Valuation of Residential Properties by Hedonic Pricing Method (HPM)

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Abstract - Hedonic Pricing Method (HPM) is used for estimating the value of a commodity or the demand for a commodity. The method has been widely used in real estate and housing market research in the recent past. In this report, Estimation of residential market price by Hedonic Pricing Method due to environmental service is discussed. Environmental services is a concept from the ecological economics literature. Environmental services refer to qualitative functions of natural non-produced assets of land, water and air (including related ecosystem) and their biota, which implies natural environment providing particular important uses or benefits that can be captured under the concept of "services." It undertake an examination of use of this methodology in the recent real estate and housing literature in the preparation of housing predictive model. The idea behind the HRM is that the commodities are characterized by their constitute properties, hence the value of a commodity can be calculated by adding up the estimated values of its separate properties. Data required that influences the residential property rates will be collect.ed and are analysed using regression analysis which relates to statistically estimate a function that relates property values to the property characteristics, including the distance to open space. Thus, the effects of different characteristics on price can be estimated. The results can be used to evaluate the variations of property rates for small change in characteristics holding all other characteristics constant. Price prediction model is than prepared.

Index Terms – Environmental Services, Hedonic Pricing Method, Implicit Price, Price Prediction Model, Surrogate good.
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I. INTRODUCTION

The term "hedonics" is derived from the Greek word "hedonikos", which simply means pleasure. The Hedonic Pricing Method (HPM) here after referred to as HPM method is used to estimate economic prices for ecosystem or environmental services that directly affect market prices. The HPM takes into consideration the value of a surrogate good or service to measure the implicit price of a non-market good. It is applied to variations in housing prices that reflect the value of local environmental attributes. It is also known as Hedonic Regression Method (HRM) or Hedonic Demand Method (HDM). The basic idea of the HPM is that the price of a marketed good is related to its characteristics, or the services it provides, rather than the good itself. For example, the price of a house reflects the characteristics of the house — land size, age, number of bedroom, bathrooms etc.). Therefore, we can value the individual characteristics of a house or other good by looking at how the price people are willing to pay for it changes when the characteristics change. The HPM is most often used to value environmental services that affect the price of residential properties. It can be used to assess economic benefits or costs linked with: Environmental quality, including air pollution, water pollution, or noise Environmental amenities, such as aesthetic views or proximity to recreational sites Air, water, and noise pollution have a direct influence on property values. By relating properties with otherwise similar characteristics or by examining the price of a property over time as environmental conditions change and correcting for all non-environmental factors, information in the housing market can be used to estimate people's willingness to pay for environmental quality. House value is a function of all of the elements relating to the house. Using HPM, data are analysed, which relates to the value of the property to its characteristics and the environmental characteristic of interest. Thus, the effects of different characteristics on value can be estimated. The regression results indicate how much property values will alter for a small variation in each characteristic, holding all other characteristics constant.

II. BRIEF REVIEW OF THE LITERATURE

Several studies and researches considering Hedonic Pricing Method and its application has been carried out. Jack E. Triplett [1] originated in the development of value indices for manufactured products (motorcars) that measure of quantity and quality by a hedonic price index. M.N. Murty and S.C. Gulati[2] has considered a generalized hedonic prices model in view of household decisions about house location, job and travel as interdependent is used in to estimate the environmental benefits from the reduced exposure of the household to pollution. Jens Kolbe Henry Wüstemann [3] paper examines the effects of UGS on house prices applying HPM. Jiansheng Wu et al [4] in his paper looks at HPM from three dimensions: structural attributes, location variables, and environmental variables. Peter Elliott et al [5] suggested method relies on highly developed property markets in the vicinity of the national park. Herath Shanaka and Maier Gunther [6] the idea behind the hedonic pricing method is that the commodities are characterized by their constitute properties, hence the value of a commodity can be calculated by adding up the estimated values of its separate properties. Alexandre Tangerini and Nils Soguel [7] have put forth the use of Hedonic price method in order to analyse tourists' preferences regarding the landscapes of Alpine resorts in the Swiss Canton of Valais. Richard J. Cebula [8]

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studied that the real sales price of residential properties by HPM of the City of Savannah and its Savannah Historic Landmark District. Dr. Haripriya Gundimeda [9] studied the applicability of HPM to value water resources such as Bays, lakes and reservoirs, building of a new harbor, river views, restoration of urban stream, noise, landfills, dumping sites etc. on nearby property values. Karen Mayor et al [10] presented paper wherein Hedonic house price model was used to estimate the value of transport networks to homeowners in the Dublin area.

Based on the afore-mentioned review of literature, an effort is made to apply Hedonic Pricing Method in preparing residential price prediction model.

III. STATEMENT OF THE PROBLEM

HPM uses surrogate market to estimate economic values for different variables which directly affect market price and most commonly applied to residential price. The basic premise of HRM is that the price of a market good is related to its characteristics, or the services it provides (like land size, age, number of bedroom, bathrooms etc.). In addition the geographical location of house also plays an important factor in influencing the house price.

Traditional house price prediction is based on cost and sale price comparison lacking of an accepted standard and a certification process. Therefore, the availability of a house price prediction model helps fill up an important information gap. Succeeding empirical research has improved the predictive power of model by emphasizing attributes of property value such as housing site, housing quality, geographical location and the environment.

HPM, improves price predictions as well as estimates of marginal prices. The present house price determination process is based on value zone map. This value zone is established according to the structural and neighborhood characteristics of the property zone. The value zone rate is established according to average property rate (price/sq. m) of transactions in the one year.

With the advent of new technologies (e.g. GIS), and statistical techniques (e.g. spatial models, clustering techniques), more sophisticated forms of analysis have become possible.

The HPM is also useful to improve price predictions as well as estimates of marginal prices. An accurate prediction of house price is important for homeowners, investors, developers, tax assessors and other real estate market participants, such as insurers, mortgage lenders. Therefore, the availability of a house price prediction model helps fill up an important gap and improve the efficiency of the real estate market.

IV. AIMS AND OBJECTIVES

The work is to apply Hedonic Pricing method in preparing residential price prediction model. Pursuant to this, the following objectives are proposed.

- To identify environmental service that has impact on property rate in the study area.
- To find the characteristics like structural characteristics, neighborhood characteristics and environmental characteristics that affects the property rate.
- To find the variation in property rates due to location of property from the identified environmental service.

V. METHODOLOGY

Without a proper well – organized research plan, it is impossible to complete the project and reach to any conclusion. Figure no 1 shows research methodology.
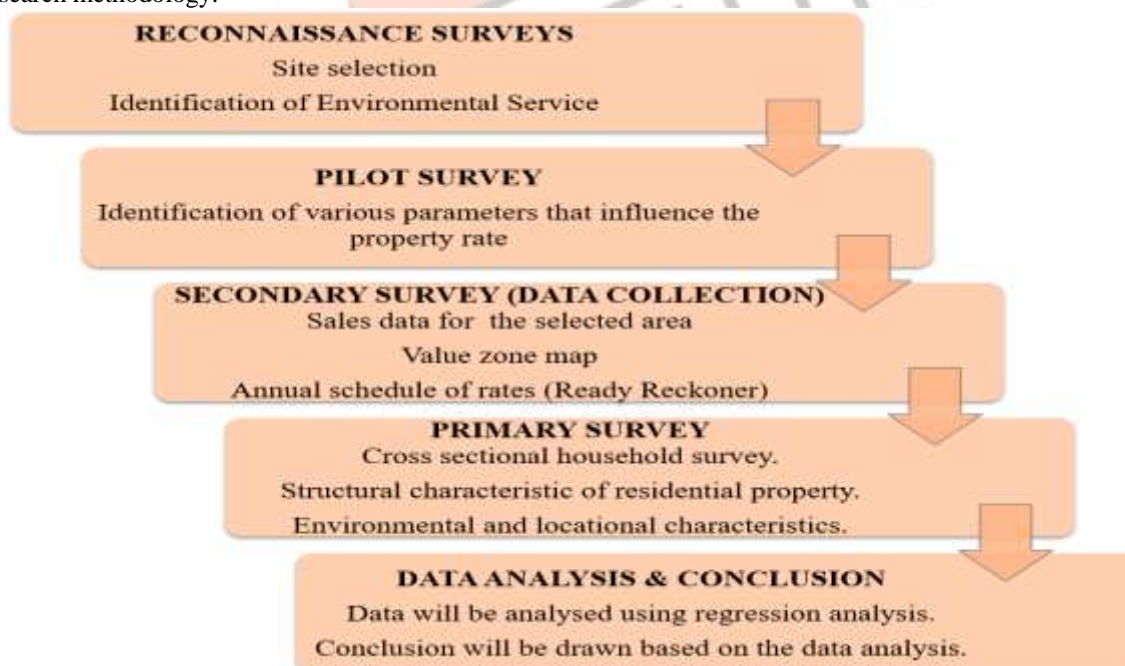

Fig. 1: Flow chart showing methodology to be adopted.

Reconnaissance Survey

Identification of Site and Environmental Service:

The site considered is located in Raigad district of Kharghar area. The environmental service that is identified is Central Park. The **Central Park, Kharghar** is spread in an area of 119 Ha. (approx.) across the sectors 23, 24 & 25 .It have been opened for public from 2010. It consists of theme parks, Morning walk-trails, jogging tracks, Water sports, Cricket & Football grounds, Sports clubs, Botanical gardens, Amphitheatres, Active & passive recreation areas etc. It is expected to be one of the largest gardens in Asia when fully developed. It is now the world's second largest park, taking the city of Navi Mumbai to a higher level.

Parameters identified for survey

Based on the various reviews of literature, Table I shows the various parameters considered for the survey:

Table I: Parameters Identified for Survey

1	Structural characteristics	-	Built up area, number and size of rooms, availability of lift, parking, security arrangement, building age.
2	Environmental characteristics	-	Noise pollution, traffic congestion, facing green area.
3	Locational characteristics	-	Distance to work and shopping centres, availability of public transport, distance to amenity, main road, school, and slum.
4	Household characteristics	-	Income group, number of vehicles, electricity bill, service charges, number of member in house.

Pilot Survey

The draft survey format is prepared and a pilot survey was conducted. In this survey, 10 samples are surveyed and some missing attributes are identified.

From the pilot survey it was observed that the actual residential price is more than the house transaction recorded in residential property sales. So a new parameter for the difference in this price is considered. The parameter is named as cash transaction.

Survey Proforma

Based on the various review of literature, reconnaissance and pilot surveys final survey proforma is prepared.

Secondary Survey

The secondary data is collected from Valuation Department- Konkan Bhavan, Belapur. Data collected are listed below,
1. Value zone map of Kharghar.
2. Sample of house transaction for 2015.
3. Ready Reckoner 2015.

Sample Size for the study

In order to get a sample size of the population, the Fisher, Laing, Stoeckel and Townsend (1998) formula for determining sample size will be employed. This formula is given as:

$$\text{nf} = \frac{nXN}{N+n}$$

Where:

nf = the desired sample size (when population is less than 10,000),

n = the desired sample size (when population is greater than 10,000),

N = the estimate of the target population size.

In other to get n, Fisher et al. (1998) provided another formula, which is

$$n = \frac{z^2 pq}{d^2}$$

Where:

n = the desired sample size (when the population is greater than 10000)

z = the standard normal deviation, usually set at 1.812 which corresponds to 93 percent confidence level

p = the proportion of the target population have particular characteristics (Considering 80%)

q = 1.0-p

d = the degree of accuracy desired, this is usually set at 0.07

Using all these values the desired sample size (when the population is greater than 10000) is calculated as:

$$n = \frac{1.812^2 * .80 * .20}{0.07^2}$$

$$= 107.22 \approx 110$$

As calculated n=110 is obtained. The population of the ward or sector in terms of resident recorded in house transaction data of 2015 is 950. Using these and putting in equation I, the sample size for the study be calculated as:

$$n_f = 110*950/ 950 +110$$

$$= 98.5 \approx 99$$

Total samples considered for the study are 99.

Method of Survey

Quota Sampling:

In quota sampling, samples are selected non-randomly according to some fixed quota. There are two types of quota sampling: *proportional* and *non-proportional*. In **proportional quota sampling,** major characteristics of the samples by sampling a proportional amount of each is shown. **Non proportional quota sampling** is a bit less restrictive. In this method, you specify the minimum number of sampled units you want in each category.

This method is the non-probabilistic analogue of stratified random sampling in that it is typically used to assure that smaller groups are adequately represented in your sample.

Systematic Sampling:

Systematic sampling is a statistical method involving the selection of elements from an ordered sampling frame. The most common form of systematic sampling is an equal-probability method. In this approach, progression through the list is treated circularly, with a return to the top once the end of the list is passed. The sampling starts by selecting an element from the list at random and then every k[th] element in the frame is selected.

In the study, 0.5 km interval from environmental service was set as the fixed quota. And within this range systematic sampling is carried out covering all income group. Selection is based on the secondary data collected i.e. Address of each property mentioned in house transaction data collected from Valuation Department, Konkan Bhavan, Kharghar.

Primary Data Collection

Based on the primary survey data is being recorded for all 99 samples in excel sheet.

VI. FINDINGS

Figure 2 shows the Environmental Service identified and the area covered under study.
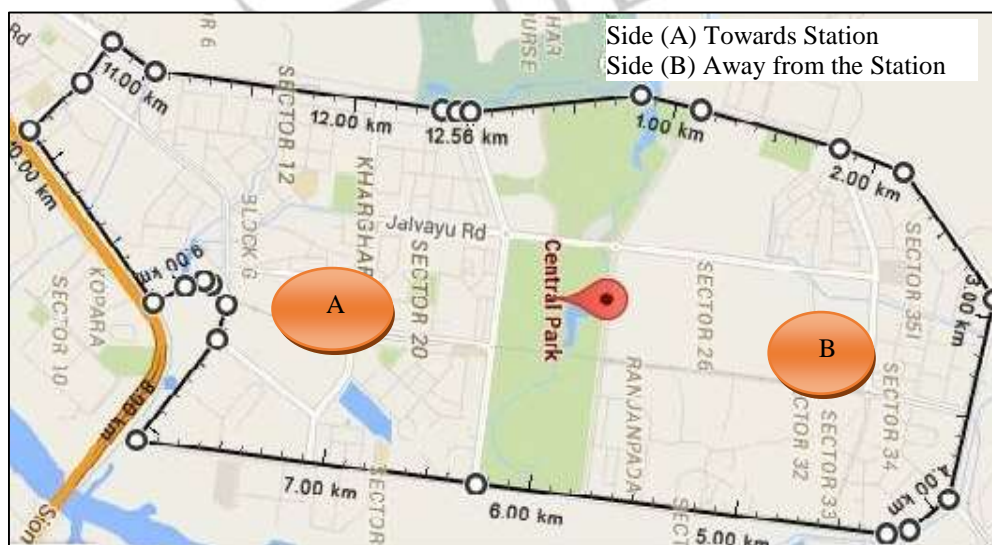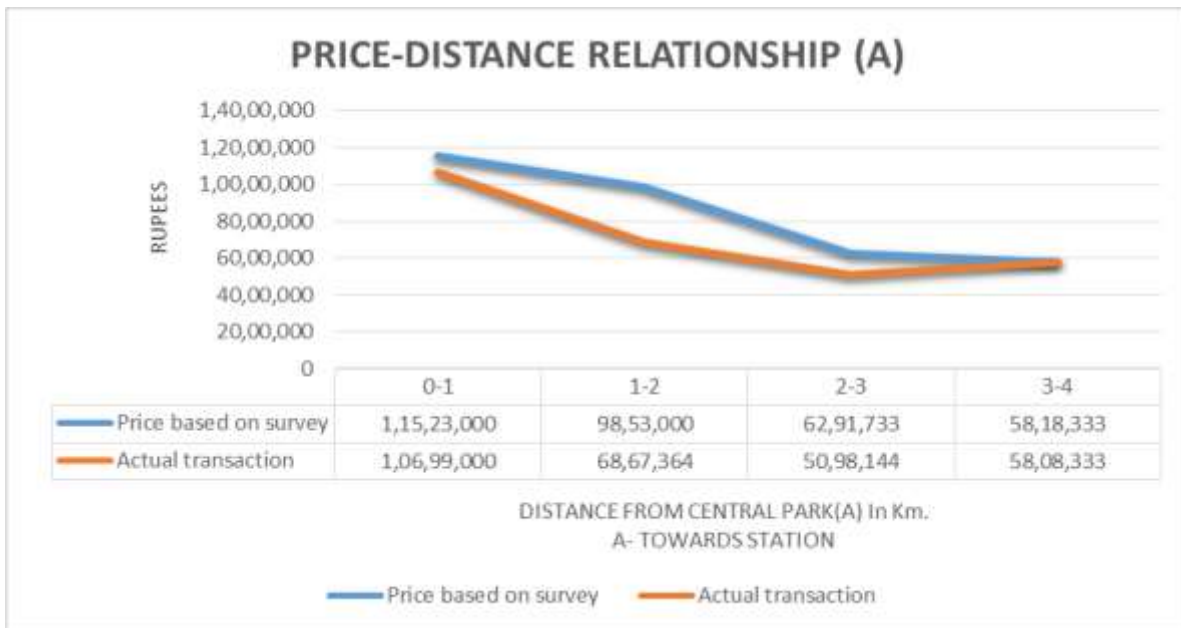

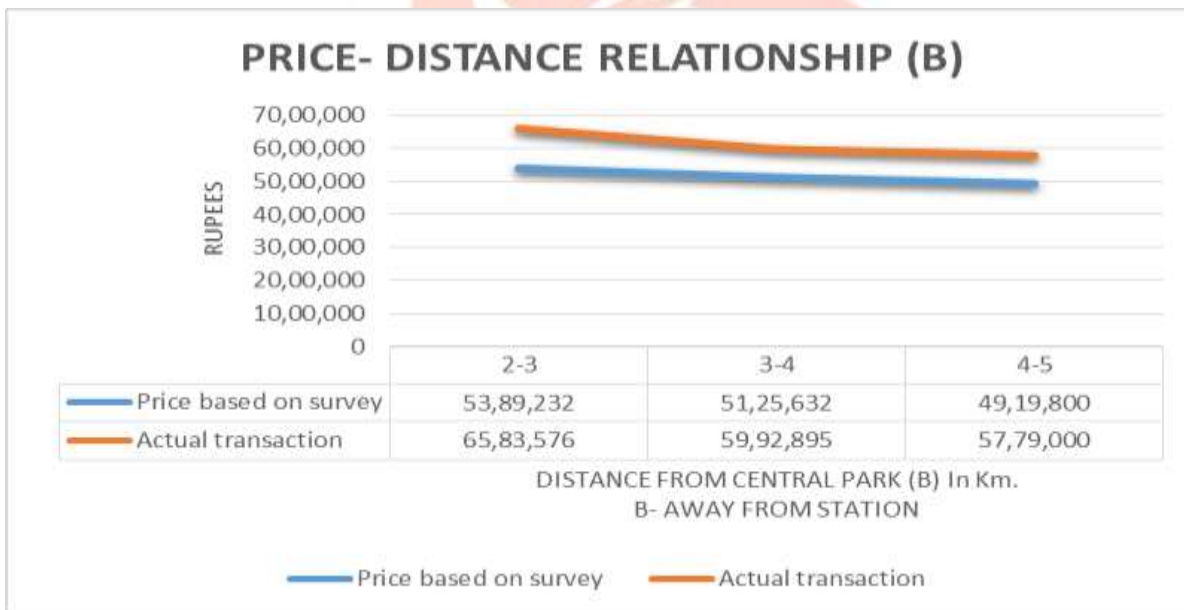**Fig. 2:** Map showing the two sides of the environmental service identified i.e. Central park, Kharghar

Correlation of Price – Distance

- Price- Distance

From the Price- Distance Correlation (Figure 3 and Figure 4) it is found that as the distance from the Central park is increasing the residential price is decreasing towards the station side and vice-versa for the opposite side of the site selected.

Fig. 3: Price to distance relationship (for site "A" towards the Station)

Fig. 4: Price to distance relationship (for site "B" towards the Station)

Like-wise various Parameters are considered with respect to distance and the benefits associated with such environmental Service (Central park, Kharghar) analyzed.

VII. CONCLUSION

Central Park influence property rate in Kharghar. From the Price- Distance Correlation it is found that as the distance from the Central park is increasing the residential price is decreasing towards the station side and vice-versa for the opposite side of the site selected. People are willing to pay for environmental quality. People residing near to the park pay more than the people residing away from the park. From the view of the afore-mentioned some of the finding emerged from the present investigation, it can be concluded that the housing market is affected by many parameters one of which is the presence of the environmental service in the vicinity.

VIII. SCOPE OF FUTURE WORK

The present investigation was confined to the application of HPM to the Residential/ Housing Market only. This investigation can be extended in future to incorporate some of the following aspects which have not been covered in the present study:

- Analysis and Preparation of Price Prediction Model.
- Consider time of sales of property and check how the property rate is influenced by it.
- Consider a variable that shows property is in which floor.
- Compression of price as from HRM and other methods of valuation.
- How can HRM be applied for other than residential purpose.

IX. ACKNOWLEDGMENT

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