

Potential of High-resolution Satellite Data and other Geo-ICT for Land Valuation in Urban Areas

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Abstract: The use of satellite-based Remote Sensing (RS) data, Global Position System (GPS) and Geographical Information System (GIS) are being established in various applications and the process of semantic spatial information systems has now become a reality. The urban development is a complex phenomenon, which is changing rapidly. Hence, it requires enormous amount of dynamic data to support the decision system. RS technology has proved to be time effective and cost effective. High-resolution satellite data can be used for base map preparation, land-use map preparation and many other maps of the urban area, which can be updated frequently. These base-maps can be made more accurate using GPS. These data, along with GIS software, has enabled surveyors to create more detailed maps for surveys.

This conceptual paper reviews land valuation methodology followed in Karnataka in general and with respect to Bangalore in particular. Though, a well-established system is available for Land Administration as well as for land valuation in Karnataka, it is not efficient and effective in serving the growing need of common man in urban area. In order to make an efficient land valuation system, various factors can be taken into account and different scenarios can be visualized through GIS and arrive at a comprehensive property valuation module which will enable general public to know the cost of their property according to Government rules.

1. INTRODUCTION

Due to rapid urbanization, drastic land transformation is happening in the urban area in India. As per 2001 census, the average India's urban population is 28% and the same is 34% in case of Karnataka (Bhagat 2005). Bangalore has emerged as the fifth largest metropolis and its population has increased to phenomenal 5.7 million today from just 1.4 million in 1941 (Nagaraja Rao 1996). During the 1990s Bangalore developed into a preferred location for high technology industries such as electronics, information technology (IT), telecommunications and emerged as a globally integrated centre of high technology research and production. Today Bangalore is India's fifth largest and the fastest growing city in Asia and ranked among the 10 fastest growing cities in the world; also Bangalore has moving population of more than 1 lakh. This ever-growing population has a strong impact on urban land administration. Hence, Bangalore has been considered in this study.

The use of satellite-based Remote Sensing (RS) data, Global Position System (GPS) and Geographical Information System (GIS) are being established in various applications and the process of semantic spatial information systems has now become a reality. The advent of GIS technology has transformed spatial data handling capabilities and made it necessary for re-examining the roles of government with respect to the supply and availability of geographic information. Many studies are available in literature, which assesses the RS, GIS and GPS capabilities to monitor the physical transformation of land in urban areas (Ting and Williamson 1999; Roger A. McCain 2003; Saxena 2003; Hussain, Qureshi et al. 2005)

2. LAND VALUATION

All land and the construction on it has value. This value depends on the purpose for which that value is determined. For example, value of a building for insurance purpose is different than the selling value of that property. Land valuation is the process of assessing the characteristics of a land to determine value. The use of a particular property valuation technique is dependent on property type and the

purpose of the valuation(Dale and McLaughlin 1988). In the land valuation, it is a common understanding that the value and potential of a property are fundamentally determined by its location.

In Karnataka, a well-established system is available for Land Administration as well as for Land Valuation. Though Government of Karnataka has set up computerized land record kiosks (Bhoomi centres) in taluk¹ offices to provide farmers with the Record of Rights, Tenancy and Cultivation (RTC), technologically, this is far away from the use of GIS, GPS and RS for the effective use of these technologies for easy and effective tax calculation. However, there are many more steps towards e-governance in Karnataka (P.V.Rajasekhar 2005).

2.1 Current Method Followed In Karnataka

The origins of fiscal cadastres that support a system of land valuation, and land tax can be traced to Egyptian times (Dale and McLaughlin 1988). On the other hand juridical cadastres, information systems that underpin the legal registration of land in support of land transactions are far more recent. Over time many of these cadastral systems have evolved beyond their primary purposes to provide the basis for general land administration systems (Ting and Williamson 1999). In many countries, Central Valuation Authority is responsible for administering government valuations and the fiscal cadastre (ECE/HBP/96 1996; Miller 2000). As per the Karnataka Act (2003), a Central Valuation Committee (CVC) has been constituted under the chairmanship of the commissioner of stamps. It may be noted that the department of stamps and registration is one of the top revenue earners to the State. Representatives from various departments includes Directorate of Town Planning, Bangalore City Corporation, Bangalore Development Authority, Income Tax Department, Karnataka Public Works Department and Federation of Karnataka Chamber of Commerce and Industry. The need for including the representatives of officials of the local/planning authorities is that, one of the main factors to be considered in assessing the Land Value is the Zone use of the land as prescribed by the planning authorities and the maximum built up area that can be constructed in the land as per the Development Control Rules. A representative from Income Tax department is included because the guideline value is considered the base for computation of capital gains tax if the guideline value is higher than the sale value.

The Karnataka Act envisages the constitution of market valuation sub-committees in each sub-district and district for the purpose of estimation and revision of the market value guidelines of the properties. The members of the sub-committees are drawn from departments of Revenue Survey and settlement Public Works Municipal Councils or Town Panchayats.

2.1a Estimation of Market Value Guidelines

The CVC sends instructions along with general policy guidelines by first week of October every year to all the sub-committees for estimation of market value guidelines for the next calendar year and call for objections / suggestions of the public. The sub-committee decides on the estimation of the market value rate for the guidelines and prepares a statement showing the average rates for agricultural land and residential commercial industrial sites. The data is then sent to the registrar of the concerned district in the last week of December every year. The registrar verifies and records his views and sends it to the CVC in the first week of January of the next calendar year.

Various parameters considered for Land valuation by CVC are(2003) :

a. In case of agriculture land

- Classification of land as dry, garden, wet and the like
- Classification under various classes of soil in the survey records.
- Other factors which influence the valuation of the land in question
- Value of adjacent land or lands in the vicinity

- As far as practicable, the nature of crop and average annual yield from the land for the last five consecutive years;
- Determination to road and market distance from village;
- Facilities available for irrigation such as tanks, well and pump sets.

b. In case of house sites

- The general value of house sites in the locality
- Proximity to road / railway station / public transport
- Distance to market shops and the like
- Amenities available in public offices, hospitals and other educational institutions
- Development activities and industrial improvements in the vicinity
- Land tax and valuation of sites with reference to taxation records of the local authorities concerned
- Any other features having a special bearing on the valuation of the site
- Any other special features like bore well in addition to public water supply, lawn, garden and swimming pool

c. Properties other than lands house site and buildings

- The nature and conditions of the property
- Purpose for which the property is being put to use
- Any other special features having a bearing on the valuation of the property.

With regard to commercial property, functional qualities may include:

- Location influences (accessibility to the market place, proximity to suppliers of raw materials and important nodes such as railway stations, car parks and open spaces)
- Physical attributes (size, shape, age and condition)
- Legal factors (lease terms and restrictive covenants)
- Planning and economic factors (planning constraints, permitted use and potential for change of use).

2.1b Actual Market Value

In reality, the actual market value is altogether different from that of guidance value. Market value is usually determined by a sale of a property in a competitive market between two prudent and knowledgeable parties and represents the highest price that one can get for his property under current market conditions. The market value for a residential site / house in an urban area would be estimated based on the following factors (These parameters are derived from literature (Yomralioglu and Nisanci 2001) and interviews with limited number of site purchasers in Bangalore).

1. Nature of the land like BDA, Housing Co-operative Society, Converted, CMC, Gramathana.
2. Availability of basic services
3. Permitted number of floors
4. Permitted construction area
5. Landscape, view
6. Access to street
7. Environment
8. Parcel location within block (corner, middle)
9. Street frontage
10. Available utilities

11. Distance from nuisances
12. Neighborhood quality
13. Land parcel shape
14. Currently usable area
15. Distance to city center
16. Commuting time to the working place
17. Distance to educational centers
18. Distance to health services
19. Access to bus stand / railway station / airport
20. Access to highway
21. Distance from noise
22. Distance to shopping center
23. Soil condition
24. Topography
25. Distance to recreational areas
26. Distance to religious place
27. Distance to play garden
28. Distance to fire station
29. Distance to police station

Apart from these parameters, availability of finance, Interest rate on housing loan and incentives from the government in the form of income tax rebate etc., decides the demand for house / site. Bangalore being the hub of IT activities is growing very fast. Also, IT companies are providing a good perk in the form of housing loan that attracts income tax rebate. Many other sector employees are also in the process of acquiring a plot or house as they can avail housing loan with attractive interest rate (Interest rate has been dropped significantly from 18%-20% during beginning of 1990s to 7%-8% today)².

2.1c Guidance Value Vs Market Value - Issues

Guidance values are those fixed by the Department of Registration and Stamps through the above process. These are the minimum values that a property in specified areas is supposed to fetch and on which stamp duty and registration charges are to be paid. The value varies from area to area; also, practically, different from that of market value.

Market value is the most probable sale price of a real-estate property in terms of money assuming a competitive and open market. A buyer would purchase the land / property with market value, not as per guidance value. It varies from area to area but not in accordance with guidance value.

Issues: If the purchase value is more than the guidance value, the stamp duty and registration charges are to be paid on the purchase value as mentioned in the document (sale deed). In case the value of property is less than guidance value, the stamp duty and registration charges are collected as per guidance value. As such the land value itself is high in Bangalore because of the rapid urbanization also, when stamp duty and registration charges are also high, people find various ways to avoid / reduce the registration charges through disclosing the less value in the document, or holding the property through General Power of Attorney, affidavits, by declaration of delivery of possession and avoid registration. All these hardships can be avoided if the guideline value is fixed following a proper procedure so that the difference between it and market value will be marginal.

3. POTENTIAL OF MODERN TECHNOLOGIES

The urban development is a complex phenomenon; also changing rapidly. Hence, it require enormous amount of dynamic data to support the decision system. RS technology has proved to be time effective and cost effective to provide such data. High-resolution satellite data can be used for base map

preparation, land-use map preparation and many other maps of the urban area, which can be updated frequently. These base-map can be made more accurate using GPS. These data, along with GIS software, has enabled surveyors to create more detailed maps for surveys. This information, when further combined with other systems such as communications devices, computers and software can perform a wide range of tasks. GPS, along with GIS software, can provide a reliable and efficient system, which serves various applications like traffic planning, vehicle tracking, land-use modeling, urban growth, etc.; including land valuation.

3.1a Remote Sensing

Aerial photography played a major role in cadastral mapping; presently high-resolution satellite data is providing the needed accuracy for cadastral level mapping at 1:4000 or better scale. Use of RS data for tax assessment is also not new in India. Maharashtra Krishna Valley Development Corporation (MKVDC) has successfully utilized geo-referenced village (cadastral) map for sugarcane crop identification and revenue targeting in command areas. These maps were integrated with crop maps which facilitated to identify parcels where sugarcane crop is grown. Village wise crop area statistics provide revenue target for the field officer to collect levy(RRSSC 2005). Many such programs are launched by various Departments. One such example: Department of Space has launched programme to create a seamless Cadastral Referencing Database for Karnataka and Gujarat with the respective state remote sensing centers(NNRMS 2005).

3.1b GPS

Triangulation became the basis of all modern mapping. Today, the Global Positioning System (GPS) has become a significant alternative to triangulation, which establishes the positions of points on the surface of the earth using artificial satellites. The base map prepared using satellite data can be made more accurate using GPS. One can also measure the exact height, dimension of the plot, exact location of infrastructure like underground pipe, telephone lines, optical cables, water supply pipes etc., using GPS. The primary advantage of GPS is that the property tax administer can determine the location of any point without maps in the field. Comparing information from field sightings with ownership plots in the office can determine property ownership. This will help identify improvements, which are not on the assessment roll, location of gravel pits and oil drilling rigs, and other properties far from urban areas. GPS is an important tool for the property tax administrator, however, parcel descriptions needs to be considered from the land registry.

3.1c GIS

GIS allows users to input data from various sources like remote sensing, traditional cartographic maps, aerial photographs and other textual information. The power of GIS lies in the ability to combine spatial and attribute data to account for location's impact on property values. Once GIS is developed, various other users can also share and use the data more effectively(Tuladhar, Radwan et al. 2005).

3.2 Use of Modern Technologies in Karnataka

The Local authorities in India, (specifically in Karnataka) have understood the requirement of GIS in their everyday operations. In most of the cases Local Authorities have initiated to develop new Urban GIS applications to provide wide range of analysis capabilities. Few Initiatives by Karnataka Government to use Geo-ITC are:

- a. Industrial Estate Planning through GIS in Karnataka by Karnataka Industrial Areas Development Board (KIADB),
- b. Property enumeration & mapping system for Bangalore by Bangalore Mahanagara Palike (BMP) which is the local municipal body,
- c. Digital urban management programme - Evolution of Bangalore GIS model by Bangalore Agenda Task Force (BATF)

- d. Bhoomi by Revenue Department, Government of Karnataka
- e. GIS based cadastral database generation for Karnataka State Remote Sensing Center
- f. Etc.,

However, there is a need to have an integrated approach to share the data as well as the infrastructure to use the technology in a more effective and efficient way.

4. SUGGESTED APPROACH

Various factors influencing the property value in long run can be seen from four angles : Social, Economic, Government and Environmental aspects(Tuladhar 2004). Population changes, Rate of household formation, Life style options and Education matters mainly from social point of view, where as Income level, Employment, Demand and Supply are the major Economic concern. However, Environmental aspects like Climate condition, Topography, Position and Desirability of areas as well as Government regulations, zonation by Government are also important factors influencing the land value. The same is depicted in the Figure 1.

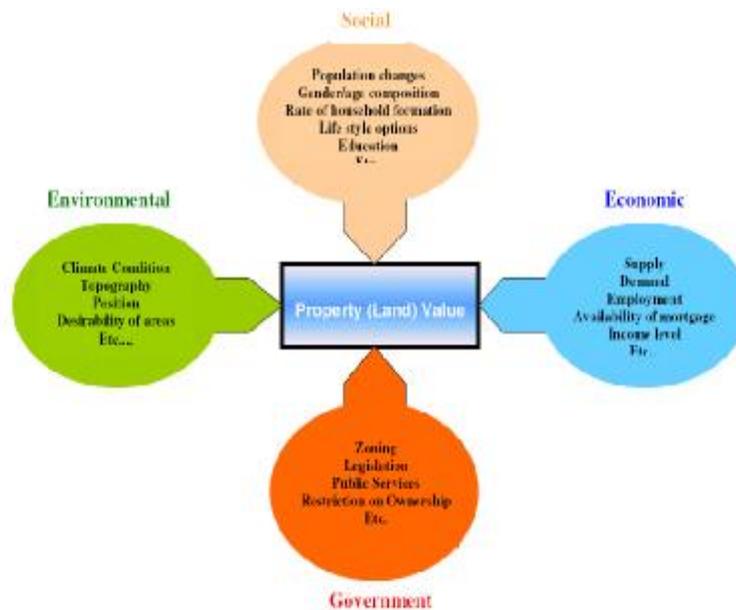


Figure 1 : Factors affecting the Land Value

All the factors affecting the land value can be analysed in GIS environment. GIS is undoubtedly useful in decision making of land valuation. The advantage of GIS is that land characteristics can be incorporated in an objective way. Both tangible and intangible land valuation factors could be taken into account during the valuation process. The parameters derived from a combination of the selected land valuation factors, can be spatially analysed using GIS. Land value can then determined as a single unit figure, which represents all factors affecting the land as compared to others. Once, these GIS database is ready, following advantages can be envisaged:

- Each factors considered for land valuation can be given a weight based on its importance. This could be in two forms. 1) Importance value or weight within a layer, say nature of plot 2) The weight could be relative with respective another layer/parameter. In a GIS environment, one can easily model and arrive at a best

land valuation map giving a comprehensive value based on all the factors affecting the land value.

- Similarly, one can prepare a market value map after collecting the actual market value. This map can also be build from the parameters affecting the market value. Some of the parameters may be very important while deciding the value and others may not be very critical. However, one can easily arrive a very appropriate value based on its relative importance.
- Another advantage is the one can consider the previous years land value map as a base for the next year's calculation. This can be easily compared with market value map.
- Guideline value map and market value map can be compared easily. It is possible to explain the discrepancy if found as each value has been arrived as a combination of various factors.
- A visual land valuation model can be created which will be readily understood by individuals unfamiliar with CVC procedures and also the valuation professionals.
- Before deciding the land value, valuation sub-committee can seek the public opinion / objection / suggestion. In this mode it becomes easy for the public to participate actively in calculation of land value.
- These information can be published on the web/internet where user can access to know the value of site/plot of his interest thus providing a transparency in the system. Integrated Database Management System could serves a large variety of users such as municipalities (CMC), real estate brokers, provincial governments (BATF,BMP etc.), insurance companies, financial agencies (including bank), utility companies who provides public services (BWSSB, KEB, Bangalore telecom etc.), various ministries, courts, individual citizen, notaries, etc .,

5. CONCLUSIONS

Land administration system in India was originally set up to raise revenue from Land. In the State of Karnataka a State Tax called Land revenue that is collected by the Revenue Department is used and has proved to be quite effective. However, in urban areas where rapid changes are occurring, there is a need to use the modern techniques like RS for Land use change detection, GPS for establish the positions of points on the surface of the earth and GIS to study the implication of these changes and for re-valuate the taxes. A comprehensive property valuation module which will enable general public to know the cost of their property according to Government rules.

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