation Analysis Phase**

The built-in map integration function helps technicians to identify local land development conditions quickly, to clarify the mismatch between land development and environmental requirements, and thus optimize the planning scheme.

### **3.2 Basic data investigation stage**

Through the application of data analysis function, it is possible to quickly retrieve the land use and development situation in different areas of the city, to clarify the direction of planning work.

### **3.3 Plan Formulation**

Through the collection of various attributes of the land, we can seek a suitable space for future land planning

and contribute to the sustainable development of urban planning.

### **3.4 Modelling and forecasting links**

Through the application of environmental planning models, it is possible to predict the effectiveness of the land planning process<sup>[3]</sup>.

### **3.5 Option selection process**

By presenting the data by categories, it can provide some technical support to the planners.

### **3.6 Planning and Implementation**

Green eco-city planning has been a critical point of urban planning, and through the use of GIS systems, the environmental impact of development projects can be evaluated.

## **4 GIS application strategy**

### **4.1 Application of GIS in Preliminary Research**

In multiple locations where urban planning is carried out, a feasibility analysis of the plan is required. By using the GIS system, built-in slope, slope, contour, watershed analysis, etc., can be used as a reference basis for feasibility analysis.

### **4.2 GIS in data analysis planning indicator statistics in the application**

In urban planning and design, the floor area ratio, population density, greening ratio, floor area, building mass, development intensity and other indicators of the planned location need to be defined in advance. Compared with traditional CAD urban planning, the application of GIS technology significantly improves the accuracy of data processing and data processing efficiency, GIS database for hierarchical data processing, more convenient for planning and design personnel to attribute data index calculation and analysis, significantly reducing the planning and design personnel's physical labour.

### **4.3 Application of GIS technology in 3D visualization techniques**

The use of 3D GIS technology allows planners to verify the feasibility of many different design options simultaneously. It is also possible to compare multiple quantitative perspectives on a particular index. The spatial aspect of architectural planning to provide a more productive data support; can also be the above

data and building spatial attribute data integration, so that urban planning in the basis of spatial analysis, can be more targeted on the attribute data classification assessment, assist the technical staff in making a scientific and reasonable decision<sup>[4]</sup>.

Although the GIS system has played a significant role in urban planning in recent years, its real application advantages have not yet been fully realized. The reason is that there are technical and non-technical factors involved: e.g., organizational problems of the system itself, limited availability of specialized planning modules etc.

The highest value of GIS in urban planning lies in its data analysis and summarization capabilities. However, a limited amount of data is often overlooked in model simulations. Therefore, to better solve real-world problems through software applications, comprehensive data collection is required rather than problem-solving requirements.

The use of GIS systems in the process requires strong support from higher authorities and close cooperation with the relevant planning and mapping staff, the applicable technical departments need to apply cloud-based data sharing capabilities, and finally, the local community in the planning region. Environmental and cultural traditions also have an impact on the success of GIS systems. This suggests that different GIS systems can be used with mixed success in different socio-territorial contexts<sup>[5]</sup>.

## 5 Application of GIS in urban planning and research hotspots

### 5.1 Extensions to GIS functionality

Improve the practical use of the system and the ability to analyze data by incorporating third-party software.

### 5.2 Data problems

The analysis and integration of data and processing have been one of the significant difficulties in the application of the system. According to research, although the GIS system in the form of data expression is more diverse, most of the planners focus on data collection, rather than the use of the software. At the same time, for the form of the problem can be analyzed, for no input data module, it will be challenging to carry out the planning simulation and analysis. As the GIS system continues to upgrade, the future of the order will be more

towards the efficiency of data collection and access to possibilities to reduce the impact of data collection on the ability of planners. However, the construction of the GIS database is not overnight but requires a long period of work to accumulate; therefore, the need to seek the support and participation of government departments. The maintenance and construction of the system need to be carried out by all sectors of society to achieve<sup>[6]</sup>.

## 6 The future development trend of GIS systems in urban planning in China

With the continuous development of computer science and technology and related disciplines, GIS systems are bound to integrate more third-party technologies in the future. For example, into the latest PS software, 3Dmax software, SKETCHUP software makes the system's executable functions more diverse; future GIS system processing information from two-dimensional to three-dimensional, better preservation of spatial data in urban and rural planning. With the application of intelligent analysis technology, the future GIS system will automatically realize the prediction, analysis and decision support functions related to geographic data<sup>[7]</sup>.

## 7 Conclusion

With the rapid development of urban and rural integration planning in China, it profoundly affects the heart of every people. In recent years, in the process of urban planning, the application of more high-tech technology, significantly improving the level of civic planning work carried out in China. The use of GIS systems, for planners to carry out the work has brought great convenience, and played a vital role in the planning process. With the future of information technology, intelligent technology, the continuous development of big data technology, the future of the GIS system will become more multi-functional, more convenient for planners to carry out their work, thus ensuring that urban and rural planning work can be sustained.

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