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# Role of transportation cost in housing affordability for the urban poor in the metropolitan cities in India- a case of Lucknow

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## Abstract

Housing affordability is conventionally measured by the thumb rule of 30% of monthly income spent on housing. This thumb rule does not consider location, transportation cost, or accessibility. However, if a residence is far away and requires expensive travel, it is not actually affordable. Multiple planning goals can be accomplished by increasing the availability of inexpensive housing in convenient places, including decreasing transport costs, improving economic opportunities for underprivileged groups, lowering accident risk, conserving energy, and lowering pollution emissions. An H+T affordability index is a tool that is recently developed by researchers to assess the overall cost of housing and transportation relative to household income for different locations in a city. Researchers have recently developed a metric called the H+T affordability index to assess the entire cost of housing and transportation relative to household income for various areas of a city. This analysis is used in the study of Lucknow, India. The results show that households in suburban areas spend more than 57% of their monthly income on housing and transportation than those living in central zones and they spend only 45% of their income on these expenses. This aligns with the findings of other urban regions' studies. This demonstrates the viability of housing and transportation affordability analysis to discover inexpensive and sustainable development in developing countries.

**Keywords:** Accessibility, Affordability, Housing, Lucknow, Slums, Urban sprawl.

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**Ethical Statement:** This study followed all ethical practices during writing.
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## 1. Introduction

Governments strive worldwide to achieve sustainable development, which aims to balance economic, environmental, and social goals. Governments are also working to lower the cost of housing. Housing policies and programs that are well-designed, inclusive, have a lot to offer in this regard. [1]. As a result, researchers, professionals, and policymakers are

collaborating to establish practical housing reforms to boost the availability of affordable housing. These issues are intertwined. While cities contribute to the expansion of the nation's economy, they also fall short of maintaining the minimum requirements for living standards and quality of life. Maurya and Biswas [2]. Numerous economic, social, and environmental effects can result from house design and its location choices. Affordable housing must be built and situated to support sustainability goals in order to be successful. Increases in the percentage of housing in inaccessible areas, where inhabitants can access basic amenities with minimal vehicular traffic which tend to foster long-term development. A careful estimate of housing affordability and demand is required while housing policies and programs are being developed. Housing demand's price elasticity would determine how effective housing subsidies would be Tiwari and Parikh [3].

Housing affordability is the relation between household earnings, household expenditures, and the other costs of life. The housing affordability assessment is mostly constrained by the availability of data and the inability to measure the expenses of essential living components accurately. Frequently, housing affordability is measured in terms of the economic equation, ignoring other crucial variables such as the cost of transportation or accessibility. Housing affordability is traditionally evaluated by the ratio of housing expenditure to household income. As a general rule, households that spend more than 30% on housing expenditure and earn less than 40% of the median income are deemed to be experiencing housing stress. This method has been widely embraced by worldwide housing programs due to its simplicity as it relies upon a small number of variables that are easily calculated. The house expenditures and income ratio technique has received a lot of criticism for its arbitrary and descriptive character, as well as for failing to take transportation costs into consideration. The location has a significant impact on the cost of housing. Housing located on peri-urban areas or in areas with low density may appear more affordable. Still, they might not be as easily accessible to urban destination destinations and infrastructure, resulting in longer average travel times and a larger reliance on private vehicle use, which increases household expenditures. On the other side, houses the in the central business districts and near it are likely to have a high mortgage and rental costs. Nonetheless, such areas typically have shorter average travel distances to various destinations and decreased reliance on private vehicles. In the context of “land rent theory”, the complementary relationship between transportation cost and land rent has already been identified. However, the link has been found to be more complex and reliant on various external factors, such as geography and land use. There are numerous connections between affordable housing and other facets of an individual’s well-being. Mueller and Tighe [4]. Affordability problems are even graver in developing countries like India. India has faced rapid urbanization in recent decades. The second-largest urban population of 377.16 million in the world is found here. By 2030, there will be around 210 million rural residents living close to the 70 largest urban hubs. Sankhe, et al. [5].The fast pace of urbanization has created massive opportunities and challenges for urban and rural areas. Indian cities fall far short of the long-term goal of achieving an egalitarian and inclusive society and building urban resilience [2]. Housing supply in the urban centers has been unable to match the massive demand due to continuous immigration and natural increase in population. This demand-supply mismatch has resulted in congested living conditions, dilapidated housing, and an increase in the number of slums. All of these factors ultimately lead to the housing shortage in urban centers. When housing price exceeds an individual's earnings, there is either a housing market bubble with severe implications for economic policy or other economic imbalances [6]. As per the 2011 census, the housing stock was estimated to be 78.48 million. The gap between household and housing stock has gone down due to the various initiatives that increase the stock. But there is a shortage of adequate housing as many people live in dilapidated and congested conditions Figure 1. The old core of many cities is full of dilapidated conditions that are not fit for habitation. Large household sizes are Economically Weaker Section (EWS) and Lower Income Group (LIG) are the main reasons for congested living conditions Figure 1. Demand supply mismatch is another reason leading to the acute housing shortage. As per the Technical Group report 2012 by the Ministry of Housing and Urban Poverty Alleviation, 96% housing shortage lies in the EWS and LIG sector, which receives only 15% of the supply compared to the Middle Income Group (MIG) and Higher Income Group (HIG), which receive 85% of the supply Figure 2 [7].

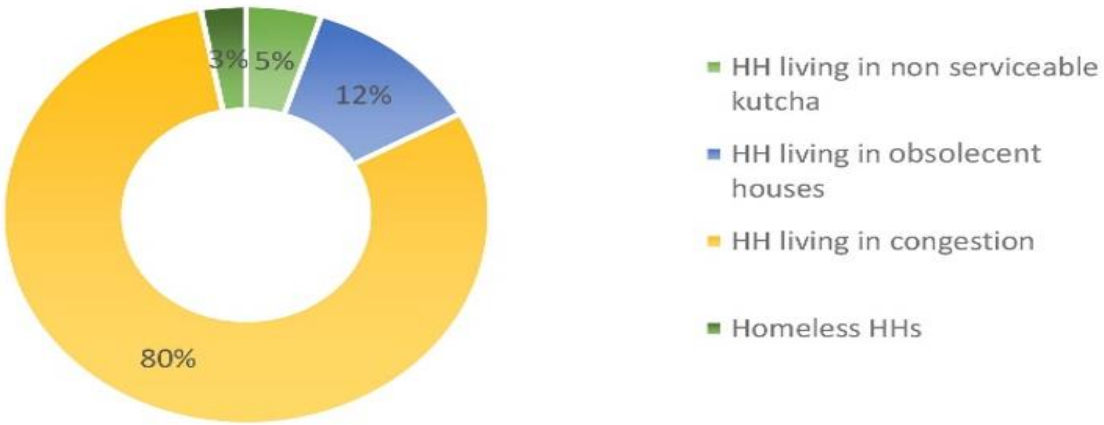


**Figure 1.**
Urban housing shortage 2012.
**Source:** TG12.

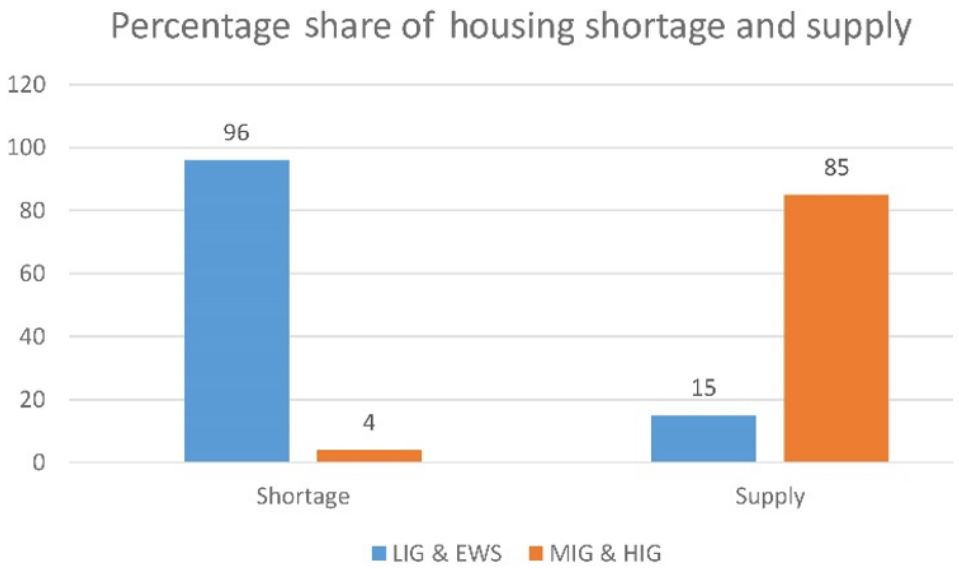


**Figure 2.**
Housing demand supply mismatch.
**Source:** TG12.

## 2. Literature Review

*2.1. Measuring Housing Affordability*

Affordability is a subjective term; therefore, it is complicated to have a standard definition of affordable housing. There are many methods used globally to define affordable housing. The most common and famous is the ratio of house price to income ratio Kutty [8].

Housing affordability by definition refers to "an expression of the subjective social and material experiences of people, constituted households, in relation to their individual housing situations". Affordability of housing applies to both ownership and rented housing. Housing affordability is the capacity to obtain decent home without compromising on essentials. Housing affordability is a concern for both owned and rental homes. The ability to obtain a quality home without compromising on necessities is referred to as housing affordability.Linneman and Megbolugbe [9].

Due to its arbitrary and normative nature, the housing expenditure and income method has received significant critique in the literature Hulchanski [10].

Numerous factors, including the head's gender, household situation, employment status, the number of breadwinners in the household, and the location of the household, affect affordability. Ben-Shahar and Warszawski [13].Various methods used globally for measuring housing affordability can be categorized into three types Ratio Approach, Relative measurement, and Residual income method [14] Table 1.

**Table 1.**
Methods of measuring housing affordability.

| Method | Technique | Country | Affordability criteria |
|---|---|---|---|
| Ratio method | Housing and urban development guidelines | Unites States of America | Housing costs represent < 30% of household income. |
| | Housing and transportation affordability index | Unites States of America | Housing and transportation costs represent less than 45% of household income. |
| | Amenity based housing affordability index | Unites States of America | All the amenities (Education, health, etc.) along with housing account for 50-80% of household income. |
| | Affordable housing, 2008 | India | 30–40% of total monthly income is spent on housing. |
| Relative measurement | National Association of Realtors' housing affordability index | Unites States of America | Data on how family income and housing prices are related. |
| | Reserve Bank of India's affordability measure | India | Ratio between the house price index and the household income as per group. |
| Residual income method | Shelter poverty method | United Kingdom | All necessary expenses should be covered by household incomes once housing costs are deducted. |
| | Australian housing and urban research institute model | Australia | Family earnings after deductions of housing costs should be higher than the city's budget standard. |

**Source:** Rao and Biswas [14].

*2.2. Housing and Transportation Costs*

One of the significant characteristics of housing is that it is connected to the land. Unlike other assets, it is fixed into a particular location. Thus, location plays a crucial role in selecting adequate housing. The location factor is also important for defining housing affordability. It could seem cheaper to buy a home in an area with less residential density or at the outskirts of the city. However, they may experience difficulties in accessing a variety of metropolitan amenities and destinations due to increasing reliance on private vehicles and longer average commute distances, which raises household expenses. Saberi, et al. [15]. With the increase in urban sprawl, cities have grown to such sizes that peripheral locations have become inaccessible. Unlike metropolitan cities, Mid-size Indian cities do not have enough rapid public Transport systems available for peripheral areas. Due to this, travel expenses have gone up for business, school, healthcare, and leisure purposes. EWS and LIG households frequently have to weigh transportation costs against housing costs in order to choose a truly cheap home. Where there is a high level of car dependency and housing affordability, there may not be much room in household budgets for rising expenditures in either one of these or both.Cao and Hickman [16].

United States Center for neighborhood technology has developed an innovative method to measure housing affordability, including transportation costs and housing. This method measures the true affordability of a home's location for a particular income group. To better reflect the true cost of consumers' location decisions, the H+T index suggests extending the definition of housing affordability to include transport costs at a home's location [17].Transportation cost for this method has been calculated for three factors: auto ownership, auto use, and transit cost( for public transportation). Center for Neighborhood Technology (CNT) has created an index called H+T Index that calculates true affordability and location efficiency within the city. We can identify the affordable location based on this index as per the income group.

*H+T Affordability Index = (Housing cost Transportation cost)/Household IncomeX100*

Housing affordability is defined by H+T index as households spend less than 45% of their income in housing and transportation.

H+T index has many applications and advantages over the traditional ratio method.

i. Identify suitable locations for public and private affordable housing as per the city's development.
ii. Homebuyers can refer while selecting an adequate house as per their requirements.
iii. Affordable housing policies can be shaped according to the index.

This type of index usage is prevalent in developed countries for affordable housing development. However, it is beneficial for rapidly developing countries like India. The proposed use of H+T index has a number of implications for policy and planning, as well as applications for finding locations that are reasonably accessible in order to increase the amount of affordable housing available and lower the cost of the area, inform prospective homebuyers, and change development policies to support affordable transportation.

## 3. Methodology

This paper builds upon recent studies on housing and transportation affordability. Center for Neighborhood Technology [17].

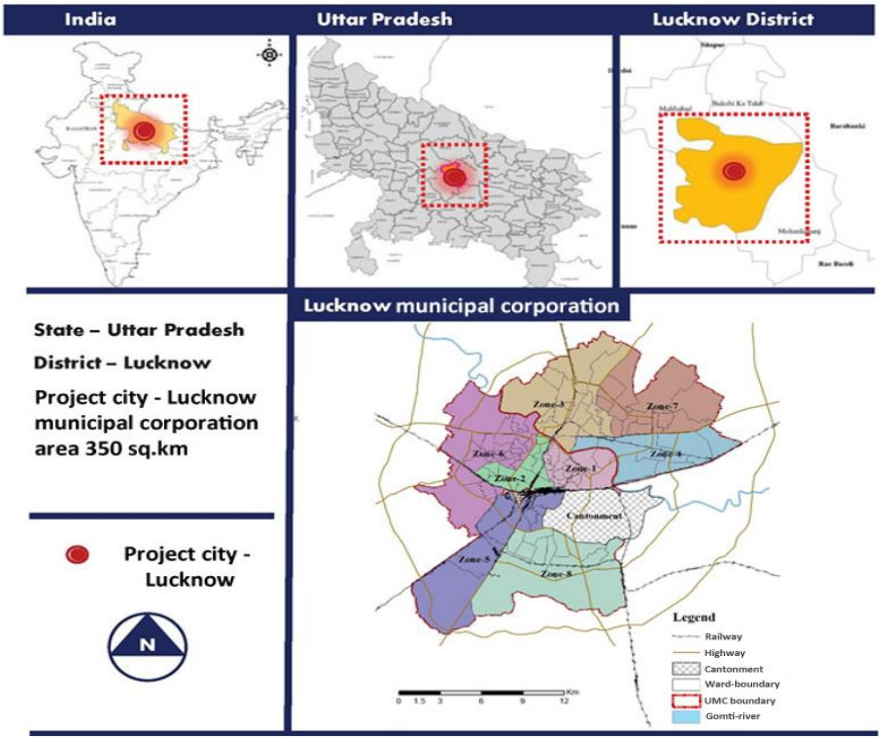


**Figure 3.**
Lucknow location and Lucknow municipal corporation map.

H+T affordability index is applied to mid-size city in India to understand the role of transportation cost. This study uses data from a household survey conducted for slums and unauthorized colonies of study area. A detail on the study area and survey procedure has been given below. H+T index is created for Lucknow city at zone level. The study is specific to the economically weaker section and hence the data is collected pertaining to the specific group. Figure 5 explains the methodology followed for developing H+T index for Lucknow city.

### *3.1. Study Area: Lucknow*

Lucknow is the administrative capital of the most populous state in India, Uttar Pradesh and it is the second-largest and fastest-growing city in the State of Uttar Pradesh. Figure 3 shows location map of Lucknow and its Municipal Corporation Map. According to the 2011 census, India has more than 53 million cities. With a population of 28,17,105, and Lucknow is ranked number 12 in India and number 2 in UP. Ahmad, et al. [18] the average household size in the city is 5.8, with 477860 households.

In the past six decades, Lucknow City's population has practically six folded Figure 4. The 1991 was the only year when the municipal limit was increased. As a result of population growth, density has been gradually increasing. The population density increased from 49ppha in 1991 to 83ppha in 2011.

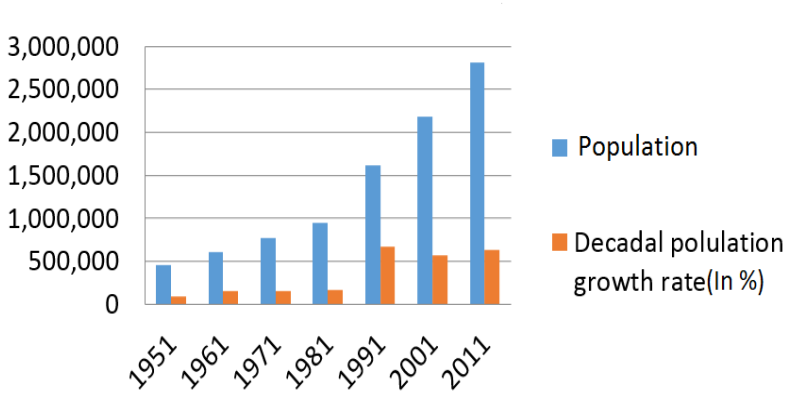


**Figure 4.**
Decadal population and growth.
**Source:** Ahmad, et al. [18].

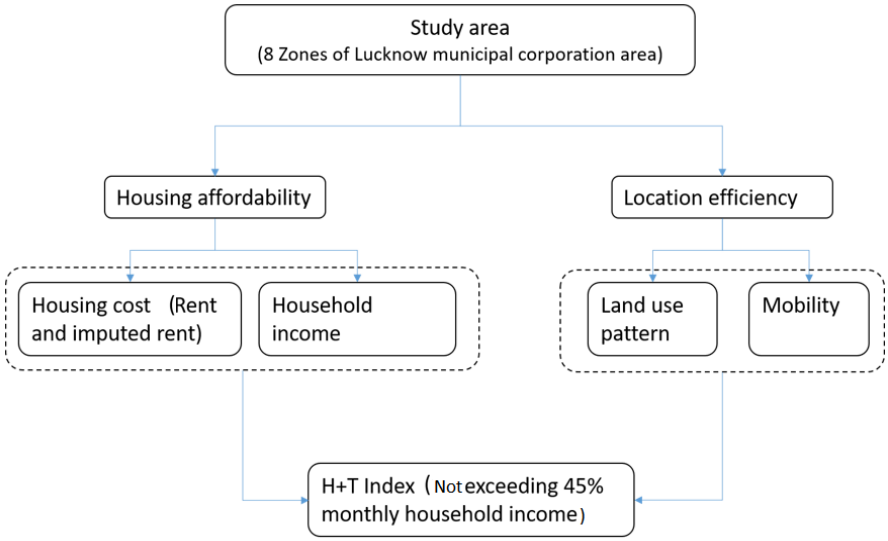


**Figure 5.**
Methodology.

### *3.2. Survey Procedure*

For this study, total 450 households were surveyed from slums and unauthorized colonies. These households are from the economically weaker section. These households were selected based on stratified random sampling; hence each type of household is represented in the study. Data was collected through questionnaires and interviews.

### *3.3. Questionnaire Design and Analysis*

A questionnaire was prepared to collect data based on five parameters: household size and composition, income and expenditure pattern; transportation; housing adequacy; and housing finance. A pilot survey on 20 households was conducted to validate the questionnaire. A few questions were modified as per the results of the pilot survey. The survey

and data collection were done with the help of the final questionnaire. The data was analyzed with Microsoft excel and Minitab software.

**Table 2.**
Personal details of households.

| Variable | Modalities | Zone 1 | Zone 2 | Zone 3 | Zone 4 | Zone 5 | Zone 6 | Zone 7 | Zone 8 | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| | | % | % | % | % | % | % | % | % | % |
| Gender | Male | 68 | 72 | 78 | 63 | 66 | 65.8 | 64.5 | 63.1 | 66.8 |
| | Female | 32 | 28 | 22 | 37 | 34 | 34.2 | 35.5 | 36.9 | 33.2 |
| Age | <25 | 27.2 | 26.4 | 22.5 | 27.6 | 20.5 | 26.5 | 28.1 | 23.5 | 26.8 |
| | 25-50 | 45.2 | 44.6 | 38.6 | 48 | 47 | 50 | 45 | 48.1 | 47.5 |
| | >50 | 27.6 | 29 | 38.9 | 24.4 | 32.5 | 23.5 | 26.9 | 28.4 | 25.7 |
| Education | Illiterate | 5 | 5.2 | 4.2 | 4.4 | 3.8 | 4.1 | 4.5 | 4.8 | 4.8 |
| | Primary | 15.5 | 16.5 | 14.8 | 17 | 14 | 18.1 | 13.5 | 14.8 | 16.8 |
| | Secondary | 26.5 | 25.6 | 24.2 | 22.8 | 24.1 | 22.6 | 21.5 | 22.5 | 24.3 |
| | Higher secondary | 28.5 | 30.5 | 24.8 | 26.8 | 31.2 | 29.6 | 33.5 | 27.1 | 29.8 |
| | Graduate | 20.5 | 21.6 | 24.2 | 25.1 | 22.8 | 18.5 | 20.2 | 17.8 | 21.6 |
| | Post graduate and above | 4 | 0.6 | 7.8 | 3.9 | 4.1 | 7.1 | 6.8 | 13 | 2.7 |
| Occupation | Unemployed | 1.1 | 0.2 | 0.8 | 1 | 0.9 | 0.4 | 0.6 | 0.4 | 0.5 |
| | Daily wages/Casual laborer | 19.2 | 18.5 | 15.6 | 20.1 | 19.5 | 16.8 | 17.5 | 21.2 | 18.5 |
| | Self employed | 70 | 69.4 | 75.2 | 68.5 | 66.8 | 74.1 | 69.2 | 70.4 | 72 |
| | Regular wages/Salaried | 5.5 | 7.1 | 6.2 | 6.4 | 7.4 | 6.8 | 7.4 | 6.3 | 6.5 |
| | Others | 4.2 | 4.8 | 2.2 | 4 | 5.4 | 1.9 | 5.3 | 1.7 | 2.5 |

## 4. Results and Discussion

### *4.1. Personal Details*

Personal details were recorded to understand the socioeconomic character of respondents. Table 2 presents the personal details of surveyed households. A total of 66.8% of males were responded as head of the family against 33.2% of females. This demonstrates how society is dominated by men as 26.8% of respondents were under 25, followed by 47.5% of respondents in the 25–50 age range, and 25.7% were over 50. Educational qualification was found higher than the state average, being 4.8% illiterate, 16.8% primary, 24.3% secondary, 29.8% higher secondary, 21.6 % graduate, and 2.7% postgraduate and higher.

Occupational character reports that most of the people are involved in unorganized sector as self-employed or daily wages labors. 0.5% respondents were unemployed, 18.5% as casual laborer, 72% were self-employed, 6.5% were salaried, and 2.5% were involved in others. The main cause of the low unemployment rate is the majority of households moving to metropolitan areas in search of employment.

**Table 3.**
Household and housing characteristics.

| Variable | Modalities | Zone 1 | Zone 2 | Zone 3 | Zone 4 | Zone 5 | Zone 6 | Zone 7 | Zone 8 | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| | | % | % | % | % | % | % | % | % | % |
| Household size | 1 -2 | 11.5 | 12.6 | 14.5 | 13.2 | 16.1 | 15.2 | 18.1 | 13.1 | 12.5 |
| | 3 -4 | 13.1 | 15.5 | 16.2 | 12.5 | 11.5 | 10.5 | 16.8 | 10.2 | 13.1 |
| | 5 -6 | 39.5 | 44.2 | 36.5 | 41.2 | 38.4 | 38.2 | 40 | 42.5 | 41.8 |
| | 7 and above | 35.9 | 27.7 | 32.8 | 33.1 | 34 | 36.1 | 25.1 | 34.2 | 32.6 |
| Ownership status | Owned | 80.2 | 76.1 | 82.1 | 78.5 | 78.9 | 81.4 | 81.5 | 75.2 | 78.5 |
| | Rented | 19.8 | 23.9 | 17.9 | 21.5 | 21.1 | 18.6 | 18.5 | 24.8 | 21.5 |
| House condition | Kutcha | 10.2 | 8.6 | 9.6 | 11.5 | 12.5 | 8.8 | 13.1 | 15.4 | 9.9 |
| | Semi pucca | 35.6 | 32.5 | 29.5 | 33.1 | 29.7 | 31.9 | 30 | 27.9 | 32.2 |
| | Pucca | 54.2 | 58.9 | 60.9 | 55.4 | 57.8 | 59.3 | 56.9 | 56.7 | 57.9 |

### *4.2. Household Size and Housing Characteristics*

Table 3 presents household and housing characteristics of the surveyed households. The average household size (median) is 4.7 for all the samples. 32.6 % households have more than 7 members followed by 41.8% having 5-6 members. 13.1% household have 3-4 members and the least is 112.5% households having 1-2 members. Urban poor households tend to be larger on average since more people are expected to contribute in the future.

Regarding the ownership 78.5% houses are occupied by owners and rest 21.5% are on rent. Most of these household does not possess land ownership, rather they have encroached on public or inhabitable land. Yet, only 9.9% of households have kutcha dwellings, which is a problem. 32.2% of households have semi-pucca homes, while 57.9% have pucca homes.

**Table 4.**
Household income.

| Household income/Month (INR) | Zone 1 | Zone 2 | Zone 3 | Zone 4 | Zone 5 | Zone 6 | Zone 7 | Zone 8 | Total |
|---|---|---|---|---|---|---|---|---|---|
| | % | % | % | % | % | % | % | % | % |
| <5000 | 1.2 | 1.8 | 2.5 | 1.1 | 3.1 | 2.8 | 3.3 | 2.5 | 2.6 |
| 5000-10000 | 24.5 | 29.1 | 26.8 | 27.2 | 28.4 | 25.5 | 30.1 | 27.8 | 27.4 |
| 10000-15000 | 38.9 | 34.2 | 37 | 33.5 | 39.2 | 34 | 35.1 | 33.7 | 36.3 |
| 15000-20000 | 22.5 | 17.6 | 21.2 | 22.4 | 18.5 | 19.1 | 20.2 | 21.1 | 20.1 |
| 20000-25000 | 5.6 | 5.5 | 8.2 | 6.5 | 5.9 | 8.1 | 7.4 | 6.8 | 7.8 |
| >25000 | 7.3 | 11.8 | 4.3 | 9.3 | 4.9 | 10.5 | 3.9 | 8.1 | 5.8 |

*4.3. Household Income and Non-Housing Expenditure*

Household income has a direct correlation with housing affordability. Table 4 presents household income details of the surveyed households. It is the single most important parameter that define housing affordability. Since the survey is conducted for urban poor, income bracket has been taken from 5000-25000 Indian Rupee (INR) per month. (Economically weaker section is defined as 300000 INR per annum household income as per the Government of India). The average monthly (median) household income was found 17500 INR. Approximately 36.3% of households make between INR 10000-15000 per month, followed by 27.4% with INR 5000-10000 per month and 20.1% earning with15000-20000 per month. Merely a pitiful 7.8% made between 20000 and 25000 Rupees. This shows that more than half of Households are earning INR 10000-20000 per month.

*4.4. Housing Cost*

Housing cost for this study has been calculated as rent or imputed rent for the house along with other expenses like maintenance cost, taxes and other related expenses. Figure 6 shows housing cost for each zone. Average housing cost in Lucknow for EWS house is INR 8408 per month which is 33.6% of monthly income. Zone 1 being the core area with commercial activities has the highest housing cost of INR 12171 per month. Other zones have subsequently lesser housing cost and zone 6 has the least housing cost of INR 6085 per month.

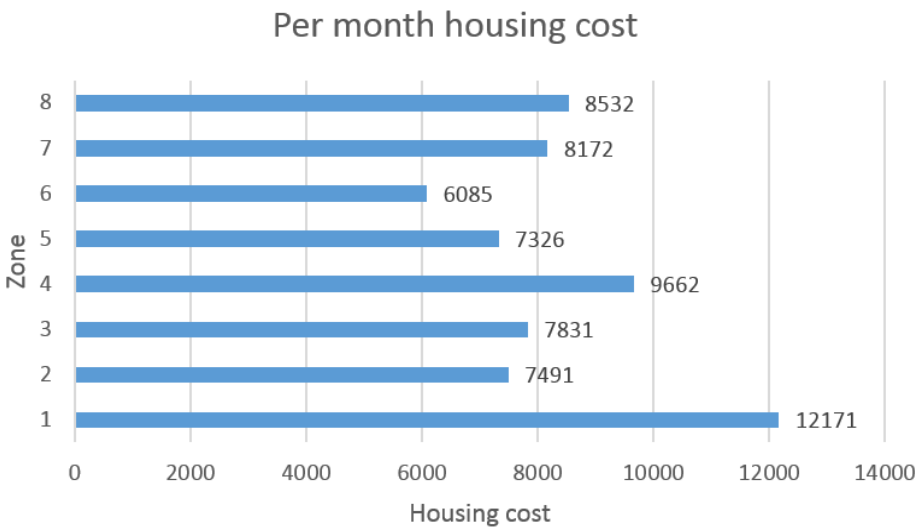


**Figure 6.**
Housing cost.

*4.5. Transportation Cost*

Travel pattern for all members of households was collected through survey. All members' travel expenses, such as those for work, school, the hospital, and other destinations, are added to the transportation cost. Almost 80% of the households were found using private mode for travels and only 20% using public transport. Around 90% of the household were using motorbikes as primary mode of commute. Average commute time for all the households was 35 minutes. In order to determine the unit travel cost for private modes, vehicle ownership and operating expenses were taken into account. Figure 7 shows per month transportation cost for each zone. Each EWS household spend INR 3366 per month on travel which is 13.4% of their income. Zone 6 spends most with INR 4950 per month on travel and zone 1 least with INR 2370 per month.

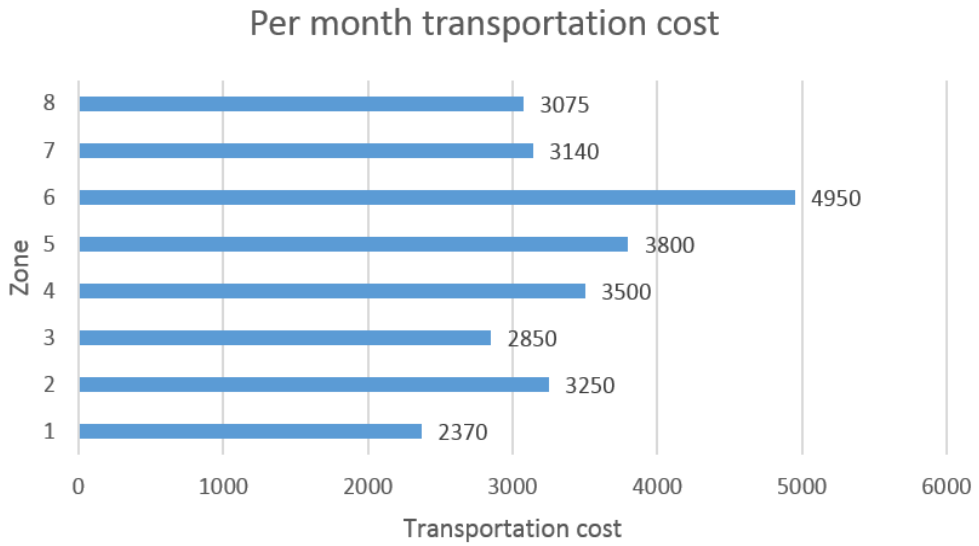


**Figure 7.**
Transportation cost.

*4.6. Housing Cost and Transportation Cost*

To get a clearer picture of role of transportation cost in housing affordability, regression analysis is done. A simple linear regression model is created between housing cost and transportation cost. Here both of these costs have been taken as percentage of household income. Table 5 and 6 explains model's summary and its coefficients.

**Table 5.**
Regression model summary.

| S | R-sq | R-sq(adj) | R-sq(pred) |
|---|---|---|---|
| 2.23720 | 17.15% | 16.86% | 15.42% |

**Table 6.**
Coefficients.

| Term | Coefficient | Standard error of coefficient | T-value | P-value | Variance inflation factor |
|---|---|---|---|---|---|
| Constant | 1.508 | 0.414 | 3.64 | 0.000 | |
| Housing cost (%) | 0.1599 | 0.0206 | 7.75 | 0.000 | 1.00 |

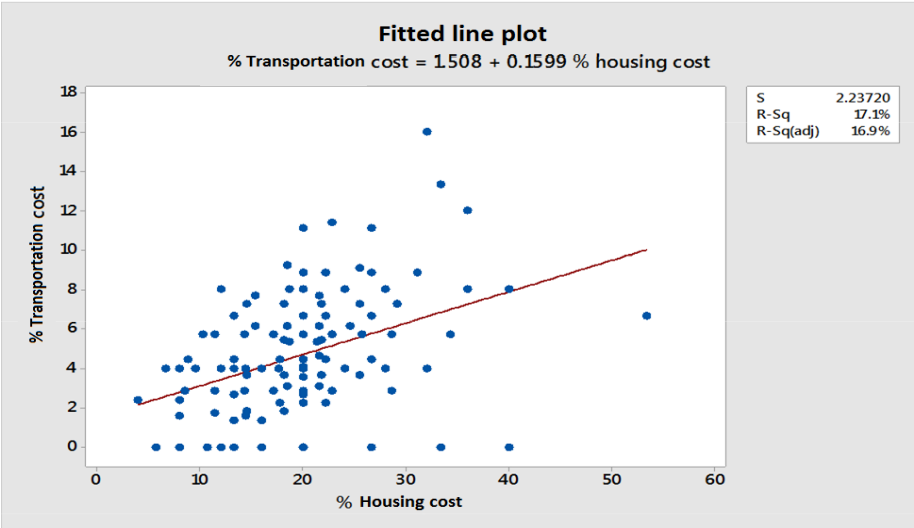


**Figure 8.**
Fitted line plot.

*4.7. Regression Equation*

Transportation cost percentage = 1.508 + 0.1599 Housing cost percentage

Figure 8 explains a linear relationship between percentage housing cost and percentage transportation cost in the fitted line plot. Although R square is very low (17.1 %) to explain a direct relation. Hence both can be taken as independent variables to explain housing affordability.

## 5. H+T Index for Lucknow: True Housing Affordability

Lucknow's H+T index is created using the above equation for eight zones.

H+T Affordability Index = (Housing cost + Transportation cost)/Household IncomeX10

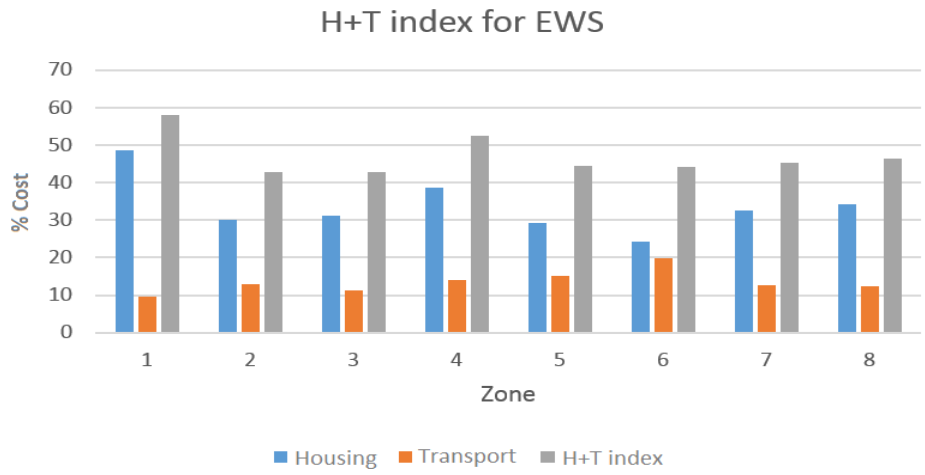


**Figure 9.**
Zone wise H+T index for EWS.

### *5.1. H+T Index for EWS*

Figure 9 illustrates comparison of the housing cost share with transportation cost share and H+T affordability index. Considering the housing affordability index, zones 2, 5, and 6 are within the affordability benchmark of 30%. However, none of the zones are below the 30% affordability benchmark for the H+T index. The most affordable Zone is zone 2 and 3, with a 45% affordability ratio. Both of these indexes are displayed on the Lucknow Zone map as themed maps to help in explaining the geographical factor of the H and H+T indexes. Figure 10 shows that outer zones remain no longer affordable once we take transportation costs into consideration. Zone 3, 7, and 8 change from 25-35% housing cost to 40-50% housing and transportation cost. Thus, peripheral zones become out of the affordability limit of 45% H+T cost.

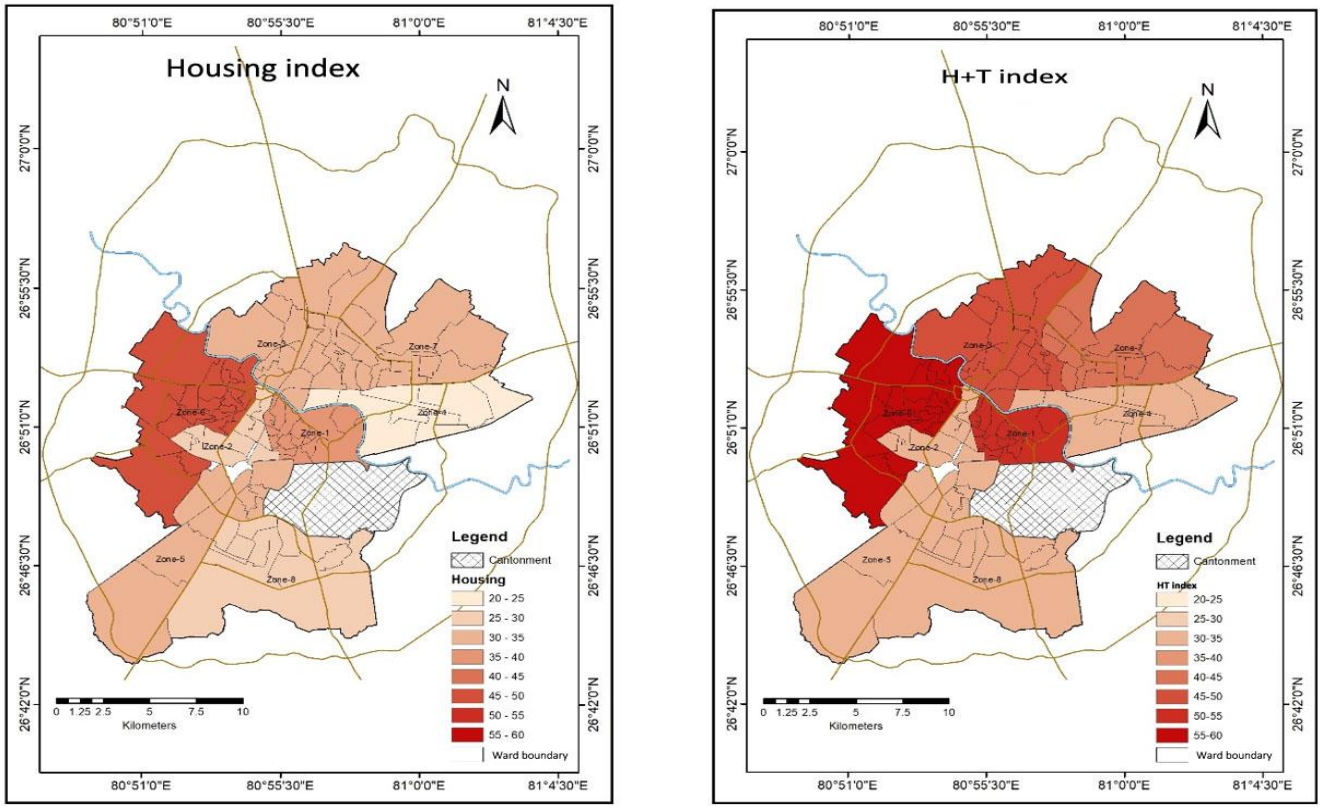


**Figure 10.**
Zone wise housing affordability index and H+T affordability index for EWS.

## 6. Results and Discussion

H+T index shows that transportation cost plays a major role in defining housing affordability. As per this study Zone 1 spends highest share of income on housing, being around 48%. But this is compensated by its lower share on transportation

cost which is around 10%. Zone 1 spends around 58% on housing and transportation which is much higher than 45%. Zone 6 is most affordable if only housing cost is considered, where people are spending 24% of their income on housing. Transportation cost in zone 6 is 20%, close to double of zone 1. In total zone 6 spends 45% of their household income on housing and transportation. While determining transportation costs for this study, commuting time, energy use, and accident risks are not taken into account. However, all these factors affect working hours and productivity of the household members.

This study shows how crucial it is to take into account transportation along with housing expenses to assess affordability. This demonstrates that in order to afford homes for EWS, houses must be placed in regions that are easily accessible to reduce the cost of transportation. The need for residents to leave their neighborhoods can be decreased by building holistic neighborhood that include the services and amenities they need, like schools, medical facilities, convenient shopping, and parks, as well as improving cost effective transportation modes (walking, cycling, and public transportation) in EWS and LIG. Building truly sustainable communities that maximize the positive benefits on the economy, society, and environment is made possible by planning for many modes of transportation and utilizing smart growth development principles.

The results of the Index show locations where building patterns, job access, and land use patterns are more conducive in the usage of walking, and biking, as well as reduced auto use. The results also reveal regions where future growth patterns are anticipated to auto ownership, multiple daily auto trips, and long work commutes, and where fixed route transit is challenging to service. There are two different forms of pertinent information that the Index may offer. Starting with a single number, based on anticipated monthly household transportation expenditures, rate the affordability of each place. In addition to that set of unbundled indicators (such as transport connection, block size, distance to work, and housing density) used to assess which of these aspects contribute to the cost of a region, such as big block sizes, limited job access, low density, and few adjacent services.

Thus, this research suggests that reducing transportation costs and increasing accessibility of affordable housing locations is essential to make them truly affordable. Strengthening public transport and connecting new developing sites in the city is vital in achieving the target of sheltering at the bottom of the pyramid. Connectivity from workplaces and amenities should be an integral part of all affordable housing policies and programs. Many public and private, affordable housing schemes are being developed in the city under affordable housing policies by central and state governments. But these housings are located in isolation and have poor connectivity from the core areas.

## 7. Conclusion

A significant objective of public policy is housing affordability. It shouldn't, however, be analyzed separately. Families frequently have to choose between paying for rent and transportation. If a less expensive home is in the outer location that requires expensive transportation, it is not really affordable. Households spend more time and money traveling to less accessible areas, but they also incur more indirect costs. These costs are generated due to loss of employment opportunities and lack of amenities. In order to encourage sustainable growth, more affordable housing should be made available in peripheral areas where inhabitants can easily access basic amenities and recreational opportunities. This is sometimes referred to as "smart growth" policies.

The housing and transportation affordability index (H+T index) is one tool developed by researchers- to measure housing affordability, which increases accuracy for housing affordability. The majority of earlier evaluations of the affordability of housing and transportation were carried out in industrialized countries. Urban areas in developing countries like India are growing horizontally. Low rise and low-density development - is a trait seen in most mid-size cities in India and Lucknow is also one of the examples. In This case, the H+T index becomes a prudent method to measure housing affordability.

This paper shows through a case study that the conventional approach to assessing housing affordability is inadequate since it ignores costs associated with accessibility or transportation. The research uses the H+T method to estimate household transportation expenditures that consider expenses related to public transit, owning and operating a private vehicle, and journeys for both business and leisure on weekdays and weekends. The study demonstrates that residing outside Lucknow's central zones does not always result in lower living expenses. When the cost of transportation is considered, the inner suburbs are more economical, whereas the outer suburbs are less so. However, the maps illustrating the distribution of housing and transportation costs offered here should not serve as the only basis for a thorough study of location affordability. The affordability of the two places should be compared while taking into account their different lifestyles, neighborhoods, demographics, etc. Overall, by combining housing and transportation costs in a case study of Lucknow, India, this study offers a better way to quantify geographic affordability. Our findings suggest that investment plans for transportation infrastructure should coordinate closely with government plans and strategies for enhancing housing affordability.

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