The Practice and Exploration of GIS-based Commercial Housing Price Statistical System - The example of Shenzhen

Li Sha[16], Chong Xiaoli[2],Wang Weiwen[3], Geng Jijin[4], Xie Zuozheng[5]
[135]National Bureau of Statistics Survey Office in Shenzhen, CHINA
[24]Center for Assessment and Development of Real Estate, Shenzhen, CHINA
[6]Corresponding author: Li Sha, email: lis@szdcd.com.cn

Abstract

Residential property has become the most important asset class held by residents today. As such, systematic collection and management of accurate price points at the level of each apartment; and noting related price fluctuations have become a new and important trend in real estate statistics.

Taking Shenzhen city as a working example, we expound upon a new concept merging a Geographical Information System (GIS) with statistical analysis of the real estate market, and further present a new real estate price calculation system based on the collection of residential real estate data.

Based on field research, our model established three standard units of comparison: the standard apartment, the standard building, and the standard residential district. These three distinct levels were used as standards for comparison and extrapolation in the establishment of residential price points for the entire city. Using this model, we built a system that could take a sample of actual residential price points for the month, and extrapolate the price of every residential apartment. Further, this system could establish a price index for each type of residential property in each district in the city.

To illustrate the use of this system, we took a sample of residential property price points for the Jingtian District in Shenzhen. The 35,997 results of the system's calculations were indeed consistent with the actual prices we collected. We believe the model and system presented in this paper is of great value to the residential buyer seeking residential pricing information; and furthermore, is a beneficial tool for the government policy maker.

Keywords: GIS, spatial statistics, housing price

1 Introduction

Housing price is not only the heart core of the real estate industry, but also a key matter concerning the national economy and the people's livelihood. As a result, statistics of housing prices require more accurate and comprehensive data. Based on a housing price statistical database covering all transactions of commercial housings of the city, the paper calculates the price for each house via establishing a price relation of "Benchmark House + Parity Rate", and then figures out the average price for

different types of home by district, which can be referred for house buyers and government policies.

2 The Methodology of Commercial Housing Price Statistics

As a result of distinct regional characteristics and locations keeping unchanged, GIS technology can reflect the reality of "pricing by single house" and satisfy the goal of dynamic monitoring. The paper mainly introduces a GIS-based housing price spatial data integration system and a model of price relations, which can collect the current prices of sold housings, and then estimate the price of the unsold houses, and finally tag each house a corresponding price, whether it has been traded or not.

The housing price measurement approach of "Benchmark House + Parity Rate" provides a price value for each house based on interior price relations between independent projects (including buildings) with 1.7 million existing residential homes, and selects comparable cases for a full-sample price calculation via a further housing price relation structure and the price ratios between the projects within the same area, allowing each house to have a price and then figuring out the average price for each type of house in the area.

3 Design of GIS-based Housing Price Spatial Data Integration System

The combination of GIS technology with the housing price statistical method and a variety of functional subsystems can perform data collection, assessment, query and display of housing prices based on the whole samples. Price assessment is the core of the whole system, while GIS realizes the visualization throughout the calculation processes.

3.1 The Theory of Housing Price Measurement System

The GHPMS collects detailed information on actually sold commercial housings on a monthly basis, and uses the system of "Benchmark House + Parity Rate" to deduce the prices of all houses.

Firstly, the price measurement of Shenzhen's commercial housings is divided into four levels in terms of the size of space. The first level consists of six administrative districts, including Luohu, Futian, Nanshan, Yantian, Longgang and Baoan. The second one includes 440 subareas as defined by Shenzhen Planning Standard Subareas. The third one is the price relation between each building of a project. The fourth one is the price relation between each house of a building.

Secondly, price relations at three levels (including projects, buildings and houses) are built as part of the price calculation system. The price relation between projects is on the basis of market price of a benchmark house, and the partition of districts is for the purpose of building a price relation between the projects in one district, helping search and modify comparable cases for the measurement of benchmark houses. Price relations between buildings of a project consider the factors including location, landscape, the distance to exits of benchmark houses, while interior price relations in a building consider the storey, housing toward direction, type and landscape of a house. With external investigation and market analysis, to what extent each factor will

influence price could be clear.

The pricing of a benchmark house mainly adopts the approach of market comparison. The benchmark price can be figured out via searching comparable cases, which are for the same purpose of use, or have a close connection to assessed house, and then make revisions. Using a batch calculation model, the system sets calculating parameters, and then figure out the current market price of each house.

3.2 Case Study

The GHPMS has been used to evaluate the housing price of Jingtian area. The area has a total land area of 273.59 hectares, most of where are for residential use. It also has complete supporting facilities meeting the demand for business, offices and finance. There are a total of 68 residential projects in the district, with 35,997 houses.

The spatial data and basic information of all houses across the district are loaded to the system, including the location, name and address of project, the name of developer and property management organization, property management fees and standard interior facilities. Attribute information can reflect the overall quality of a project and is a key factor to price. figure 3-1 shows the attribute information of Runfengyuan, a project located at 36 Jingtian East Road, Futian of Shenzhen.

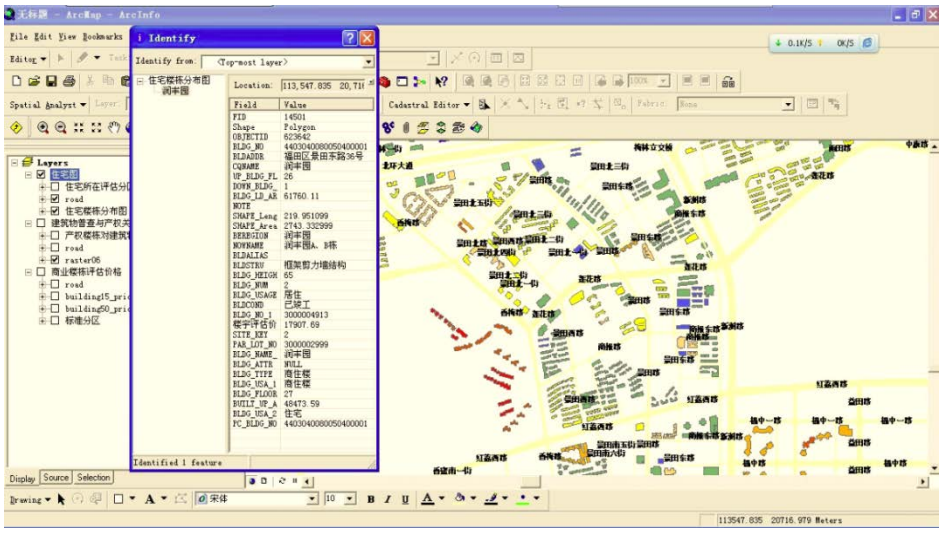

Figure 3-1 Attribute Information Query Table of Runfengyuan

The price estimation for all commercial housings in Jingtian includes process of data collection, accounting and calculation. A verification subsystem is used to check the generated data, while the method of ratio analysis is used to check the proximity of such results to their market price and make revisions.

The calculated data can be exported from a query analysis system. The combination of search criteria with logical operators can perform fuzzy and refine search. Figure 3-2 shows the query results of Dongfang Meiguiyuan.

Figure 3-2 the Output of Query Results

The GIS technology can intuitively display the factors imfluencing price, such as location, type of building and surroundings, and also can provide analysis results in terms of location, subdistrict and time using maps, diagrams and tables (Figure 3-4 and 3-5). Figure 3-3 lists the price of multi-stories residential housings in Jingtian by attributes, year of construction, as well as the monthly price movements.

				June	July	August	September	July	August	September
	Floor Area	Less than 90 Square Meters								
	Year of Construction	Unit	Total Area	Price (RMB)	Price (RMB)	Price (RMB)	Price (RMB)	Growth Rate on a Monthly Basis		
	1997 and before	3819	299602.2	21197	21287	21572.52	21463.61	100.42%	101.34%	99.50%
	1998-2005	153	8724.76	21117	21187	21459.26	21434.2	100.33%	101.29%	99.88%
	2006 and beyond	0		—	—	—	—			
		90-144 Square Meters								
Multi-story Residential Housings		Unit	Total Area	Price (RMB)	Price (RMB)	Price (RMB)	Price (RMB)	Growth Rate on a Monthly Basis		
	1997 and before	1253	127656.08	21062	21138	21533	21311.64	100.36%	101.87%	98.97%
	1998-2005	202	23739.69	21772	21221	22259.38	22233.38	97.40%	104.89%	99.88%
	2006 and beyond	0		—	—	—	—			
		More than 144 Square Meters								
		Unit	Total Area	Price (RMB)	Price (RMB)	Price (RMB)	Price (RMB)	Growth Rate on a Monthly Basis		
	1997 and before	112	64798.98	18753	18778	19010.31	19079.89	100.13%	101.24	100.37%
	1998-2005	170	29105.58	25136	24967	25544.56	25514.72	99.33%	102.31	99.88%
	2006 and beyond	7	1155.24	57430.18	57430.18	57430.18	57430.18	100.00%	100.00%	100.00%

Figure 3-3 Month-on-month Price Index of All Multi-story Residential Housings in Jingtian

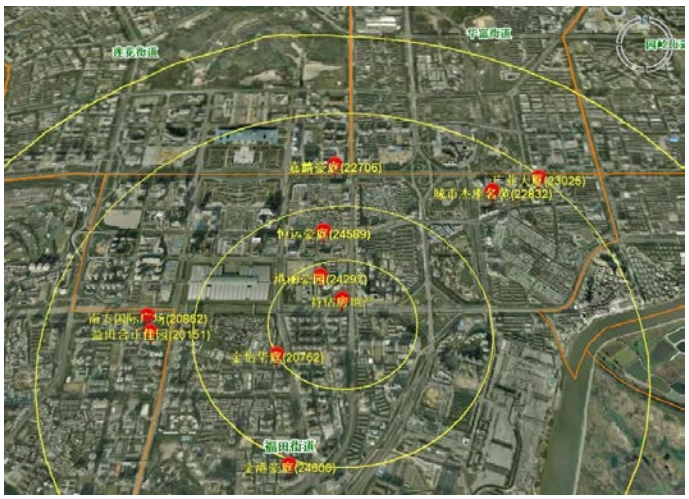

Figure 3-4 2D Display of Comparable Cases

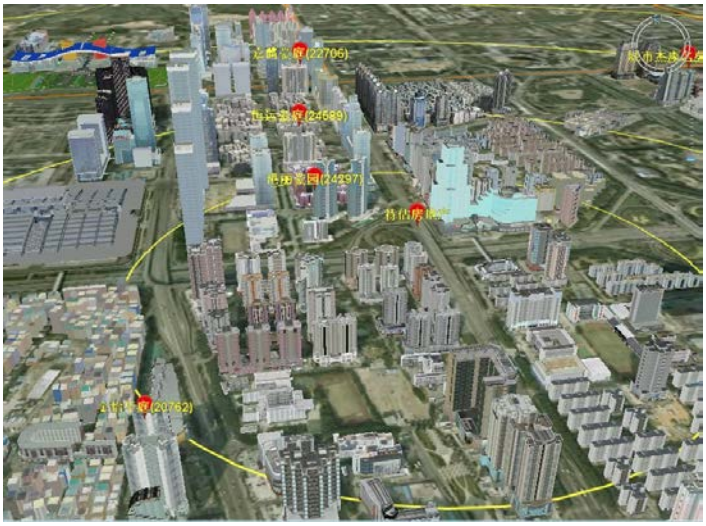

Figure 3-5 3D Display of Comparable Cases

4 Conclusions

The paper holds a view that the combination of house price statistics and GIS is inevitable trend, which can solve more tricky problems than traditional data Statistics method, and can develop new ideas and methods for housing price statistics. Meanwhile, the market prices estimated by the housing price measurement system could provide a basis for government to monitor and control the dynamic real estate market, and also can be referred by house buyers. With the help of this system, real estate developers are capable of making a more informed pricing decision for their new projects, and brokers could make a smooth deal between the buyers and sellers.

There are some aspects can be improved in the study. Such as, we could launch a diversified housing price publication system, further ensuring the authenticity of source data and improving the basic database of housing prices.

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