THEME

Valuing Livelihood, Land use and Habitat

Externalities of Locally Unwanted Land Use (LULU) on Residential Land Values

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Abstract

The urban planning process involves the regulation of land use to provide for civic amenities. Land Use Planning decisions often include the allocation of land for cemeteries, dumping grounds, STPs, prisons, factories, etc. These amenities generate externalities and affect everyone living in the proximity; therefore, these are associated with "Not In My Backyard" (NIMBY) syndrome and are often termed as "Locally Unwanted Land Uses" (LULU). The presence of such land use has a significant impact on land and property value in its neighbourhood. Since the impact of externalities is inversely related to the distance from the source, therefore, a closer proximity to LULU is less desirable. Contemporary valuation Practices recognize this correlation and levy due consideration while generating a value estimate. However, in the absence of a scientific method, the value estimate is based on logical assumptions and empirical understanding. It has been argued that value estimates generated through contemporary practices are prone to errors and there is a need for scientific methods to improve accuracy and effectiveness. This article aims to quantify the extent of the correlation between residential land values and LULU using a GIS-based regression model. The market prices of residential land in Noida-NCR were collected using popular listing website and the location of LULU was identified from the Geo-Portal of the NCR Planning Board. The study resulted in developing a proximity-dependent assessment of externalities generated by LULU. The findings of this study shall assist professionals to generate value estimates using scientific methods thereby improving the overall accuracy and dependability.

Keywords: Planning, Value, Externalities, Land use

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1 Introduction

Background: Land Use Planning is an important tool of the Urban development process; it ensures equitable distribution of land to provide for urban amenities. Land Use decisions are often associated with conflicts and challenges, particularly in providing land for uses such as cemeteries, dumping grounds, graveyards, STP, polluting industries, waste-to-energy plants, etc.[3] These amenities are essential for the everyday functioning of any urban area, yet they are objectionable to people living close by because of the negative externalities associated with them. It has been observed that the selection of sites for these uses is problematic in most parts of the world.[3] These amenities are associated with the “Not In My Backyard” (NIMBY) syndrome and are also termed “Locally Unwanted Land Use” (LULU).[7, 10] As defined [7, 19], the land uses that impose external costs on the neighbourhood by inviting potential health hazards, poor aesthetics, unpleasant sceneries,

and reduced property value are called Locally Unwanted Land Uses (LULU). Because of the external costs associated with LULU, they are opposed by the local inhabitants of the area wherever they are sited, hence Not In My Backyard (NIMBY) syndrome is always associated with LULU. Zoning regulations of the city often find disadvantaged and less developed areas to place such sites to oppose resistance from locals.[3, 7, 11] Since all such sites negatively impact property prices and environmental values, therefore, they shall be strategically located to ensure minimal impact and at the same time, these amenities shall serve the basic needs of urban areas.

Residential properties near LULUs are less desired by potential buyers due to NIMBY syndrome and therefore their value is less than other properties in the same locality[17]. It has been argued that the negative externalities generated by LULUs will diminish with reduced proximity, thereby creating an influence zone around the LULU site within which the impact on the value of the property can be noticed. Such zones are often called stigma zones, and the extent of the stigma zone will vary for different types of facilities listed as LULU. It has been noticed that the influence of a cemetery on property value can be noticed within a 200 mt radius whereas a large dumping site can influence up to 5000 mt of residential area around it[6, 22, 27]. Since the properties are always fixed to the location, therefore, they may fall in the influence zone of one or more such LULU sites depending on the zoning regulations. It is critical to quantify the externalities associated with LULU as it can contribute to urban policymaking, particularly for internalising externalities through obligations or subsidies. In addition, the Quantification of externalities is also important for effective valuation and property taxes. The valuation professionals carefully consider the impact of such sites in the immediate neighbourhood thereby generating value estimates based on empirical methods using logical assumptions.

However, the diminishing impact of distance is not scientifically considered due to the lack of a scientific approach, A report by the World Bank argues that land is undervalued in most parts of the world and there is a need to relook into valuation approaches for effective decision making.[5, 9, 16, 29] Also, most of the literature on LULU is associated with the study of housing/apartments and there is very little discussion on residential land.

The objective of this paper is, therefore, to quantify the impact of LULU on residential land values and identify the key factors influencing this impact. A GIS-based regression analysis approach was adopted to quantify this impact and Residential land in the stigma zone of cemeteries (including Burial Grounds, Graveyards & Shamshan ghats), dumping grounds (including waste dump/Landfill sites & scrap yards) and Sewage treatment plants located in Noida-NCR were considered for analysis. Noida is a satellite town of the national capital of Delhi and together with Gurgaon, Faridabad, Sonipat and Ghaziabad, it forms the National Capital Region (NCR). Therefore, it has witnessed tremendous growth in the recent past due to fast urbanization. The civic authorities have faced resistance and resentment while locating LULU sites in the neighbourhood of residential areas leading to the identification of alternate sites outside the city boundaries. A lot of urban development is yet to be conceived in Noida and the civic authorities will have to identify LULU sites therefore Noida forms a good study location to quantify the impact LULUs on property values so that policy framework for internalization of externalities can be developed. The following chapters shall discuss the seminal work published to understand LULU and NIMBY followed by method and data collection. The fifth and sixth chapters shall showcase and discuss results followed by policy implications and conclusions.

1.1 Need for the study

Locally unwanted Land uses are not studied from the perspective of their impact on residential land values in India. However, valuation practitioners have been accounting for their negative externalities based on logical assumptions and experiences. It has been argued that such an approach is prone to errors and can lead to inaccurate estimates. Therefore, this article aims to study the externalities of LULU and its impact on residential land values.

2 Literature Review

2.1 LULUs and Property Values

Undesirable land use has always remained at the centre of concern during any planning decisions since they were first introduced in 1980.[19] Locally unwanted land uses (LULU) are mostly associated with health, environmental and aesthetical concerns, hence there are remain associated with NIMBY syndrome. Properties in the close vicinity of LULU sites attract fewer takers due to external costs thereby reducing demand and leading to a negative impact on the value of the property. Areas in the close vicinity of LULUs have scanty development and a thin real estate market due to poor growth potential. Most of the areas around LULUs are either non-residential or informal and poor-quality settlements. Such areas are often occupied by marginal sections of society who are unable to afford housing in other planned areas. It has also been seen that the smaller parcels of land are unable to mask the negative externalities and are therefore greatly affected by the presence of LULU[1–3, 20].

The sites identified as LULU include sites for cemeteries, dumping grounds, landfill, waste processing units, graveyards, burial grounds, shamshan ghats, STP, polluting industries, waste-to-energy plants, etc[4, 7, 19]. These are essential amenities for urban living and are considered as unavoidable in urban settings therefore such uses always remain at the centre of concern during zoning regulations. Zoning regulations, influenced by planning theory have always advised identifying sites for such amenities in the less developed areas outside the city,[10, 11, 17] however, the city has been witnessing outgrowth and agglomeration in urban fringes and these sites are then included in the urban areas. It has been often seen that there are residential areas surrounding LULU sites. Such a phenomenon is often seen in densely populated cities where the demand for land is very high. Literature has identified tangible and non-tangible risks associated with LULU and therefore discusses these effects and sites separately.

The following section discusses the studies on Dumping grounds and cemeteries separately:

2.2 Dumping grounds & Landfill

Landfill sites are an important component of urban infrastructure, and they shall be strategically located to avoid ill effects on the habitation around them particularly in densely populated cities having scarcity of land. Regulations in India advocate that there shall be a 500 mt buffer zone around these sites to mitigate their ill effects.

However, studies have identified that the impact can go up to five kilometres and the properties can lose up to 8% of their value.[14, 24] Most of the studies have used distance as a proxy to indicate the impact of landfill sites on property values, however, it has been argued that the proximity studies do not fully capture the externalities associated with landfill sites, and there is a hesitation to live near the landfill sites[18]. There are sensory factors of view and smell that can influence the demand and therefore the value. Sewage treatment plants are also associated with poor smell and hazardous gasses dissipating in the direction of wind movement, thereby reducing the demand, and influencing the property values. The presence of waste material in the neighbourhood is associated with foul smell, poor scenery, and potential ill health. All these factors are capitalized into lower property value. All types of waste sites negatively affect property values, and the properties associated with hazardous wastes bring larger discounts Literature on waste management sites in America has verified the role of negative externalities of such sites in reducing adjacent property values. However, it is also argued that landfills reduce the property values in their vicinity, and it reduces the demand and construction of new properties as well. With every one-kilometre increase in the distance from the landfill site, there is a reduction of 1.3% to 8 % reduction in the property value.

2.3 Cemeteries

The impact of cemeteries on property values has generated contradictory results among different studies, these are reported to be associated with both positive and negative externalities. In the proximity of developed and well-maintained neighbourhoods, cemeteries are the source of large green space thereby enabling peaceful and calm surroundings. Such large greenspaces are otherwise limited in dense neighbourhoods in urban areas and therefore there is a positive impact on the value of nearby residential land [4, 7, 19, 27]. However, only well-maintained cemeteries can generate such positive externalities, poorly maintained facilities create health hazards and increase the nuisance value in the neighbourhood thereby leading to a reduction of the land value [1]. In addition to maintenance of the neighbourhood, cemeteries are also associated with non-tangible factors such as fear, superstition and insecurity that lead to a reduction in the value of the residential property[1, 27]. The impact of cemeteries is significant up to 200 meters and the appreciation of such properties is low as compared to other properties outside the influence zone. It is argued that the sites close to the graveyard will also attract 15-20% lower rental values. There are physiological factors associated with cemeteries that often remind neighbourhood inhabitants of their morality. It is noticed that the impact of cemeteries on residential land values is different for different markets, and it is associated with a lot of heterogeneity.

Contemporary practices in land development ensure that the sites identified for LULUs are located outside the urban areas [7, 10]. However, with the expansion of cities, such sites become a part of urban areas and their presence continues to impact the value of properties. A lot of problems associated with LULU are due to perceived risks associated with them, it has also been argued that an awareness of the measures taken to mitigate such risks may reduce speculation and thereby reduce the impact on the value of land. As argued, the impact of these sites can be different in different countries. Therefore, an approach to quantify and thereby internalize the externalities may help an ordered development of areas in the vicinity of such sites. The impact of these sites is less studied in the Indian context and consequently, there is an absence of a framework to internalize these negative externalities.

3 Methodology

A Geographic Information System (GIS) is a system that analyses descriptive data effectively by connecting it with its location on the map. This makes it the most appropriate tool to access the spatial attributes of a site location[8, 26] and regression is one of the most appropriate methods to explain the relation between dependent and independent variables [23, 25]. Therefore, this paper adopts a quantitative study using the GIS-based Ordinary Least Square regression method to quantify the impact of LULU on the value of residential land. This method has been adopted in similar studies [12, 13, 15, 21, 28]and the results generated are considered dependable. The results from the regression analysis will be used to develop a model that can quantify the impact of LULUs on the value of residential Land. The following flow diagram indicates the detailed methodology.

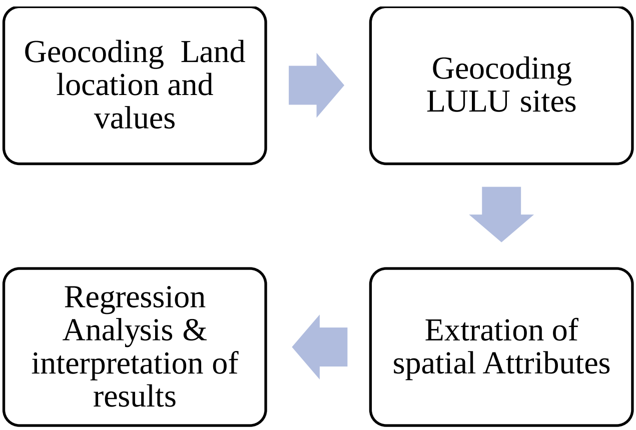

Fig. 1. Methodology

Source: Author

4 Data

The study is based in Noida, a satellite town of Delhi, therefore, the location and the value of the residential land were collected from one of the leading property listing portals by writing a computer programme for the purpose. The residential land data comprising of asking price, attributes and geographical location of properties that were listed during the month of February-March 2023 were extracted for the study.

The asking price of listed properties was validated with a land value market survey report of a public sector bank. Recently listed properties with clear titles were selected so that the impact of national and global economic factors could remain constant, and the impact of spatial parameters could be studied separately. Land value data along with the location coordinates were plotted on the GIS interface and the spatial proximity from urban infrastructure points were extracted for analysis. Similarly, LULU sites were identified using the GIS portal of the NCR planning board and plotted on the GIS interface along with the selected property. The NCR planning board is the nodal agency looking at the growth and development of all satellite towns of Delhi-NCR. Geo-coded property locations and LULU sites are presented in Figure 2. A 1000 mts Buffer zones are highlighted around the LULU sites considered for study purpose.

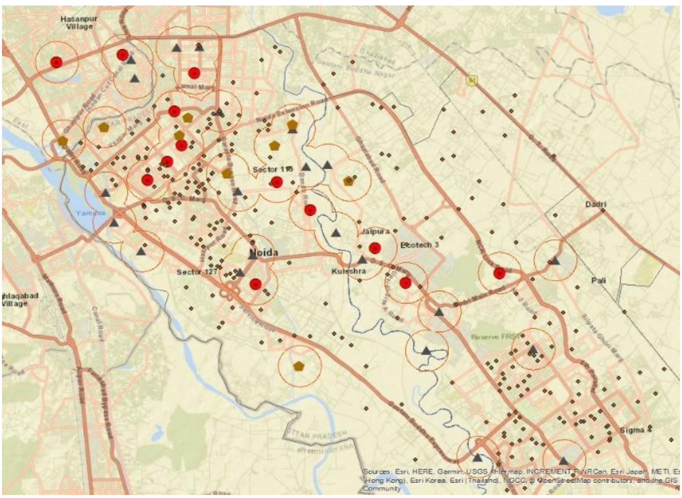

Fig. 1. Study Area: Noida- Delhi NCR

Source: Author

A total of 1415 residential land properties were identified having descriptive statistics mentioned in Table 1. In addition, a total of 10 STPs, 12 Dumping grounds and 26 Cemeteries were identified for study. The area map from the GIS interface indicates that the properties under consideration were in different parts of the city and the data comprise a wide range of land value data and their proximity to LULU sites.

4.1 Descriptive Statistics

Table 1. Proximity Values

Variable	Land value (Rs/sqft)	Proximity (meters)		
		STP	Cemetery	Dumping Site
Min	1000	293	199	415
Max	45000	51044	12650	16307
Mean	7627	7597	3710	5924
Median	5574	4977	2702	3848
SD	6363	6384	2718	4870

Source: Author

5 Results

The data retrieved from the GIS portal was analysed to understand the relationship between dependent and independent variables. Table 2 indicates the correlation among all the variables.

The correlation matrix indicates that all three explanatory variables have a negative correlation with the per square unit value of residential land indicating a negative externality, however, the extent of the correlation is different.

Table 2. Correlation Statistics

	STP	Dumping	Cemetery	LV/Sqft
STP	1			
Dumping	0.899244	1		

Cemetery	0.700222	0.849176	1	
LV/Sqft	-0.3076	-0.27906	-0.18354	1

Source: Author

Further, a scatter diagram and trend line were plotted between each independent variable and dependent variable. The scatter plots of each of the explanatory variables are placed in Figures 3,4 & 5.

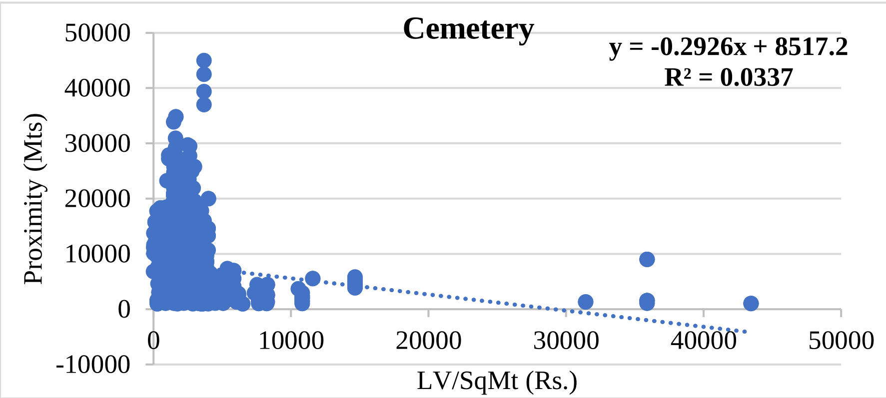

Fig. 2. Scatter Plot: Cemeteries and land values

Source: Author

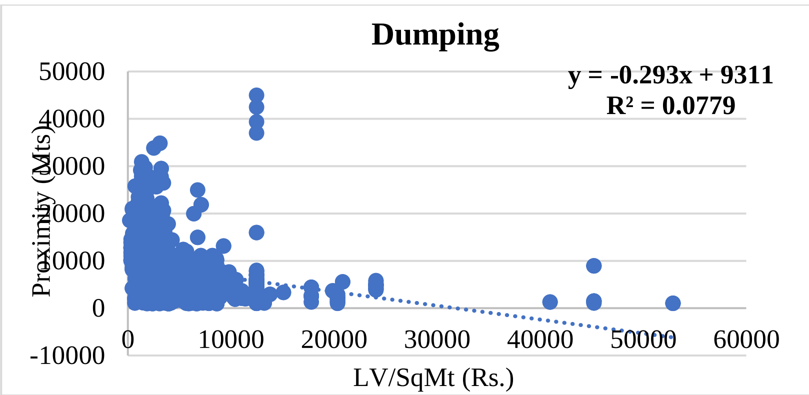

Fig. 3. Scatter Plot: Dumping Sites & Land Values

Source: Author

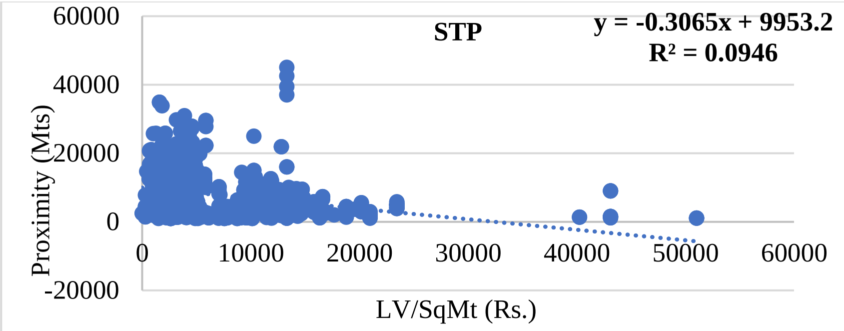

Fig. 5. Scatter Plot: STP & Land Value

Source: Author

Further this data was subject to multiple linear regression analysis and the results of the analysis are place at table 3. Significance F value is below 0.05 and p-values of all parameters are below 0.05 therefore the results of the model are plausible.

Table 3. Regression Results

Regression Statistics	
Multiple R	0.315136552
R Square	0.099311047
Adjusted R Square	0.097396045
Standard Error	6045.474817
Observations	1415

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	5686048629	1895349543	51.85951872	8.52592E-32
Residual	1411	51568897495	36547765.77		
Total	1414	57254946123			

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	9885.414533	254.4138897	38.85564009	3.5809E-225
STP	-0.250677871	0.059847085	-4.188639646	2.98029E-05
Dumping	-0.175325635	0.085258279	-2.056405988	0.039926961
Cemetery	0.214250305	0.079303258	2.701658312	0.006982108

	Lower 95%	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	9386.344372	10384.48469	9386.344372	10384.48469
STP	-0.368076706	-0.133279037	-0.368076706	-0.133279037
Dumping	-0.342572253	-0.008079016	-0.342572253	-0.008079016
Cemetery	0.058685334	0.369815276	0.058685334	0.369815276

Source: Author

Based on the above results, the regression equation can be written as:

$$LV = 9885.4 + 0.0587(C) - 0.3425(D) - 0.368(S) \quad (1)$$

Further, these results are deliberated in detail in the discussion section.

6 Discussion

This study was intended to measure the extent of the correlation between the value of land and its proximity to LULU sites. To analyse, three facilities listed under LULU were studied in the city of Noida and a regression equation was developed to measure the extent of its impact on the value of residential land. A total of 1415 Land value data was extracted from one of the leading property listing portals. The properties identified were listed during the month of February-March 2023 indicating the latest market trends. The fit of the model indicates a significance F value and p-value of all the independent variables is less than 0.05 there by indicating that the null hypothesis can be rejected and the changes in the Proximity values of Cemeteries, dumping sites and STPs are able to explain the changes in the land values. The results also indicate a moderately strong linear relationship between the value of residential land and proximity to LULU. The value of r^2 is 0.099 which indicates that around 10% of the value of residential land can be explained by independent variables related to LULU sites. This stands in conformity to literature that location-based parameters inform the value of land significantly. All three independent variables were negatively correlated with the value of land indicating that with the reduced proximity with LULU, there will be an increase in the value of land. Cemeteries have lesser impact on land values as compared to dumping sites and STP. This may be because of the wider stigma zone and higher health hazards related to dumping sites and STPs. The impact of LULU sites in Noida is estimated at 10%, which is more as compared with studies in other developing countries indicating a reduction of 8% in property prices [2, 3, 20]. The land markets in study areas have a strong negative sentiment around such sites and their proximity brings down the value of land substantially. Descriptive statistics highlights a mean proximity value of more than 3000 mts indicating that several properties studied are away from the perceived stigma zone of 1000 mts around the LULU sites. This signifies that a dedicated study of all the properties in the stigma zone of LULU sites up may highlight even higher impact on property values. It is also worth mentioning that government of India recognizes a 500 mts of buffer zones around dumping sites, however the impact on the property values extends much beyond.

6.1 Policy Implications

The quantification of the impact of LULU on the value of residential land will help policymakers understand land value gradients around LULU sites, this can further lead to the identification and demarcation of stigma zones. An appropriate estimate of the impact will help formulate regulations to internalize negative externalities such as appropriate parcel size, urban greens, etc. A better understanding of land values around LULU sites can be achieved by adopting this model which in turn can facilitate in providing a strategic mix of land use. In addition to this, a LULU impact model may assist professional valuers in adopting a data-based & scientific valuation approach.

7 Conclusion

This study aimed to quantify the impact of LULU on the value of residential urban land. It was understood from the study of literature that LULU sites face a lot of resistance from residents, particularly when the identification of sites happens after the settlement of people in each residential area. Most of the resistance is due to perceived health hazards, environmental concerns, and likely devaluation of property. For the study, Residential land properties listed on the leading property portal were extracted and their spatial distance from the LULU sites was calculated using geocoding on the GIS platform. LULU sites were Identified from the Geo-Portal of the NCR planning board. Analysis was done using multiple regression which resulted in a LULU Impact model. This model will facilitate in quantification of the impact of such sites on residential land values. Three different LULU sites were considered comprising Cemeteries, STPs and Dumping grounds. It was seen that all three LULU sites have different impacts on the value of residential land. The scenarios with dumping and STP sites are different from those of cemeteries, these sites are associated with strong health hazards and there are immediate effects on the health and well-being of the people living in the vicinity, therefore influence zones around such sites are larger with greater impact on residential land values. The model developed during the study can explain 10% of the variance due to the presence of LULUs, these results are in concurrence with housing studies conducted in developed countries where it has been identified that landfill sites have around 8% impact on the value of residential land.

8 Recommendation for future research

This study highlights the sellers' perspective on the impact of LULU sites on the value of residential land, it will be useful to understand and quantify the buyers' perspective on buying land near LULU sites. Through limited literature based on Indian studies, it is highlighted that there is a strong negative sentiment for buying residential land near cemeteries. A case study-based approach may highlight plausible findings. Since civic agencies are making efforts to internalize externalities and market sentiments are different in different cities, therefore caution needs to be adopted before generalizing the results to other locations.

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