DOI - 10.68648/ijte-q-2026-49-03-001

Urban Residential Property Values: Identifying the Key Influencing Parameters

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ABSTRACT

Property value is a dynamic concept influenced by various parameters. The limited number of controlling parameters for property value is discussed in the existing literature, highlighting the need for a comprehensive list of factors and their relative importance. This paper focuses on identifying factors that affect property values in urban areas and provides their rankings and weights. A systematic review of literature was conducted following the PRISMA model by searching for terms like "factors impacting property values," "valuation factors of real estate," and "parameters of property values" across Google Scholar, ResearchGate, and Scopus. A total of 104 factors were identified through an exhaustive survey. Using a two-cycle Delphi method with a 5-point Likert scale, the list was refined to 67 and then further reduced to 37 factors under 10 major categories, which are further categorized into three levels: Macro, Meso, and Micro. These factors and sub-factors were ranked and weighted using the relative ranking method. Experts from academia and industry participated in the Delphi process. Location, connectivity, and accessibility were found to have the most tremendous impact on property values. This study has identified and categorized factors, regardless of geographic limitations, using PRISMA techniques and a relative ranking approach.

KEYWORDS *: Property values; Real Estate; Parameters; Accessibility.*

INTRODUCTION

Property value is a crucial element in both domestic and national economies. A property is a multi-dimensional entity [1]. These factors and their impact vary depending on the place and city (Wyatt, 1997) [2]. Therefore, the identification of critical factors of property values is essential for all stakeholders [3]. Property values increase with the availability and quality of physical and social infrastructure. [4]. A buyer might be interested in paying a substantial amount for real estate, based on the availability of basic amenities, including access to utilities such as water supply and electricity [5]. It has been shown that cities with adequate transportation and economic growth have consistently seen increases in land and property values [6]. Infrastructure availability is highly important for property values[7]. To estimate a property, the well-documented influence of neighborhood services, property features, and amenities on property values was demonstrated. Studies conducted in various geographical locations emphasize the significance of location and the stage of urban development [8].

It has been found that previous individual studies have emphasized limited parameters, and expert opinions have also been utilized in prior research to evaluate the factors that affect property values and location-specific factors. Furthermore, relative ranking and weights were not used in property management studies to choose variables.

So, the primary focus of the present investigation is to identify the main attributes that affect property values in a region by determining the relative weights and rankings. The necessary data for this research were collected through a systematic literature review, which was further refined by a two-cycle expert survey using a 5-point Likert scale along with a relative ranking

method. This research focuses solely on the factors that affect residential homes. The results will help those working in urban planning, real estate development, and property management understand the most significant variables that affect their decisions. The methodology can also be implemented in similar contexts.

METHODOLOGY

The adopted research approach, as shown in Table 1, consisted of a systematic literature review using the well-established PRISMA technique, as well as a two-cycle Delphi survey. A systematic review was done through a comprehensive search of publications related to the value of property factors.

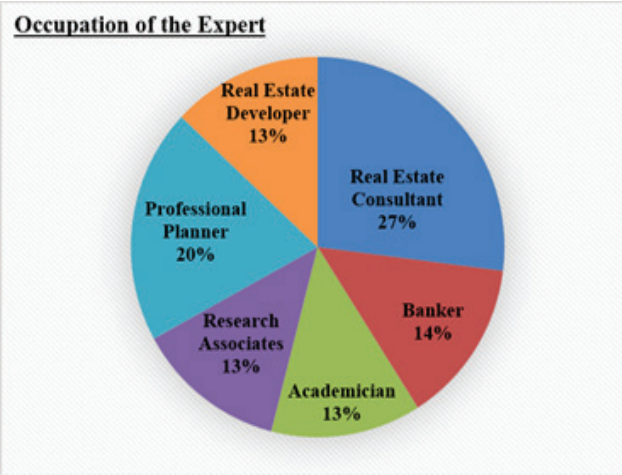
Table 1. Methodology adopted for the research

Step 1: Systematic Literature Review Via PRISMA Technique Identification of 104 factors that affect property values with keywords: Property values, Real Estate Pricing, Land Pricing, and Infrastructure. Reduction of 104 factors into 67 factors.
Step 2: First Cycle Delphi Survey based on 5 points Likert Scale 67 factors were reduced to 37 factors and further classified into 10 categories
Step 3: 2nd Cycle Delphi Survey based on a 5-point Likert scale The 10 main factors are further grouped into 3 main categories – meso, micro and macro. Relative Ranking and weight of 37 factors within the categories within the sub-factors.

Various papers and articles were searched using keywords such as property values, real estate pricing, land pricing, and infrastructure with Boolean operators. With a time frame filter of 1990-2024, almost 200 papers were downloaded from Google Scholar, ResearchGate, and Scopus. Of these, only 65 were relevant to the study.

After a thorough review, 104 factors were identified through the literature review, with redundancy, which was considered improper as discussed, and subsequently filtered down to 67 factors. In the first cycle of the Delphi survey, experts were asked to rank the 67 factors. Following the first cycle, 19 components were eliminated because they were either combined with other elements or designated as important factors. In the second cycle of the Delphi survey, experts were asked to re-rank the factors selected in the first cycle of the survey. This involved identifying the 37 key factors that affect property values. A questionnaire-based survey employing a 5-point Likert scale was designed to gather two-cycle expert opinions on the factors that were shortlisted and categorized. One was the least significant, and five was the most significant. Those 37 factors were grouped under ten major headings of attributes. Then, the 10 main variables were grouped into three categories: micro, meso, and macro, based on the scale of the influence of the attributes. These 37 factors were further examined in detail to understand their impact on property values and the direction of causality.

The most important decision factor in a Delphi survey is the selection of experts. [9][10]. For the research, the experts include academics, real estate professionals, urban and transportation planners, Real Estate developers, and other professionals with at least 10 years of experience, including real estate bankers and real estate investment professionals.



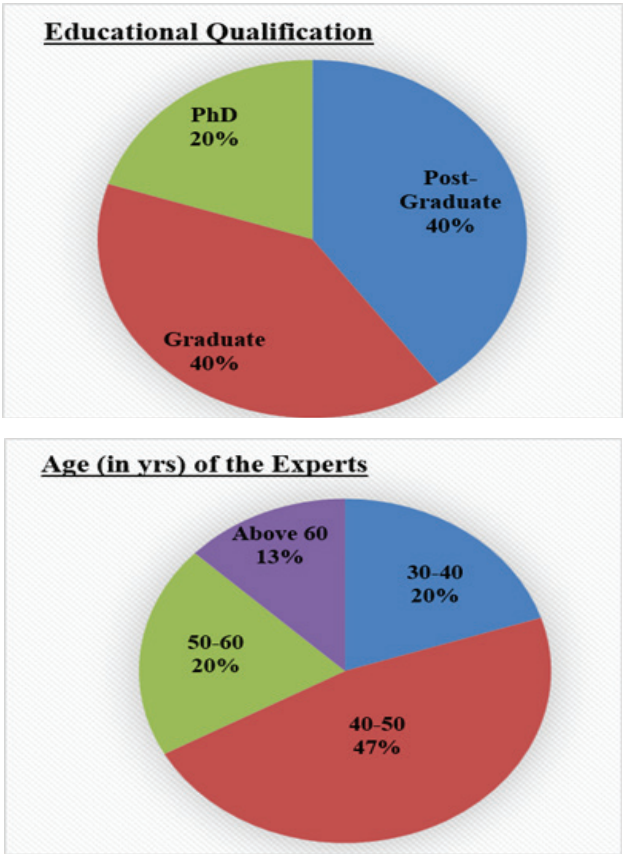


Fig 1: Professional details of the Experts

In a two-cycle Delphi survey, a questionnaire-based survey was conducted by 15 experts from the fields of property professionals and urban planners using Google's survey form. The professional details of the experts are presented in Fig 1. Out of 15 experts, 4 were Real Estate Consultants, 2 were investment bankers, 2 were academicians, research associates, and real estate developers, and 3 were professional urban/town planners.

LITERATURE REVIEW

The value of real estate is a crucial aspect of the market that depends on several factors. Knowing these things and how they relate to each other is a significant part of determining a property's value [3]. Location, physical attributes, legal and environmental factors, accessibility, and proximity to infrastructure are key elements that affect property values [4]. The investigation examined the impact of MRTS and BRTS on property prices in the housing sector. It concluded that property values were greater in controlled areas than in the catchment regions, taking into account neighbourhood features. The study examined the effect of MRTS on housing pricing in the pre- and post-construction stages of the metro corridor and divided the factors into Spatial and Temporal Categories. Spatial attributes took into account the characteristics of spatial dimensions. Temporal attributes are considered the dimension of time [11].

The study identified 80 parameters from various literature studies and shortlisted the factors into 25 after discussion with experts in real estate. The study examined the influence of structural and environmental factors on real estate values in Artivin City. It concluded that the structural value was five times greater than the environmental value. Other research also identified accessibility to social and physical amenities as an important parameter that affects property values in any location. The study by Anantsuksomsri & Tontisirin determined how mass transit directly influences the residential property values in the Bangkok Metropolitan Region, Thailand. Current Research concluded that proximity to MRTS positively influences residential property values. A study by M. Zhang & Wang 2013 also concluded that the property values are higher in the case of MRTS, and values go down as we move away from the transit station. It emphasized the notable influence of the Mass transit system on property and compared transit technologies, such as BRTS, LRTS, and MRTS, in Beijing. The research concluded that urban growth and land values are directly proportional, as the land value increases with an increase in urban sprawl, and emphasized the proper future planning of cities and urban sprawl [13]. The study emphasized the other factors, such as location, economy, land use type, urban sprawl, land scarcity, and infrastructure availability, also play a crucial role in determining land values in Chennai city. [14] gave preference to infrastructure facilities such as water, electricity, transportation, and medical facilities, which impact property values in Unity Estate, Lagos Metropolis. The study ranked physical infrastructure as the most critical facility impacting property values [14]. A study examined the impact of BRT on the land market

in Seoul, Korea, and concluded that improvements to the BRT system compelled property owners to convert single-family houses into higher-density apartments [15]. Other research examined residential, office, and retail property values around the new stations from 2001 to 2008 and found that the property values were higher near the CBD area and lower in the catchment areas [16]. The regulations and zoning also impact property values, as studied by McMillen and McDonald (2004). Studies conducted by Umar Ismail (2021) and Oloke et al. emphasized security as an attribute that affects property values. The study by [17] examined the impact on the property values of Beijing's residential, commercial, and retail properties. The study observed that the transit system near the CBD had a greater influence than properties located away from the CBD. The research conducted by Bartholomew and Ewing found a significant influence of transit-oriented development on property values, examining proximity and accessibility parameters of transit stations and policies related to TOD. stations and policies related to TOD. Property values near the station area were found higher than in the area along the transit line. Residential, commercial, and industrial property values were also higher within the 1-mile radius of the station [18]. The study found that the Light Rail System positively affected property prices, but it was also associated with negative impacts, such as noise pollution and traffic congestion [19]. A study investigated key factors influencing residential property values in the Auckland, New Zealand, property market and ranked variables. The study utilized 18 independent variables and one dependent variable, and the top 5 most important attributes were the number of bedrooms, location, land size, and construction type. The availability of a garden is listed as the most significant attribute that impacts property values, whereas the size and number of bedrooms have a higher impact [3]. Urban infrastructure strongly influences property values. Also, along with infrastructure availability, quality plays a critical role in determining property values [20] [21]. Therefore, property values may depreciate due to infrastructure degradation. The various factors identified in the literature review were shortlisted into 37 critical factors, which are explained in detail below.

Table 2. List of the factors identified from the Literature

S.No.	Identified Factors
1	Location
2	Accessibility to Public Transport (Metro, Rail & Bus)
3	Accessibility to Public Amenities
4	Accessibility to the CBD
5	Accessibility to the Retail Area
6	Accessibility to Health Facilities
7	Literacy Rate
8	Population & Population Change
9	Crime Rate/Security & Safety
10	Water Scarcity
11	Pollution (Noise, Air, and Water)
12	Flood Zone
13	Urban Heat Island
14	Availability of Water Supply, Sanitation, Electricity, and Waste Disposal Systems
15	Availability of Transportation Facility (BRTS/MRTS/Airport)
16	Availability of Commercial/Market
17	Availability of Open/Green/Recreational Space
18	Availability of social infrastructure (Educational facilities -School/College/ Healthcare Facilities)
19	Current & Future Land Use
20	History of Ownership
21	Land Scarcity
22	Neighbourhood Characteristics
23	Distance from Public Transport (Airport, Bus, Metro, and Rail)
24	Distance from Solid waste, landfills, sewage treatment plants, and polluted drains
25	Distance to school/health
26	Distance from CBD
27	Distance from Park

28	Government Policies (TOD/TDR/FAR)
29	Urban Sprawl
30	Local Market Trend (Pricing & Appreciation)
31	Unsold Housing Stock/Vacancy
32	Structure of property
33	Age of the building
34	Buyer's Income
35	Open and green within the building (Structural Attribute)
37	Area of the building

Literature related to the classification of factors

The various factors that influence property values can be categorized into several groups, such as political, contextual, managerial, economic, and physical attributes [18]. Other studies identify and group factors into four categories: structural, physical, neighborhood, and environmental [19]. Some literature classified the factors into two main categories: microeconomic and macroeconomic in the case of commercial property values [20]. While other literature has clubbed the various factors into micro, meso, and macro factors based on the influence of the factors [21][22]. The factors can be classified into Intrinsic Variables and Extrinsic Variables. Intrinsic variables included the interior features of the building along with the spatial features like the number of bedrooms, number of bathrooms, construction quality, built-up area, availability of parking, etc., whereas extrinsic factors included economic growth, urbanization, Population, GDP, Employment growth, per capita income, Bank Credit, investment demand, and regional prosperity [23]. As per the study conducted, 28 attributes were identified and classified into four major categories: locational factors, Land attributes, Demographics, and neighborhood attributes[24].

Methods adopted for various studies

The identification of factors influencing property values involves a variety of research methods customized to the specific context and objectives of the study. In Delhi, India's National Capital Territory, a combination of structured and semi-structured interviews was employed to develop a Relative Importance Index (RII) and identify key factors through rank correlation analysis. Similarly, a three-cycle Delphi survey and RII method were employed in the urban areas of Kerala, engaging experts from various fields, including property valuation, real estate, and urban planning. The criteria were rated on a seven-point Likert scale until everyone agreed, with road access and proximity to disturbing sources being the most important ones [8]. In Jakarta, a structural equation model (SEM) was employed to analyze 628 property data points gathered by the Directorate General of State Asset Management, effectively recognizing important property characteristics and calculating the impact of unobserved variables on value [25]. In California, multiple linear regression was applied to examine 1,000 samples to understand multicollinearity among explanatory variables. This technique identified geographical location, housing median age, population, total bedrooms, and median income as notable factors. A Geographical Information System (GIS) was employed to create a valuation model and collect the data of spatial variables that affect the properties of urban local areas. This model featured a coefficient of correlation analysis for identification of the strongest connections, indicating that distance to the central city, distance to major roads, and width of access roads had the most notable impact [26]. These varied methodologies underscore the need for context-specific strategies to recognize and assess the factors that impact property values accurately. The research by Bender et al. 1999 employed the Analytic Hierarchy Process (AHP) following a questionnaire survey to identify the environmental quality parameters and their effect on property values in Geneva, Switzerland. A study by [27] employed a quantitative method for analyzing data collected from semi-structured interviews, identifying key factors that impact property values. A valuation model utilizing a GIS has been developed for an urban area to analyze the influence of spatial features on property values. Additionally, a study of the coefficient of correlation was conducted to determine positive aspects of relationships with the property's value [28]. The hedonic pricing model (HPM), spatial autoregressive model (SAR), and error term (SEM) were employed to quantify the study area and assess variables influencing commercial property value in a region surrounding Xi'an metro station [29].

RESULTS & ANALYSIS

Based on literature studies, 104 factors that impact residential, commercial, and other property values have been identified. With a questionnaire-based survey involving experts in a two-cycle Delphi survey, the factors are ultimately filtered down to 37. They are clubbed together under the heading of ten main attributes under the umbrella of 3 categories based on a scale of their impact, which is micro-scale, mesoscale, and macro-scale, and according to the intensity of the scale. Micro-scale parameters are categorized into structural attributes. The main attributes, including location, DCR, policy, infrastructure, real estate dynamics, connectivity, links, and legal considerations, are grouped under the mesoscale. The other attributes, which include socio-economic profile and demographics, are grouped under the macro scale, along with connectivity and linkages, as well as legal considerations. The 10 main factors include connectivity and linkage, location, infrastructure facilities, physical and social aspects, legal considerations, policy and development control regulations, real estate dynamics, structural attributes, demographics, and environmental factors.

Location

Location is the primary factor, according to the expert survey and analysis, with an average weight (AW) of 3.3, a Relative Ranking (RR) of 1, and a weight (W) of 0.161 among the 10 primary factors. The six significant sub-factors that are clubbed and analyzed under location are neighborhood characteristics, distance from public transport like Metro, bus, and Airport, distance from school/health facilities, distance from CBD, distance from Solid waste, Landfill, and sewage treatment plants & polluted drains, and distance from the park. As per analysis, it is concluded that neighborhood characteristics are the main sub-factor with, RR=1 & W=0.224, followed by distance from public transport like Metro, bus, and Airport with RR=2 & W=0.212, Distance from Solid waste, Landfill, and sewage treatment plants & polluted drains (RR=3 & W=0.196), distance from school/health facilities (RR=4 & W=0.184), distance from CBD (RR=5 & W=0.183), distance from health facilities & educational facilities (RR=5 & W=0.183) and distance from the park (RR=6 & W=0.168). Location is a factor influenced by various sub-factors, as shown in Equation. 1.

$$F1\,(Location) = 0.224x(L1) + 0.212x(L2) + 0.196x(L3) + 0.184x(L4) + 0.183x(L5) + 0.168x(L6) \quad (1)$$

Connectivity & linkages

Under the category of connectivity and linkage, five further sub-attributes are listed: accessibility to public transport, accessibility to health facilities, accessibility to the CBD, accessibility to retail areas, and accessibility to public utilities. The relationship of the factor with its sub-factors is shown in Equation 2.

$$F2\,(Connectivity\ \&Linkages) = 0.229x(CL1) + 0.207X(CL2) + 0.195X(CL3) + 0.186x(CL4) + 0.181x(CL5) \quad (2)$$

According to the analysis, connectivity and linkage are the second most important factors, as the average weight assigned by the expert is 3.2, the ranking score is 2, and the weight is 0.151. There are five sub-factors, which are categorized under the category accessibility to public transport (metro, railway, and bus) has the first rank and weight 0.229, accessibility to public amenities (RR=2 & W=0.207), accessibility to CBD (RR=3 & W=0.195), accessibility to health facilities (RR=4 & W=0.186), and accessibility to Schools/Colleges/ Universities (RR-5 & W=0.181).

Infrastructure Facilities

Infrastructural facilities (physical and social) are one of the factors that scored RR=3 & W=0.122. This category consists of water supply, sanitation, electricity, and waste disposal with RR= 1& W=0.178, transportation facilities with RR=2 & W=0.178, health facilities with RR=5 & W=0.155, commercial/market (RR=4 & W=0.141), school/ colleges (RR=5 & W=0.145), and open/ recreational spaces (RR=3 & W=0.175), which is shown in Equation 3.

$$F3(Infrastructural\ Facilities) = 0.178x(IF1) + 0.178x(IF2) + 0.175x(IF3) + 0.167x(IF4) + 0.145x(lF5) \quad (3)$$

Structural Attributes

Structural attributes are also primary attributes for a buyer. Design, area, age, and structure of the property are the sub-factors that fall under this category. According to the analysis, structural attributes are scored as RR=4 and W=0.116. Among the sub-factors, the structure of the building is ranked first with W=0.297, followed by the area of the building (RR=2, W=0.380), the age of the property (RR=3, W=0.379), and design (RR=4, W=0.250). Therefore, the structural attribute is a combination of the four sub-attributes, and the relationship between the factors is illustrated in the Equation 4.

$$F4(Structural\ Attributes) = 0.397x(SA1) + 0.380Xx(SA2) + 0.379x(SA3) + 0.250x(SA4) \quad (4)$$

Policy & Development Control Regulations (DCR)

Policy and development control regulation (DCR) is one of the parameters with RR=5 and W=0.099807. Three sub-factors are grouped under this category: government policies (RR=1 & W=0.335), land use and zoning (RR=2 & W=0334), and urban sprawl (RR=3 & W=0.329), and the relationship between the attributes and their sub-attributes is shown in Equation 5.

$$F5\ (Policy\ \&DCR) = 0.335x(PD1) + 0.334x(PD2) + 0.329x(PD3) \quad (5)$$

Real Estate Dynamics

Real estate dynamics is at rank 6 with a weight of 0.091. Two sub-factors are grouped under this factor, which are a local market trend (pricing & appreciation) and unsold housing stock (RR=1, W=0.517), and (RR=2, W=0.482), respectively, as shown in Equation 6.

$$F6\ (Real\ Estate\ Dynamics) = 0.517x(RED1) + 0.482x(RED2) \quad (6)$$

Legal Considerations

This category of Legal consideration consists of three sub-attributes: current and future land use (RR = 1, W = 0.347), history of ownership (RR = 3, W = 0.338), and land scarcity (RR = 4, W = 0.314). Out of three sub-attributes, current and future land use is the most significant, and land scarcity is the least significant attribute. The relationship between the factor and sub-factors is shown in Equation. 7.

$$F7(Legal\ Consideration) = 0.347x(LC1) + 0.338x(LC2) + 0.314x(LC3) \quad (7)$$

Demographics

Demography ranks 8th with a weight of 0.071. The sub-attributes under demographics are population and population change, literacy rate, and income category. According to the expert survey and analysis, Income (RR = 1 and W = 0.351) is the primary sub-factor, followed by literacy rate (RR = 2 and W = 0.339) and population and population change (RR = 3 and W = 0.310). The relationship is as shown in the Equation. 8.

$$F8(Demographics) = 0.351x(D1) + 0.339x(D2) + 0.310x(D3) \quad (8)$$

Socio-Economic Profile

The socioeconomic profile, as an attribute, has a relative ranking of 9 and an overall weight of 0.059. Three sub-factors have their scores as crime rate and security (RR = 1 and W = 0.371), buyer's income (RR = 2 and W = 0.371), and employment (RR = 3 and W = 0.267). The relationship of the subfactors with the main factor is shown in the Equation. 9.

$$F9(Socio-Economic\ Profile) = 0.371x(SEP1) + 0.371x(SEP2) + 0.267x(SEP3) \quad (9)$$

Environmental Factor

The attribute comprises four sub-attributes that negatively affect the property's value. The environmental factor is ranked 10th with a weight of 0.0579. Water Scarcity (RR=1 & W=0.262), Pollution levels (RR=2 & W=0.258), flood zone (RR=3 & W=0.255), and heating (RR=4 & W=0.245) are four subfactors under the Environmental factor, with UHI having the least impact. The relationship is shown in Equation. 10.

$$F10(Environmental\ Factors) = 0.262x(EF1) + 0.258x(EF2) + 0.254x(EF3) + 0,255x(EF4) \quad (10)$$

The Property values are the aggregation of the factors and sub-factors that influence the intensity of the main factor's impact, as shown in the Equation. 11.

$$PV = 0.161(F1) + 0.151(F2) + 0.122(F3) + 0.116(F4) + 0.099(F5) + 0.091(F6) + 0.072(F7) + 0.071(F8) + 0.059(F9) + 0.58(F10) \quad (11)$$

Where PV-Property Value, F1-Location, F2-Connectivity & Linkages, F3-Infrastrcuture Facilities (Physcial &Social), F4- Structural Attributes, F5-Policy and Developmemt Control Regulation, F6- Real Estate Dynamics, F7-Legal Considetation, F8- Demographics, F9- Socio-Economics Profile and F10- Environmental Factors

According to the analysis, it is concluded that property value is a function of location attributes, connectivity and linkages, availability of infrastructural facilities, structural attributes, policy and development control regulations, real estate dynamics, legal considerations, demographics, socio-economics, and environmental factors, as shown in Fig 2. Among all the factors, location, connectivity & linkages are the primary factors that impact property values overall. Neighborhood characteristics (4.67) have the highest weight within the sub-factors of location, followed by distance from public transport (4.47).

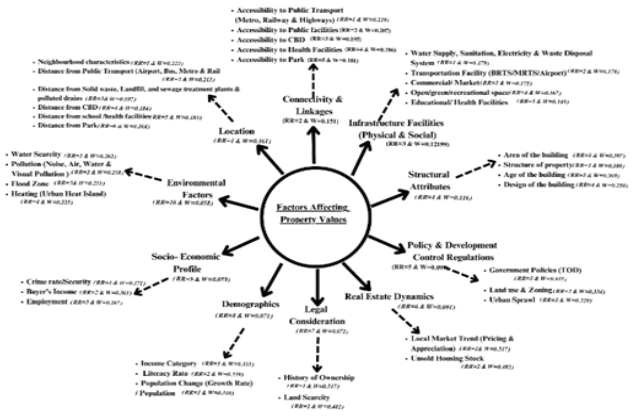


Fig 2: List of Factors and sub-factors affecting property values with their weights

Distance from a park has the lowest weight, at 3.85. Connectivity and linkage have a weight of 3.2 and a relative ranking of 2 out of 10 main attributes. Availability of public transport has the highest relative ranking out of 5 sub-factors of Connectivity & Linkages, and accessibility to parks has the lowest, i.e., 5. Infrastructure Facilities (Physical and Social) received a weight of 2.5 and a relative rank of 3, followed by structural attributes, Real Estate dynamics, demographics, and socioeconomic profile. Environmental factors have the lowest weight and ranking. The results show that property value doesn't depend on one factor but on the cumulative effect of various parameters. The proposed equation provides a comprehensive decision-making framework that can be used by policymakers, real estate consultants, developers, and various financial institutions for the assessment of any project.

CONCLUSION

The study clearly proves that the location and connectivity & linkage are the primary factors that impact the property value, which proves the classical urban economic theories like the Bid Rent Theory. It was discovered that the Delphi technique was effective in determining and examining the critical factors that affect the values. The relative ranking method was utilized to identify the relative significance of variables. All identified factors impact property values to some extent. Properties in desirable locations tend to have higher values because of their proximity to amenities, schools, shopping centers, and other conveniences. Additionally, properties in areas with better connectivity, easy access to public transportation, good job opportunities, and low crime rates often command higher prices. Regarding the impact on property value, MRTS has a greater effect than other available infrastructure, such as BRTS. Metro presence has increased the achievable FSI/FAR, resulting in higher real estate values. DCR (Development Control Regulation) is very important for the applicability of TOD. Therefore, Government policies play a vital role in the infrastructure, which directly or indirectly impacts property values. Structural attributes of a property also affect its value. The size, layout, number of bedrooms and bathrooms, and the property's overall condition can impact its market value. Despite its exploratory character, this study offers insight into the identification and selection

of parameters that determine property value. The study's methodology is believed to aid researchers in adopting comparable approaches in various Indian and international marketplaces. Additionally, it is expected that the investigation outcomes will help working professionals in various fields such as real estate development, property management, urban planning, banking, and local governments identify the crucial influencing factors while making decisions. Only the most significant factors have been identified in this research; can directly be included in further analysis, which can reduce the workload associated with gathering a large amount of data. Also, this variable selection strategy may be replicated in similar circumstances and may be useful when data is limited. To create property value models, further study is needed to statistically evaluate the identified factors and determine the relative importance of each component on property value.

ACKNOWLEGEMENT

The authors are thankful to the departmental research committee members for their regular reviews and suggestions, and the parent organization for allowing us to conduct the research in this domain.

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