e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:06/Issue:07/July-2024 Impact Factor- 7.868 www.irjmets.com

STUDY ON LINKAGES BETWEEN TRANSPORTATION AND QUALITY OF LIFE WITH AN EMPHASIS ON ACCESSIBILITY INDICATORS

Ankit Singh[*1], Anshul[*2]

[*1]M.Tech Student, Department Of Civil Engineering, World College Of Technology And Management, Gurugram, Haryana, India.

[*2]Assistant Professor, Department Of Civil Engineering, World College Of Technology And Management, Gurugram, Haryana, India.

DOI: https://www.doi.org/10.56726/IRJMETS60110

ABSTRACT

The success of transport policies is determined by among other things accessibility which affects the design of cities in many aspects. However, this research construes accessibility in terms of transport where it is defined as the convenience of reaching destinations. This study aims at giving an extensive examination into how different types of transport systems relate with peoples' life quality and fairness in cities. With reference to a variety of disciplines, it examines how various social amenities can be accessed through different modes of transportation thereby impacting on people's welfare and community equity. By examining a number of different aspects like Lorenz curve, Gini index, the study sheds light on discrepancies in accessibility, environmental justice and community cohesion. It also brings to light the intricate relationship that exists between different modes of transportation, urban planning and socio-economic considerations. In addition, the study introduces a novel methodology for assessing transportation quality of life (TQOL), with a focus on accessibility indicators. Furthermore, the study uses hedonic regression models to objectively evaluate its effectiveness compared to standard assessments. This study intends to identify pathways towards more equitable and sustainable transportation systems by studying case studies and policy frameworks.

Keywords: Quality Of Life, Hedonic Regression, GIS Platform, Bing Map API, VBA.

I. INTRODUCTION

The fast transformation of modern cities in response to unprecedented levels of urbanization is characterized by a notable feature: the concurrent expansion of transportation infrastructure. The growing urban environments necessitate a more thorough investigation of the complex interrelationships among equity, quality of life, and transportation. Through navigating this intersection, this thesis undertakes a thorough investigation to clarify how transportation systems both contribute to and mitigate socio-economic disparities, in addition to shaping the quality of life experienced by metropolitan people. Global population trends have seen a significant shift due to urbanization, with a growing proportion of people increasingly residing in cities as shown in figure 1. The need for effective and sustainable transportation systems that go beyond merely facilitating mobility has been highlighted by this occurrence. It is impossible to exaggerate how vital transportation is to the general well-being of city dwellers. Given this, it is crucial to investigate how transportation affects equity and quality of life in order to fully comprehend the complex processes that shape urban experiences. Urban quality of life is a complex concept that includes a range of factors like social cohesiveness, accessibility, mobility, and environmental sustainability. Because of their effectiveness and layout, transportation networks become important factors that affect how people move through and engage with their urban environments. Since it reveals the intricate relationships that characterize urban life, a thorough investigation of how transportation affects quality of life is crucial. In the context of transportation, equity primarily refers to the equitable allocation of opportunities and resources among various socioeconomic groups. Equality of access to mobility options is a prerequisite for a functional transportation system, which guarantees that people from all economic backgrounds have similar possibilities to access jobs, education, healthcare, and recreational facilities. However, discrepancies in transportation infrastructure are frequently the result of past injustices and structural prejudices, which sustains larger social and economic inequalities that go beyond the domain of mobility. This thesis is primarily concerned with identifying the two ways that transportation affects urban environments. Transportation networks can, on the one hand, greatly improve people's quality of life by offering convenient and economical modes of transportation, encouraging business

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:06/Issue:07/July-2024 Impact Factor- 7.868 www.irjmets.com

ventures, and reducing the negative effects of traffic and pollution on the environment. However, differences in the availability and quality of transportation services can worsen already-existing social inequalities, making the goal of creating a more egalitarian urban fabric more difficult to achieve. By examining the complex relationships that exist between equity, quality of life, and transportation, this thesis hopes to add a nuanced viewpoint to the current conversation about urban development. It is envisaged that the results will guide future research projects, policy choices, and urban planning tactics, finally resulting in the development of more fair, sustainable, and inclusive urban environments for the different populations living in modern cities. The city is an unfinished endeavor that is continually being altered by the way the world is going, whether through the deliberate actions of its leaders or the forceful protests of its citizens. This adaptability can and should be discussed in architecture, as it is both a technology and a reflection of societal change. The urban condition has always piqued my interest as an architect and informed my work. The city has always captivated me as a place where creativity may flourish. The city compels its citizens to interact with a variety of people, places, and ideas. This is a transformative process that generates new subjectivities and patterns of engagement; at times it is explosive, at other times it is slow. It is the same in the present. Urban life has completely changed all throughout the world as a result of the world's population boom and the fastest urbanization ever seen. Half of the world's population currently lives in cities, and in the next thirty years, this percentage is predicted to increase to seventy percent. At this crucial juncture, one of the most important challenges facing architects and urban planners is how to enable cities to satisfy the new expectations in terms of infrastructure and culture.

II. METHODOLOGY

India's fast urbanization calls for a comprehensive assessment of urban development and transportation that takes social, economic, and environmental factors into account. With an estimated 2.76% annual increase rate in urban population between 2020 and 2022 transportation network accessibility becomes a critical factor in determining both urban development and human interaction. The research on the connection between equity, accessibility, and quality of life in Indian cities is noticeably lacking, nevertheless. Closing this gap will help us better understand how mobility affects equality, quality of life, and accessibility patterns. By tackling these problems, decision-makers and urban planners may create sustainable policies that foster urban expansion in Indian cities while advancing social justice and raising standard of living. The research methodology, which focuses on accessibility, equity, and quality of life in transportation, includes model building, data collection, and literature review. The review of the literature offers information about the state of the art and theoretical underpinnings of transportation systems. Trip duration matrices, traveler behavior surveys, and the acquisition of spatial data on services and rental units are some of the techniques used to collect data. These datasets serve as the basis for analysis and the development of models, with a persistent focus on equity, accessibility, and quality of life. In order to evaluate these aspects and provide evidence-based interventions and policy suggestions that would improve the quality of life and transportation experience for the population of the research region, advanced modelling techniques and analytical tools are used. This study, which covers 458.28 km2, focuses on urban transportation systems in Greater Mumbai. Using 577 Traffic Analysis Zones (TAZs) that were provided by the planning authorities, the research first divides the area. After that, GIS shapefiles are made to examine accessibility to urban amenities including parks, schools, hospitals, and grocery stores. Bus stations, major thoroughfares, and routes for public transportation are also charted. For both public and private transportation modes, a zone-to-zone journey time matrix is created using Visual Basic for Application (VBA) and the Bing Map API. The analysis of commuters' travel patterns helps to quantify the relative weights allocated to different urban service categories in the transportation-derived quality of life (TQoL) paradigm by understanding their preferences for different services. Data on rental housing is collected from real estate websites in order to compare the TQoL measure's efficacy. The spatial distribution of equity and quality of life throughout the study region is also seen using the GIS platform. This document presents an in-depth investigation of the complex dynamics of transportation equality and how it affects quality of life indicators, with a special emphasis on cities such as Mumbai. The study emphasizes the need of taking into account both objective indicators and subjective preferences when evaluating accessibility to key services through the use of advanced statistical modelling techniques and extensive data sources.

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:06/Issue:07/July-2024 Impact Factor- 7.868 www.irjmets.com

III. DATA ANALYSIS AND RESULTS

Table 1: Example of Lorenz curve

Cumulative % resources	Cumulative % of population	
	Line of Equity	Lorenz Curve
21	2.3	2.1
32	3.2	3.5
41	4.2	4.3
55	2.6	5.6
26	5.3	5.9
30	6.3	7.1

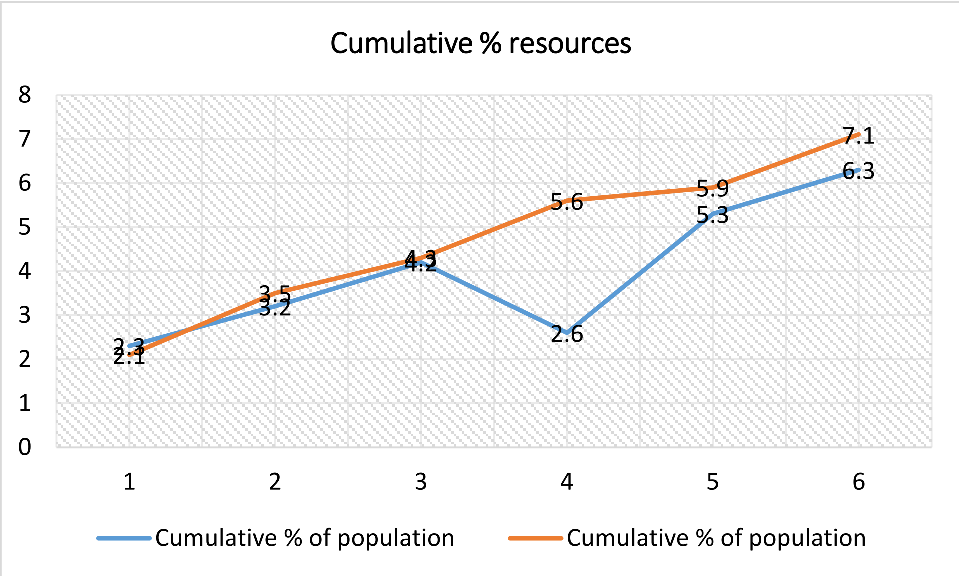

Figure 1: Example of Lorenz curve

Through the use of the Lorenz Curve and the Line of Equity, the presented data illustrates equity by presenting cumulative percentages of resource and population distribution. Resources are dispersed among various population groups in the Line of Equity, with a progressive increase in the cumulative percentage of resources. In contrast, the cumulative proportion of the population is plotted against the cumulative percentage of resources that they possess in the Lorenz Curve. Understanding the allocation of resources among the population can be gained by comparing the Lorenz Curve and the Line of Equity. Perfect equality is achieved when the Line of Equity and the Lorenz Curve intersect, meaning that resources are allocated evenly to every group in the population. Disparities between the Lorenz Curve and the Line of Equity, however, point to unequal resource distribution. It is clear from the data that is provided that different segments have varied cumulative percentages of people and resources. For instance, the Lorenz Curve shows that at 21% of resources, the cumulative proportion of the population is 2.1%, meaning that a small percentage of people own a comparatively bigger share of resources. Although at different rates, the cumulative proportion of population rises as the cumulative percentage of resources grows, reflecting differing degrees of resource distribution across various population groups. When the data is further interpreted, differences between the Lorenz Curve and the Line of Equity draw attention to inequities in the distribution of resources. In comparison, the Line of Equity represents the ideal equitable distribution, when a comparatively bigger section of the population has a smaller proportion of resources. For example, with 41% of resources, the cumulative percentage of population according to the Lorenz Curve is 4.3%.The degree of spatial inequality can be quantified and two distinct Lorenz curves can be analytically compared using the Gini index. Although the mathematical quantification of the Gini index is complicated, Eq. 4.1 can be used to approximate it.

IRJMETS

e-ISSN: 2582-5208

International Research Journal of Modernization in Engineering Technology and Science

(Peer-Reviewed, Open Access, Fully Refereed International Journal)

Volume:06/Issue:07/July-2024 Impact Factor- 7.868 www.irjmets.com

$$Gini\ Index = 1 - \sum_{k=1}^{n}(X_k - X_{k-1})(Y_k - Y_{k-1})$$

...Eq-4.1

where Xk is the cumulative proportion of the population, for k = 0, …., n, with Xk = 0, Xk = 1 and Yk is the cumulative proportion of the resource variable, for k = 0, …., n, with Yk = 0, Yk = 1.

Equity refers to how fairly resources (benefits and expenses) are allocated. Because there are many different types of equality, multiple potential affects to take into account, numerous ways to analyze those impacts, and numerous ways to classify the individuals for whom the distribution is to be carried out, it is difficult to assess equity in the transportation sector. Transport equity can be divided into two categories: vertical equity and horizontal equity While vertical equity deals with allocating resources among individuals and organizations according to need and ability, horizontal equity distributes resources equally to individuals or groups.

Table 2: Lorenz curve with a 30-minute threshold impedance function for mode-wise accessibility to workplaces and educational institutions

Cumulative % of accessibility	Cumulative % of population
Lorenz curve for accessibility for job services using private mode (G = 0.456)	2.3
Lorenz curve for accessibility for job services using public transport (G = 0.551)	2.5
Lorenz curve for accessibility for schools using private mode (G = 0.423)	4.2
Lorenz curve for accessibility for schools using public transport (G = 0.488)	6.5
Line of equity (G = 0)	5.4

In order to compare the spatial fair distribution of accessibility for all services—which represents horizontal equity—this study uses Lorenz curves. A mathematical measure to express the overall magnitude of this inequality is the Gini coefficient. The Lorenz curve is widely used in a number of fields to understand the distribution of resources over the population, including transportation. The study area's uniform distribution of accessibility for urban services is evaluated using the Lorenz curve and Gini index. The uniform distribution of accessibility throughout the space is one of the aims for the spatial distribution of accessibility, even though the Lorenz curve and Gini index aid in addressing horizontal equality. From the standpoint of both urban planning and transportation, the spatial equality is measured as the distribution across the space, assuming that the availability of urban services is a benefit of the transportation system. According to its demographic groups, the accessibility of services is evaluated in terms of its spatial distribution. The working population is used for employment services, while the student population is used to build the Lorenz curve for accessibility measures related to school services. The distribution of accessibility metrics for the other services is evaluated using data from the entire population. Piecing together the degree of spatial inequality, the relevant Lorenz curve is used to estimate the Gini index (G) values. Table 4.2 provides an example of the Lorenz curve in the context of this study. It indicates that access to work services via public transportation (G = 0.551) has a comparatively larger degree of geographical inequality than access to education services via public transportation (G = 0.488). Similarly, accessibility by public transportation (G = 0.544) has a larger degree of spatial inequality than accessibility by private mode (0.459) when comparing mode-wise access to work services. Compared to job services, there is less of a difference in the Gini index value for the 30-minute criterion for accessibility to schools using private and public transportation. This suggests that, in terms of schools, the spatial distribution

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:06/Issue:07/July-2024 Impact Factor- 7.868 www.irjmets.com

of public transportation accessibility is superior than that of private transportation accessibility in terms of school services. There are notable differences between public and private transportation options when it comes to Mumbai's accessibility to employment opportunities and educational institutions. For both services, private transportation has lower levels of accessibility inequality as indicated by Gini coefficients, pointing to a more equitable distribution of access. The difficulties in ensuring equitable access to facilities for all communities are highlighted by differences between the Lorenz curves and the Line of Equity, especially in a multicultural metropolis like Mumbai. The aforementioned results underscore the need of mitigating discrepancies in the distribution of resources and transportation infrastructure in order to augment accessibility and foster just and impartial access to vital services for every inhabitant.

Table 3: The degree of spatial disparity between various public healthcare accessibilities for various impedance functions across various population segments

Gini index	Continues Impedance Function			30 Minutes Threshold		
	Non-slum Population	Total population	Population in slum	Non-slum Population	Total population	Population in slum
Maternity care unit	3.2	2.3	1.5	2.1	2.4	2.6
Municipal Dispensary	2.5	2.5	3.2	2.5	5.3	3.4
Health post	3.6	6.2	6.4	3.6	3.2	1.2
Hospital	4.2	3.4	5.1	4.4	4.6	3.2

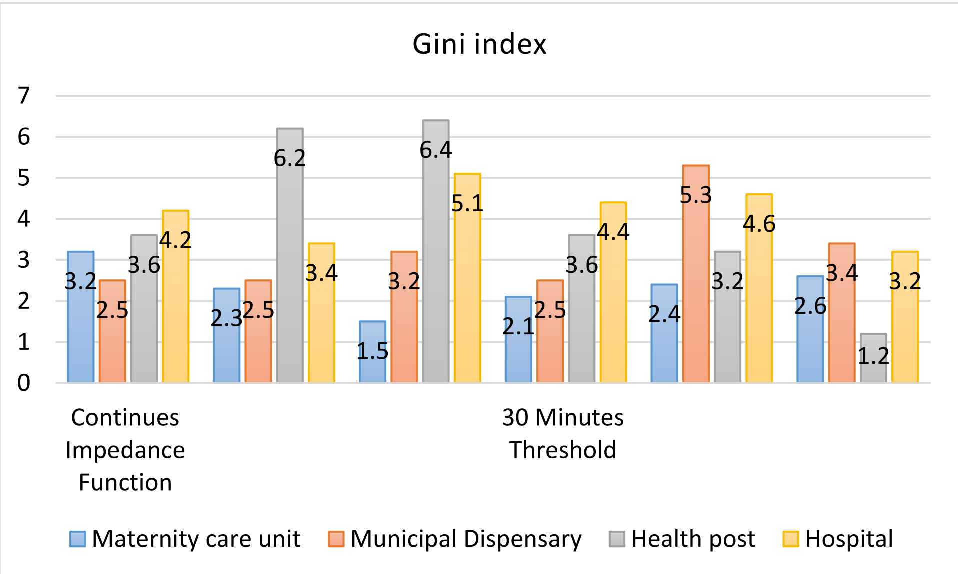

Figure 2: The degree of spatial disparity between various public healthcare accessibilities for various impedance functions across various population segments

Disparities in accessibility distribution can be seen in the Gini indices for accessibility to different facilities using private and public transportation modes across various threshold timeframes and impedance scenarios. Less inequality in accessibility is indicated by lower values of the Gini index. Private transportation typically yields lower Gini indices than public transportation for places of employment, educational institutions, and healthcare facilities; this is especially noticeable at the 15 and 30-minute thresholds. Continuous impedance scenarios, on the other hand, frequently show increased disparity, particularly in terms of employment accessibility. Accessing hospitals, parks, supermarkets, and restaurants is another area where disparities are noticeable, with differing degrees of disparity across various circumstances and modes of mobility. Supermarkets, in particular, exhibit notable discrepancies, especially when approached via public transportation and in constant impedance circumstances. These results highlight the difficulties in

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:06/Issue:07/July-2024 Impact Factor- 7.868 www.irjmets.com

guaranteeing fair access to facilities and services for a variety of demographic groups and modes of mobility. Using continuous impedance functions and a 30-minute threshold, the Gini index values for accessibility to maternity care units, municipal dispensaries, health posts, and hospitals show differences in accessibility amongst various population segments. The non-slum population's Gini indices for maternity care units, hospitals, and municipal dispensaries are typically higher than those for the general population and the slum population's, indicating that non-slum inhabitants have less equitable access to healthcare facilities. On the other hand, health posts had higher Gini indices for slum populations, which suggests that accessibility varies among slum neighborhoods. These differences highlight the necessity of focused efforts to eliminate accessibility gaps and provide fair access to necessary healthcare services for a range of societal groups and geographical locations. Additionally, the Gini index values are generated from the respective Lorenz curves and given in table 4.5 to help understand how different types of educational services affect the spatial inequality of educational accessibility. For boys and girls, there is a slight variation in the accessibility Gini index value.

Using the mode-wise difference in accessibility measure for social equity

Understanding how different modes of transportation affect the accessibility metric for urban services is one of the study's key objectives. By recognizing the gaps or variations in opportunities compared to private modes of transportation, this aids in assessing the efficiency and competitiveness of the public transportation system and can be used to gauge social fairness in the area. Determining the fairness of accessibility measurements requires consideration of the "inter-modal" difference—that is, the variation in a TAZ's accessibility value by various modalities. The distribution of benefits between private mode users (the privilege group) and public transit users is better understood with the aid of such analysis. Achieving social fairness and sustainability can be facilitated by offering comparable accessibility for private and public transportation. The mode share of public transportation in Mumbai is around 65%, indicating the city's heavy reliance on it. In this sense, the majority of regions need to have a good and similar degree of modal accessibility for users of both private and public transportation. According to Eq. 4.2, the inter-modal ratio is the ratio of the accessibility value by private mode to the accessibility value by public transportation.

$$Accessibility\ ratio\ (AccR_{i,f}^{s}) = \frac{Acc_i^{s,PT}}{Acc_i^{s,C}} \quad \text{.... Eq-4.2}$$

where, $AccRi,f\ s$ = Accessibility ratio of zone i for service s using impedance function f, $Acci\ s,PT$ = Accessibility value of zone i for service s using public transport using impedance function f, and $Acci\ s,C$ = Accessibility of zone i for service s using private mode using impedance function f.

When **K**$ccRi,\ f\ s$ is closer to or larger than unity, it indicates that public transportation can sufficiently compete with private transportation. When public transportation is scarce, the $AccRi,f\ s$ can drop to zero. When both commercial and public transportation options offer a high and almost equal access to possibilities, there is an equitable transportation system. The average accessibility ratio value for various services using various impedance functions is shown in Figure 4.6 For all services taken into consideration, the average accessibility ratio for a 15-minute threshold scenario ranges from 0.15 to 0.20, and for a 45-minute threshold scenario, it ranges from 0.49 to 0.61. It may be inferred from the average accessibility ratio result for a 15-minute threshold that users of private transportation have access to approximately 7–5 times as many possibilities as users of public transportation. Similarly, within 45 minutes of the threshold, users of private modes have access to almost 2.1 to 1.6 times the opportunities available to users of public transportation This demonstrates that at shorter access thresholds (such as a 15-minute criterion), public transportation performs worse than private transportation, but it becomes better as the threshold rises.

Table 4: Value of the average accessibility ratio for various services with various impedance functions

Items	Average Accessibility ratio value		
	15 min. threshold	30 min. threshold	45 min. threshold
Jobs	1.3	2.3	3.5
Education	2.6	3.5	6.4

Supermarkets	3.2	4.1	1.2
Medical care units	4.1	2.6	2.6
Hospitals	5.6	6.3	4.5
Parks	3.2	5.4	5.3
Restaurants	5.9	2.6	3.6

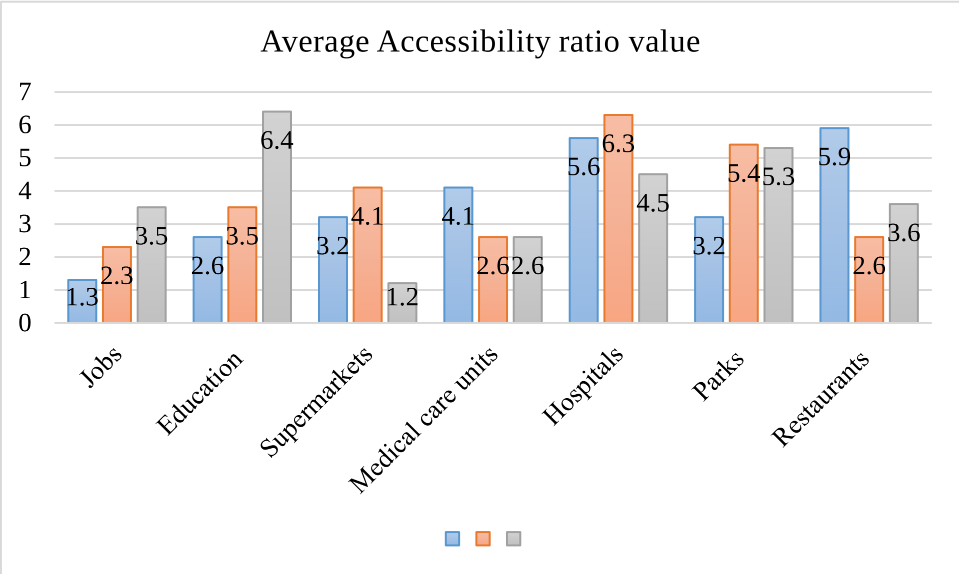

Figure 3: Value of the average accessibility ratio for various services with various impedance functions

The average accessibility ratio numbers illustrate how accessibility varies across different journey time criteria for different urban services. Greater values signify enhanced accessibility within the designated timeframes. Overall, accessibility for employment, education, supermarkets, hospitals, medical facilities, parks, and restaurants improves when the threshold time rises from 15 to 45 minutes. This emphasizes how important it is to take journey time thresholds into account while evaluating and making plans for urban accessibility. Population-weighted average accessibility ratio data according to degree of car ownership are shown in table 4.7. The average accessibility ratio value at the 15-minute threshold for employment and educational services does not significantly vary between regions based on the percentage of cars owned. However, the mode-wise disparity in access for other services, such as hospitals, parks, medical facilities, supermarkets, and dining establishments, is very small in areas with higher levels of vehicle ownership.

Enhancement strategies to lessen social and spatial disparities from an accessibility standpoint

In order to effectively eliminate inequalities, it is important to address both social and spatial differences, as highlighted by the accessibility metrics analysis. Policymakers can develop remedial actions that address both aspects of equity by taking into account the spatial distribution of accessibility ratios as well as mode-specific accessibility values. It is possible to increase accessibility generally and lessen inequities by implementing strategies like building up transit networks or putting services closer to places where accessibility is scarce. Each Traffic Analysis Zone (TAZ) can be evaluated with the use of parameters like the accessibility ratio and mode-specific accessibility. Policymakers can identify regions in need of intervention and adjust policy measures accordingly by classifying TAZs according to accessibility metrics and spatial disparity. This will help to ensure that all inhabitants have more equitable access to amenities and services.

Quality of life (QoL) as it relates to transportation

QoL is a multifaceted concept that takes into account one's physical well-being, social interactions, independence, psychosomatic well-being, personal beliefs, and surroundings, as the literature suggests Since it is frequently challenging to model QoL when all the factors are included, it is advised to make QoL domain-specific. Many transportations planning initiatives center on accessibility, which is linked to social, economic, and health well-being. Because of this, accessibility and QoL are highly correlated. Major metropolitan facilities that are more easily accessible generally meet people's needs in terms of transportation. The quality of life in relation to transportation has been the subject of relatively few studies as the total value that respondents believe to be associated with urban facilities and services in a city, based on a survey done in Nanjing. According to the QoL literature, the QoL is made up of both subjective and objective elements. With the subjective aspects related to urban facilities, the current study created the transportation derived QoL (TQoL) as the accessibility measure for major services. It is common knowledge in the transportation literature that certain services are comparatively more significant than others, but what is less clear is how different services are preferred in terms of preference. A spatial unit's accessibility value can apply to different services. Even however, the public's perception of these accessibility may vary since some services may be preferred over others. Once more, preferences for the same service may vary depending on socioeconomic factors. Weights based on preferences or subjectivity can be used to quantify the differences between QoL components. People's subjective preferences for different features are combined with accessibility-based objective indicators to quantify the quality of life associated to transportation. Because did not aggregate indicators of comparable scales, their aggregation of accessibility for various services to measure transportation-related quality of life may be skewed in favor of the accessibility of the service with higher absolute values. Rather than assigning distinct services absolute accessibility levels, The terms $PAcci\ s,m$ are utilized, and they are expressed as a percentage of opportunities reached (see to Eq. 4.3), which are comparable for various services. According to Eq. 4.3, TQoL is defined as the subjectively weighted aggregate of $PAcci\ s,m$.

$PAcci\ s,m$ is used, which is expressed as % of opportunities reached (see Eq. 4.3), which are of comparable scale for different services. TQoL is proposed as the subjective weighted aggregation of $PAcci\ s,m$ as given in Eq. 4.1.

$$TQoL_i = \sum_{s}\sum_{m} w^s PAcc_i^{s,m} \quad \forall\, i$$

.... Eq-4.3

where, $TQoLi$ = Transportation derived quality of life (QoL) of zone i, $PAcci\ s,\ m$= Percentage of opportunities reached from zone i for service s by mode m within specified travel time threshold (see Eq. 6-1), and $w\ s$ = Subjective importance for service The subjective weights can be estimated using a variety of techniques; some are straightforward and easy to grasp (like the Likert scale approach), while others may be more intricate but more accurate. Models of residential site choice are used to estimate the relative importance of various services. One of the key factors in comprehending the interaction between land use and transportation is the choice of residential location According to the review paper by **Schirmer et al. (2014),** the choice alternative in residential location choice models has been modelled very differently since it might be a spatial unit such as a building, neighborhood, zone, or residential unit. Several ideas have been created to simulate how transportation and residential choice site interact. For instance, some studies combined discrete choice theory and bid-rent theory to analyze residents' location and route choice behavior This was done with the spatial interaction model and the bid-rent theory. Some studies have constructed joint logit models based on random utility theory to evaluate transportation aspects and resident location choice. Different spatial bounds for spatial features were simulated and investigated in relation to the choice of residential location. These studies demonstrate the relationship between judgments about where to live and decisions about travel. In the current study, subjective elements influencing the development of TQoL are taken into consideration by quantifying the relative desire for significant urban services using residential choice location models. The monthly rental value, the amount of time spent travelling to and from work, school, the grocery store, the hospital, the park, and restaurants are among the variables that make up the experiment. The demand for rental homes in Indian cities is rising quickly. According to trends, there will be 4.4 million rental units available in 2021, up from 2.9 million in 2011.JLL Research (2019) offers numerous explanations for this growth. It is linked to how working people behave and to economic factors, as they do not like to face financial hardships too early in their professions. Additionally, working people in cities believe that renting a home gives them greater freedom to move around. These findings support the use of rental value as a characteristic in residential choice models to calculate marginal willingness to pay (MWTP). The following section discusses the data collecting for the expressed preference experiment, model building, and subjective weights estimate. The utility equations created with the use of discrete choice models are the basis for estimating the MWTP to enhance access to various urban

IRJMETS

e-ISSN: 2582-5208

International Research Journal of Modernization in Engineering Technology and Science

(Peer-Reviewed, Open Access, Fully Refereed International Journal)

Volume:06/Issue:07/July-2024 Impact Factor- 7.868 www.irjmets.com

services. In order to measure the subjective preference for the services, the estimated MWTP is normalized. The TQoL given in Eq. 4.3 is estimated using this subjective preference. Furthermore, using real rental housing market data from Mumbai, a hedonic regression is run in order to compare the estimated TQoL values with the average accessibility measure. This makes it easier to see how the TQoL and metrics connected to public transit infrastructure enhance the hedonic regression models.

IV. RESULTS AND DISCUSSION

Results of mixed logit and multinomial models

Through the use of SP design, the online questionnaire responses are modelled, revealing data and respondents' perceptions of access to different services. The respondent had to select one of the three residence localities on a choice card. Each respondent has eight choice cards, and 412 replies are analyzed in total. For model estimate, a data set of 3296 (412 × 8) observations is employed. The NLOGIT 5 statistical software is used in the development of the MNL (M1) and ML (M2) models. The models are constructed in accordance with the utility specification. Table 4.11 displays the estimation results for MNL and ML. In order to simplify the willingness to pay estimate, cost features are mostly considered to be non-random, as suggested. Only the estimates for the work, school, and park services demonstrated a statistically significant random influence; the coefficient estimates for travel time to service qualities are believed to be random parameters. As a result, the M2 model assumes that the other general attributes—such as travel times to restaurants, supermarkets, and hospitals—are non-random characteristics. By aggregating the observed variables (i.e., zp of Eq. under distinct groups using dummy variables, the deterministic heterogeneity is investigated for age and high-income groups of respondents on all random parameters. But only when monthly household income is divided into two groups—monthly income < 150,000 INR (income group 1, where $Inchgh$ = 0) and monthly income ≥ 150,000 INR (income group 2, where $Inchgh$ = 1)—is it found to decompose heterogeneity around the mean estimate travel time for the job, school, and park services with significant statistics.

Analysis of marginal willingness to pay (MWTP) for obtaining urban services

The desire for various urban services is highlighted by the interpretation of the models given in section 8.5. As previously mentioned, MWTP evaluations play a significant role in many urban and transportation policy, yet understanding MWTP is not simple. For every attribute, MWTP is related or estimated. All generic attributes in ML models are regarded as random, with the exception of the rental value attribute (only TTjob, TTsch, and TTpar demonstrated considerable spread). It would be simple to calculate the MWTP related to parameters if rental value were assumed to be a non-random parameter. The ratio of the non-cost attribute's coefficient to the cost attribute is typically used to estimate the MWTP. Since the cost attribute in this study—the rental value—is log-transformed, it is not possible to use the ratio of trip time estimates to the rental attribute estimate for MWTP analysis directly. MWTP for a service is defined as the ratio of the marginal utility of the service attribute to the marginal utility of the pricing attribute.

Comparing TQoL measures' performance by the application of hedonic regression

This study utilizes indulgent relapse models to examine property costs, consolidating different qualities like lodging highlights, picturesque components, and locational factors. The examination centers around the effect of transportation advantages and transportation-based Personal satisfaction (TQoL) measures on the precision of gluttonous relapse models. Four models are created: one considering just lodging credits (RV1), another adding public transportation foundation and openness (HAJHAJ2), a third consolidating TQoL rather than normal availability (HR3), and a fourth utilizing TQoL with pay based emotional loads (HR4). The consideration of transportation benefits and TQoL estimates plans to work on the prescient exactness of the models. Ascribes incorporate lodging attributes, beautiful highlights, locational factors like distance to shorelines and metropolitan conveniences, and public transportation framework measurements. By contrasting the models, the review looks to decide the degree to which transportation benefits and TQoL estimates improve the attack of epicurean relapse models.

Hedonic regression results

e-ISSN: 2582-5208
International Research Journal of Modernization in Engineering Technology and Science
(Peer-Reviewed, Open Access, Fully Refereed International Journal)
Volume:06/Issue:07/July-2024 Impact Factor- 7.868 www.irjmets.com

Hedonic regression generally does not mandate a functional form for either the independent or dependent variables. Some benefits of the log-transformed price variable include addressing the nonlinear relationship between the market price and the explanatory factors and assisting in the reduction of heteroscedasticity For this reason, linear or semi-log transformed models are typically used to estimate hedonic pricing models. The log-transformed monthly rental value (RV(H)) of the residential units is the dependent variable that is utilized. The ordinary least squares method is used to create all hedonic regression models, and SPSS statistical software is used for data modelling and diagnostics. Based on VIF results, no significant multicollinearity problems were found after the data was analyzed for multicollinearity. Regression analysis is used to model the natural logarithm of Rent (Y) as a function of many explanatory variables. For every unit change in each of the corresponding explanatory variables, the coefficients show the change in the natural logarithm of rent. When all explanatory variables are zero, the constant terms represent the predicted natural logarithm of rent. For example, the coefficient for Bed indicates that Rent increases by about 0.0714 (t-value = 16.52) for every extra unit increase in the number of bedrooms. In a similar vein, the coefficient for Distance to Work (Dist_WS) indicates that Rent drops by roughly 0.0812 for every unit increase in distance to work (t-value = -80.41). The corresponding t-values, which show the importance of the coefficients, support these conclusions

V. CONCLUSION

This analysis, which is presented in this publication, goes deeply into the complex dynamics of transportation equity and its influence on quality-of-life indicators, with a special emphasis on urban places such as Mumbai.

1. The study highlights the importance of comprehensive urban development policies that take into account both spatial and socioeconomic disparities.
2. The ultimate goal of these policies is to ensure that all residents, regardless of their mode of transportation or socioeconomic status, have access to facilities and services in a manner that is more equitable.
3. Vertical equity deals with allocating resource among individuals and organizations according to need and ability while horizontal equity distributes resources equally to individuals or groups.
4. In spatial equity it is suggested that in terms of schools, the spatial distribution of public transportation accessibility is superior than that of private transportation accessibility in terms of school services.
5. It is show that at shorter access thresholds (such as a 15 min criterion), public transportation performance worse than private transportation, but it become better as the threshold rises. From table (4.7) car ownership level at different threshold levels shows lower car ownership trend to have more egalitarian access to urban facilities, where as higher car ownership tends to have more unequal access.
6. By data collection through questionnaires and design of state preference levels of attributes saw variation in rental cost(20% decrease and 20%increase) and variation in travel time (20 min to 40 min) are represented by levels within each attribute, providing important insights in to how people prioritize these elements when selecting a location to live.
7. According to hedonic regression results the coefficient for distance to work indicates that rent drops by0.0812for every unit increases in distance to work.
8. In conclusion, research on how transportation affects equality and quality of life in urban environments indicates a nuanced and intricate relationship.
9. Cities' transportation networks are essential to their viability because they influence citizens' opportunities, mobility, and accessibility. However, the way transportation infrastructure is arranged and designed can either improve or worsen equity and quality of life.

VI. REFERENCES

[1] Aljoufie, M., & Tiwari, A. (2023). Exploring housing and transportation affordability in Jeddah. Housing Policy Debate, 33(3), 506-532.

[2] Ambrose, G., Das, K., Fan, Y., & Ramaswami, A. (2020). Is gardening associated with greater happiness of urban residents? A multi-activity, dynamic assessment in the Twin-Cities region, USA. Landscape and Urban Planning, 198, 103776

[3] Carpio, A., Ponce-Lopez, R., & Lozano-García, D. F. (2021). Urban form, land use, and cover change and their impact on carbon emissions in the Monterrey Metropolitan area Mexico. Urban Climate, 39, 100947.

[4] Chen, N., & Wang, C. H. (2020). Does green transportation promote accessibility for equity in medium-size US cites?. Transportation Research Part D: Transport and Environment, 84, 102365

[5] Chirieleison, C., Montrone, A., & Scrucca, L. (2020). Event sustainability and sustainable transportation: A positive reciprocal influence. Journal of Sustainable Tourism, 28(2), 240-262

[6] Choithani, C., van Duijne, R. J., & Nijman, J. (2021). Changing livelihoods at India's rural– urban transition. World Development, 146(October). https://doi.org/10.1016/j.worlddev.2021.105617

[7] Cui, B., Boisjoly, G., Miranda-Moreno, L., & El-Geneidy, A. (2020). Accessibility matters: Exploring the determinants of public transport mode share across income groups in Canadian cities. Transportation Research Part D: Transport and Environment, 80(July 2019), 102276. https://doi.org/10.1016/j.trd.2020.102276

[8] De Souza, C. D. F., Machado, M. F., & do Carmo, R. F. (2020). Human development, social vulnerability and COVID-19 in Brazil: a study of the social determinants of health. Infectious Diseases of Poverty, 9(1), 124. https://doi.org/10.1186/s40249-020-00743-x

[9] Dixit, M., & Sivakumar, A. (2020). Capturing the impact of individual characteristics on transport accessibility and equity analysis. Transportation Research Part D: Transport and Environment, 87(November 2019), 102473. 149 https://doi.org/10.1016/j.trd.2020.102473

[10] Ermagun, A., & Tilahun, N. (2020). Equity of transit accessibility across Chicago. Transportation Research Part D: Transport and Environment, 86(July), 102461. https://doi.org/10.1016/j.trd.2020.102461