

Criteria Analysis of Residential Location Preferences: An Urban Dwellers' Perspective

Arati Siddharth Petkar, Joel E. M. Macwan

Abstract—Preferences for residential location are of a diverse nature. Primarily they are based on the socio-economic, socio-cultural, socio-demographic characteristics of the household. It also depends on character, and the growth potential of different areas in a city. In the present study, various criteria affecting residential location preferences from the Urban Dwellers' perspective have been analyzed. The household survey has been conducted in two parts: Existing Buyers' survey and Future Buyers' survey. The analysis reveals that workplace location is the most governing criterion in deciding residential location from the majority of the urban dwellers perspective. For analyzing the importance of varied criteria, Analytical Hierarchy Process approach has been explored. The suggested approach will be helpful for urban planners, decision makers and developers, while designating a new residential area or redeveloping an existing one.

Keywords—Analytical hierarchy process, household, preferences, residential location preferences, residential land use, urban dwellers.

I. INTRODUCTION

TODAY, the pace of urbanization has increased in developing nations because of the new urban-industrial development. In developed regions, the percentage of people living in an urban area to those in rural areas is high, but in developing regions also this trend is high due to undeveloped rural areas. India, the most potential developing country in the world, is characterized by population increase, industrial development and rapid urbanization. In India, almost 32% of people are living in urban areas. The urban population has risen to 31.22% in 2011, up from was 18.8% in 1951 [1]. Urban population of India is 377 million and expected to rise to approximately 40% (550 million) urban by 2026, with urban poor estimated at 80-100 million. Population explosion, industrial development and urbanization are closely interlinked. Urbanization and pace of urbanization has increased tremendously in the last few decades. In India, we have many metro cities as well as tier two cities which observe this pace of rapid urbanization. Therefore, these cities are experiencing a tremendous pressure on resources as well as infrastructure. In the process, the major sector affected is the housing sector, resulting in huge shortages, and therefore, the urgency to reduce the gap between housing demand and supply cannot be ignored.

Various aspects of housing that call for attention in the

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Indian urban context are the quality of life in housing sector, socio-environmental impact assessment of residential projects, technical analysis of slum eradication programmes, site selection modelling for urban poor, and application of statistical modelling for affordable housing, housing market [2]. To solve these complex issues of the urban housing sector, one needs to understand the behaviour of urban dwellers in the decision-making process of residential location selection. The present study is an attempt for the same. Residential location choice behaviour is one of the important areas that need immediate attention, if housing problems are to be rightly addressed in the fast growing cities to set the urban growth in an orderly manner. Hence, the objective of the present study is to analyze the significance level of criteria that urban dwellers consider for residential location. The study area selected is Pimpri Chinchwad Municipal Corporation, a fast growing Indian city.

Residential land use is predominant in any urban area. These residential areas are divided into various zones depending on characteristics such as land potential, accessibility potential, infrastructure potential, environment potential, housing growth potential and development potential [3]. Depending on these characteristics, different zones in residential land use observe a different scale and pace of development and have different property values. Based on socio-economic, socio-cultural, socio-demographic aspects, an urban dweller chooses to reside in these zones. The current study analyses these different aspects and their relative importance with each other through an analytical hierarchy process. Effective and efficient planning and development of residential areas requires clarifying the nature of residential preferences. In reality, residential preferences are heterogeneous. These preferences can have immense bearing on policy and regulatory frameworks for future residential development anticipated in the Development Plan of the city [4].

II. FACTORS AFFECTING RESIDENTIAL LOCATION

Based on the previous investigation carried out by the author [2], [5], various criteria which affect the preference of the residential location of an urban dweller are summarized (Fig. 1). A questionnaire has been designed to incorporate these factors.

- Social aspects: Demography (household size, number of children), community preferences (religion, nearer to old residence, language), type of family (nuclear, joint).
- Socio-economic aspects: number of workers in family, total monthly income, selection criteria/purpose (1st home,

- 2nd home, investment, weekend homes).
- Economic aspects: cost (cost at the time of purchase, net current value of property), ownership (owned, on rent), type of dwelling unit (1bhk, 2bhk, etc.).
- Spatial aspects: previous residence, work place.
- Availability and Accessibility aspects: services, amenities, facilities (education, health, transportation etc.).
- Other aspects: development trend, surrounding environment and year of purchase.
- Points of interest: 1) distance from work place; 2) cost of building/land; 3) distance from city centre / market; 4) community preferences; 5) distance from school; 6) availability of recreational facilities; 7) water supply, transportation and security; 8) development trend; and 9) surrounding environment. The survey aims to find out the importance given to these criteria in the decision making process.

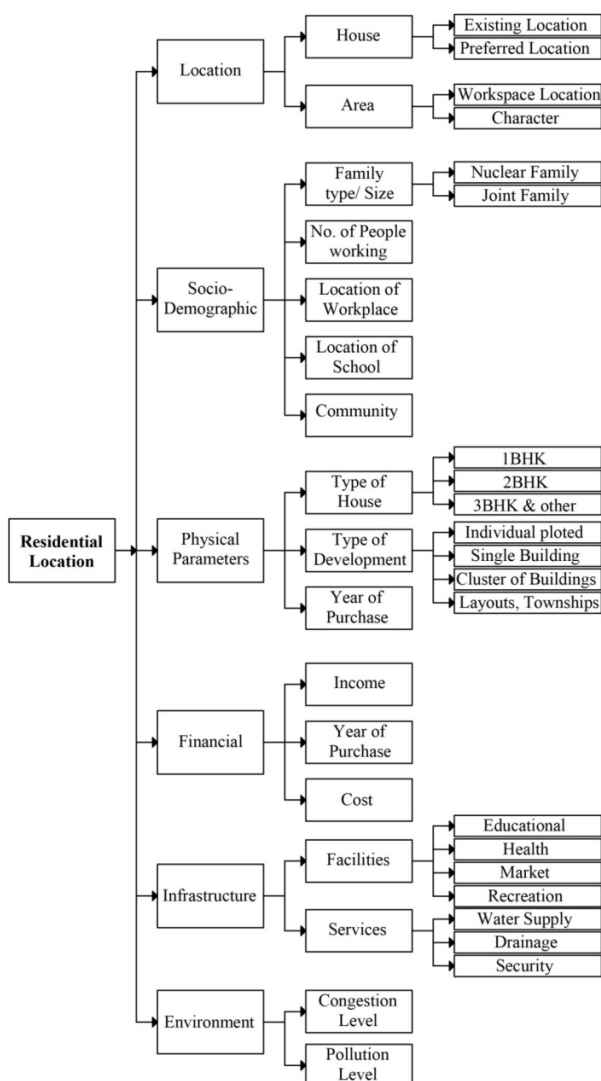


Fig. 1 Factors affecting Residential Location

III. HOUSEHOLD SURVEY AND ANALYSIS

For urban dwellers with different income groups and social backgrounds, preferences for the location of a residence may vary. The main objective is to understand the relative importance of parameters in taking the decision to locate at a particular location. An urban dwellers' residential location preferential survey was conducted in two parts, which are:

Part I. Existing Buyers' survey – A questionnaire survey was conducted in the residential areas developed in the last 12 years. The participants were the owners who purchased a residence during the last 12 years.

Part II. Future Buyers' survey – A questionnaire survey was conducted at property exhibitions held in the study area. The participants were urban dwellers currently inquiring about purchasing a residence.

IV. PART I: EXISTING BUYERS' SURVEY AND ANALYSIS

Part I includes a questionnaire survey of those urban dwellers that have purchased a residence during the last 12 years. This survey was carried out in residential areas developed in the 12 twelve years from the study area. It includes the households that have purchased homes from January 2001 to October 2012. A total of 486 samples were collected. People were requested to respond to a questionnaire, in which they were asked to rate various points of interest from 1 to 9 depending upon preferences given to these points while searching for the location - 1 for the most important and 9 for the least important criterion.

From the analysis of the survey, it has been observed that preferences vary depending upon various criteria such as personal choices, family size, income levels, and so on. Preferences also vary from zone to zone. As locating a house is a multi-criteria decision making process, it is important to understand the relative importance of various criteria with each other in the overall process. By working out priorities of urban dwellers for various criteria in the decision-making process, the importance of these criteria can be established. The preferences given by urban dwellers to the criteria have been summarized in Fig. 2. It can be observed from Fig. 2 that a total of 177 urban dwellers have given the first preference to the criterion of distance from work place, a total of 100 urban dwellers have given the first preference to the criterion of distance from city centre/market, a total of 163 urban dwellers have given the ninth preference to the criterion of community preferences, and a total of 133 urban dwellers have given the ninth preference to the criterion of development trend and so on.

A. Calculation of Weights

To analyze the priorities given to various criteria, the weight of each criterion has been calculated using the sum-product of the number of persons who have given a particular rank to a criterion and score given to various preferences. Preferences and their ranks are shown in Table I. The table also depicts the weights for criteria. For example, the first criterion distance from work places is explained below:

Summation =
 $(9 \times 177 + 8 \times 100 + 7 \times 64 + 6 \times 34 + 5 \times 24 + 4 \times 36 + 3 \times 19 + 2 \times 17 + 1 \times 22) = 3366$

B. Analysis-Based Priorities

The last column of Table I represents the priorities of these criteria. The criteria are arranged in a descending order of the weight to understand the first priority in residential location selection. It can be observed that location with respect to workplace has the highest priority in deciding residential location. The distance from the city centre/market and the

availability of infrastructure facilities in a particular area have been given more importance compared to the cost of property. It is analyzed that people are ready to spend more on travel costs to school, if the above requirements are fulfilled. The importance to the availability of recreational facilities and surrounding environment is also low compared to the workplace impact. Also, urban dwellers are comparatively least concerned about the dominance of a particular community in the decision-making process.

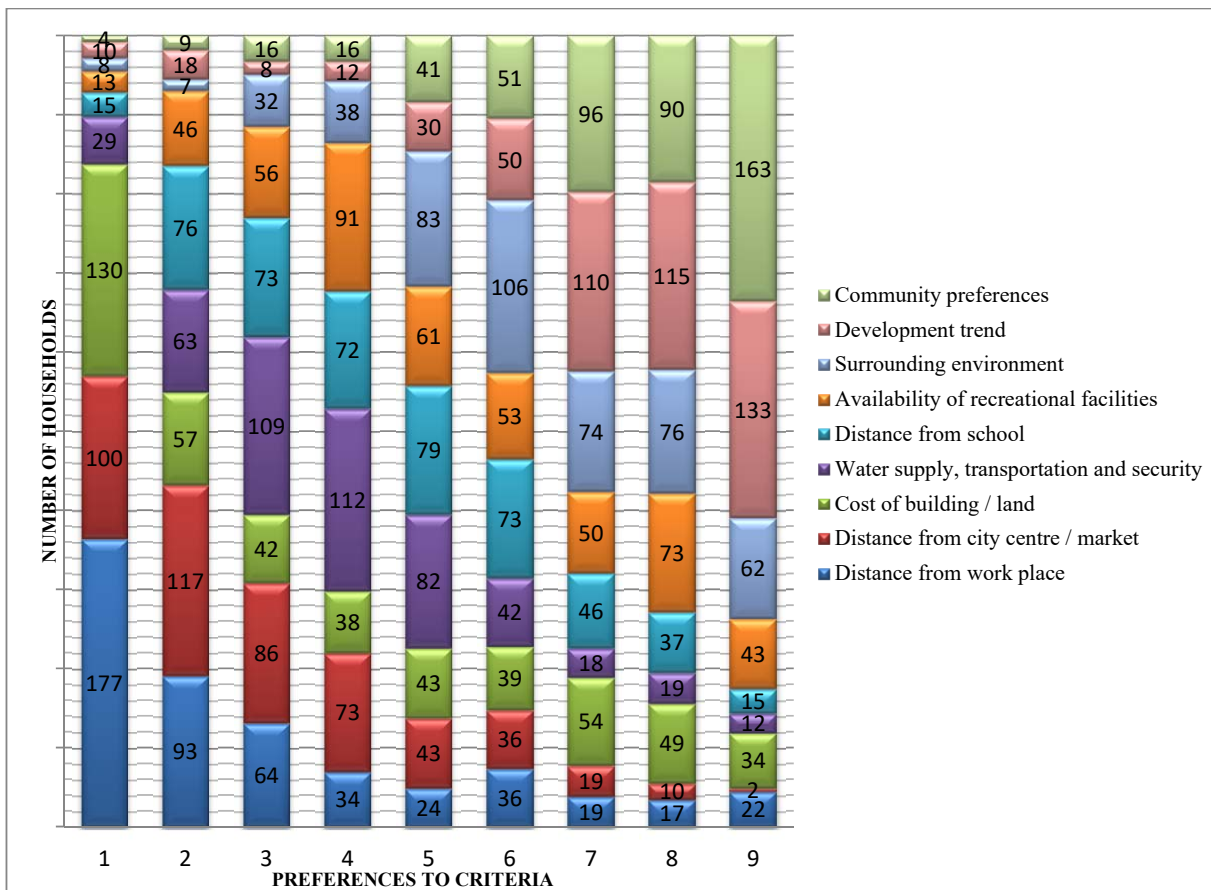


Fig. 2 Preferences to Criteria by Urban Dwellers

TABLE I
 PREFERENCES: EXISTING BUYERS

PREFERENCES	1	2	3	4	5	6	7	8	9	Summation	Normalized Weights	Priority
Distance from work place	177	93	64	34	24	36	19	17	22	3366	0.154	1 st
Distance from city centre/market	100	117	86	73	43	36	19	10	2	3314	0.152	2 nd
Water supply, transportation and security	29	63	109	112	82	42	18	19	12	2882	0.132	3 rd
Cost of building/land	130	57	42	38	43	39	54	49	34	2813	0.129	4 th
Distance from school	15	76	73	72	79	73	46	37	15	2600	0.119	5 th
Availability of recreational facilities	13	46	56	91	61	53	50	73	43	2279	0.104	6 th
Surrounding environment	8	7	32	38	83	106	74	76	62	1855	0.085	7 th
Development trend	10	18	8	12	30	50	110	115	133	1405	0.064	8 th
Community preferences	4	9	16	16	41	51	96	90	163	1356	0.062	9 th
SCORE	9	8	7	6	5	4	3	2	1			

TABLE II
PREFERENCES: FUTURE BUYERS

PREFERENCES	1	2	3	4	5	6	7	8	9			
CRITERION	Number of households									Summation	Normalized Weights	Priority
Distance from work place	34	38	9	10	5	1	3	0	0	771	0.171	1 st
Distance from city centre/market	33	20	12	10	7	8	6	1	3	691	0.154	2 nd
Water supply, transportation and security	19	9	27	14	13	9	6	3	0	641	0.142	3 rd
Cost of building/land	0	2	3	2	5	8	16	13	51	626	0.139	4 th
Distance from school	3	3	4	9	15	29	15	17	5	494	0.110	5 th
Availability of recreational facilities	1	8	15	18	20	15	8	9	6	408	0.091	6 th
Surrounding environment	8	14	22	29	14	9	2	0	2	398	0.088	7 th
Development trend	1	0	1	3	4	8	14	43	26	240	0.053	8 th
Community preferences	1	6	7	5	17	13	30	14	7	231	0.051	9 th
SCORE	9	8	7	6	5	4	3	2	1			

TABLE III
COMPARATIVE ANALYSIS

Criteria	Existing Buyers'	Future Buyers'	Priority
Distance from work place	0.154	0.171	1 st
Distance for city centre or market	0.152	0.154	2 nd
Availability of water supply, transportation and security	0.132	0.142	3 rd
Cost of building/land	0.129	0.139	4 th
Distance from school	0.119	0.110	5 th
Availability of recreational facilities	0.104	0.091	6 th
Surrounding environment	0.085	0.088	7 th
Development trend	0.064	0.053	8 th
Community preferences	0.062	0.051	9 th

V. PART II: FUTURE BUYERS' SURVEY AND ANALYSIS

Part II includes a questionnaire survey of urban dwellers that are presently interested in purchasing a residence. The survey was conducted in projects which are under construction in the study area and at a property exhibition held in the study area. A total of 100 samples were collected. The preferences given by urban dwellers to the criteria are summarized in Table II.

It was observed that a total of 34 urban dwellers gave the first preference to the criterion of distance from a work place. A total of 33 urban dwellers gave the first preference to the criterion of distance from city centre/market. A total of 51 urban dwellers gave the ninth preference to the criterion of community preferences. A total of 26 urban dwellers gave the ninth preference to the criterion of development trend and so on. Further, the same analysis, as carried out in Part I, was repeated for Part II, to understand the decision-making process of future buyers and priorities of the criteria.

VI. COMPARISON OF PART I (EXISTING BUYERS) AND PART II (FUTURE BUYERS)

Table III provides a comparison between part I and part II of the survey for weights of different criteria. Priorities for various criteria by urban dwellers who purchased a house during the last 12 years were compared with the priorities of future buyers. It was observed that these priorities are the same for both the groups but with different values. It can thus be concluded from this results that the trend in residential development which was observed in the last decade is likely to continue in near future also. Hence, the opinions given by the

people in residential surveys can be considered for predicting the future development trend of the study area.

It was observed that distance from workplace, and connectivity to various workplaces from different zones will govern the areas which are going to be developed in the near future. Zones which are well connected with a city centre or market place will have higher development possibilities. The cost will remain one of the important criteria in decision making. Preference to a particular location depending upon the community will not be the governing factor in deciding the residential location in the city.

VII. ANALYSIS USING ANALYTICAL HIERARCHY PROCESS

Merely working out the priorities does not give a clear picture of the importance given to various criteria. These criteria are considered simultaneously by a household. Hence, it is important to understand the relative importance of these criteria with each other. Analytical Hierarchy Process (AHP) is one of the multiple criteria decision-making methods that was originally developed by Prof. Thomas L. Saaty in 1977. It provides measures of judgement consistency. It derives priorities among criteria and alternatives. It simplifies preference ratings among decision making criteria by using pair wise comparisons. This is an Eigen value approach to the pair-wise comparisons. It also provides a methodology to calibrate the numeric scale for the measurement of quantitative as well as qualitative performances. The scale ranges from 1/9 for 'least valued than', to 1 for 'equal', and to 9 for 'absolutely more important than' covering the entire spectrum of the comparison. If the maximum Eigenvalue, CI,

and CR are satisfactory, then the decision is taken based on the normalized values; else, the procedure is repeated till these values lie in a desired range [6]-[8]. This section explains step wise AHP analysis.

Step 1. Decomposing the decision-making problem into a parameters or criteria: The decision making criteria considered for the study are - 1) distance from work place; 2) cost of building/land; 3) distance from city centre/market; 4) community preferences; 5) distance from school; 6) availability of recreational facilities; 7) water supply, transportation; security; 8) development trend; and, 9) surrounding environment.

Step 2. Pair-wise comparisons between Preference Criteria:

Pair-wise comparisons have been made between Preference criteria depending upon the observations from Household survey and priorities of people to various criteria. Each of the criteria has been compared with another. The degree of importance has been considered depending upon the weight obtained from the sum-product method. These criteria are then given a rating on the basis of intensity of the importance with respect to one another with the help of Saaty's standard rating scale [9]. Results of the comparison (for each factors' pair) are to be described in term of integer values from 1 (equal value) to 9 (extreme different), where a higher number means the chosen factor is considered more important in a greater degree than other factor being compared with it. The basic assumption is that if attribute A is absolutely more important than attribute B and is rated at 9, the B must be absolutely less important than A and is valued as 1/9.

- Distance from work place: Slightly greater importance than distance from city centre, and more important than cost and infrastructure facilities, more important than distance from school, as well as highly important compared to community preferences, development trend and surrounding environment.
- Cost of building/land: Slightly less important than distance from city centre and availability of infrastructure facilities, slightly more important than distance from school, more important than availability of recreational facilities, highly important compared to community preferences, development trend and surrounding environment.
- Distance from a city centre or market: Slightly more important than availability of better infrastructure facilities, more important than distance from school and availability of recreational facilities, more important than development trend and surrounding environment, highly important compared to community preferences.
- Community preferences: Community preferences are of very less importance than any other criterion.
- Distance from school: Significantly less important than availability of better infrastructure facilities, slightly more important than availability of recreational facilities, more important than development trend and surrounding environment.
- Availability of recreational facilities (gardens, clubs):

Significantly less important than availability of better infrastructure facilities, more important than development trend and surrounding environment.

- Water supply, transportation and security: more important than development trend and surrounding environment.
- Development trend: Slightly less important than surrounding environment.

Based on this, a matrix has been initialized.

Step 3. Synthesizing judgments' and Matrix Formation:

A preference matrix is formed based on pair-wise comparisons between various criteria and Saaty's rating scale (Table IV).

Eigenvector is calculated by solving preference matrix of (order $n = 9$) using AHP Software and the new Vector is calculated as the Sum-Product of Preference Ranking and Weights. For example, the criteria Distance from Work Place is explained as:

$$(1 \times 0.289 + 3 \times 0.1687 + 2 \times 0.2045 + 9 \times 0.0137 + 5 \times 0.0735 + 7 \times 0.0417 + 3 \times 0.154 + 9 \times 0.0244 + 9 \times 0.0282) = 2.929$$

'h' is calculated as $h = \text{New Vector} / \text{Eigen Vector}$ and h_{max} is average of h. Here, $h = 2.929 / 0.289 = 10.10$; similarly, 'h' is calculated for all criteria.

$$\text{Maximum Eigen Value} = 10.10$$

Here, h_{max} is greater than n i.e. 9; hence calculations are Reliable and Consistent.

Step 4. Evaluate and check the consistency of judgements: With AHP, degree of consistency can be measured; and if unacceptable, pair-wise comparisons can be revised. 'Saaty' suggests that $CR > 0.10$ indicates that the judgments' are at the limit of consistency and acceptable. However, CR as high as 0.9 and CR below 0.1 would mean that pair-wise judgments' are just about random and are completely untrustworthy.

$$\text{Consistency Index (CI)} = \frac{(h_{\text{max}} - n)}{(n-1)} = \frac{(10.10-9)}{(9-1)} = 0.13$$

$$\text{Consistency Ratio (CR)} = \frac{\text{CI}}{\text{Saaty's Value for } n} = \frac{0.13}{1.45} = 0.089$$

As the Consistency Ratio is 0.89, the pair-wise comparisons made are trustworthy. With AHP analysis, it has been proved that assumptions made in Step 2 are consistent and reliable. These assumptions were based on the residential survey data, so it can be concluded that these assumptions represent urban dwellers considerations to various criteria in the decision-making procedure of locating their house in the study area. The AHP matrix is normalized to understand the relative importance given to various criteria in terms of percentage. Table V presents the criteria and their importance in deciding residential location. With these results, Fig. 3 portrays the decision-making zone of urban dwellers for residential location.

TABLE IV
DEVELOPMENT OF PAIR-WISE COMPARISON MATRIX, CALCULATION OF CONSISTENCY MEASURE

	Distance from work place	Cost of Building/Land	Distance from city centre or market	Community Preferences	Distance from school	Availability of Recreational Facilities	
Distance from work place	1	3	2	9	5	7	
Cost of Building / Land	1/3	1	1/2	9	5	7	
Distance from city centre or market	1/2	2	1	9	5	5	
Community Preferences	1/9	1/9	1/9	1	1/7	1/5	
Distance from school	1/5	1/5	1/5	7	1	3	
Availability of Recreational Facilities	1/7	1/7	1/5	5	1/3	1	
Water Supply, Transportation & Security	1/3	2	1/2	7	3	7	
Development Trend	1/9	1/9	1/7	5	1/5	1/3	
Surrounding Environment	1/9	1/9	1/7	5	1/5	1/3	
Distance from work place	Water Supply, Transportation & Security		Development Trend	Surrounding Environment	Weights (Eigenvector)	% New Vector	h
Cost of Building / Land	3		9	9	0.2899	2.929	10.10
Distance from city centre or market	1/2		9	9	0.1687	1.704	10.10
Community Preferences	2		7	7	0.2046	2.067	10.10
Distance from school	1/7		1/5	1/5	0.0138	0.139	10.10
Availability of Recreational Facilities	1/3		5	5	0.0736	0.743	10.10
Water Supply, Transportation & Security	1/7		3	3	0.0418	0.422	10.10
Development Trend	1		5	5	0.1549	1.565	10.10
Surrounding Environment	1/5		1	1/2	0.0245	0.247	10.10
	1/5		2	1	0.0283	0.286	10.10
						h_max	10.10

TABLE V
PRIORITIES AND IMPORTANCE OF CRITERIA

Preference Criteria	Weights (Eigenvector)	Priority	Importance (%)
Distance from a work place	0.285	1 st	28.50
Distance from a city centre / market	0.201	2 nd	20.06
Water supply, transportation and security	0.166	3 rd	16.58
Cost of building/land	0.165	4 th	16.50
Distance from a school	0.074	5 th	7.35
Recreational facilities	0.051	6 th	5.09
Surrounding environment	0.025	7 th	2.50
Development trend	0.022	8 th	2.17
Community preferences	0.012	9 th	1.24

VIII.CONCLUSION

The distance from workplace is the most governing factor in the decision-making process; hence, connectivity to various workplaces from different zones of the study area will govern the areas which are going to be developed in the near future. Further, the distance from a city centre/market is observed as the second important criterion. In the decision-making process, along with workplace and a city centre connectivity availability of better infrastructure and recreational facilities in that area has also been given importance by people who prefer increased travelling cost for school if the above requirements are fulfilled.

The rate of increase in the property values is observed to be similar in most of the developing zones in the study area; hence, people give less importance to the development trend of a particular area with respect to getting higher appreciation for property in the future. As the character of the study area is becoming more cosmopolitan in nature and with changing family structure, community preferences in deciding

residential location is decreasing.

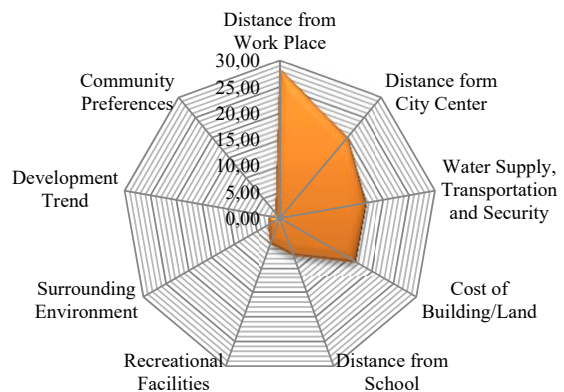


Fig. 3 Decision making zone

AHP analysis in multi-criteria decision-making has been applied to a residential location preferences study in the Indian context. As a number of criteria affect the decision-making process for the selection of residential location, it becomes necessary to identify the significant criteria to perform rapid, reliable, yet accurate forecasting of future residential locations. By performing AHP analysis, relative importance of criteria under consideration is obtained. It is, thus, concluded that the distance from the work place has been found to be an extremely important factor in deciding residential location by urban dwellers and a further decision making zone has been portrayed. The study represents the overall preferences of urban dwellers considering all survey samples together, and hence, is based on the socio-demographic characteristics of family like nuclear family and joint family are the future scope

of the study. AHP analysis, therefore, has been observed to be an effective tool in identifying significant criteria by obtaining their relative importance which would certainly ensure reliable and accurate prediction of residential location and will definitely provide a guideline to urban planners, decision makers and developers while designating new residential areas or regenerating an existing one.

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REFERENCES

- [1] Government of India, "Census of India 2011" 2011.
- [2] A. S. Petkar and J. E. M. Macwan, "Urban Housing and Policies in India: Review and Research Challenges," *J. Indian Inst. Archit.*, vol. 79, no. 12, pp. 26–31, 2014.
- [3] A. S. Petkar and J. E. M. Macwan, "Framework of Analytical Hierarchy Process based on Residential Location Preferences," in *Proceeding of the Neo-International Conference on Habitable Environments*, 2014, pp. 513–518.
- [4] A. Patil, A. Das, and T. Mazumder, "Residential Location Choice: A Study of Household Preferences for the City of Nagpur," no. September, pp. 1–19, 2010.
- [5] A. S. Petkar and J. E. M. Macwan, "Residential Location Preferences: Approaches and Research Avenues," in *Proceedings of Fourth International Conference on Advances in Civil Engineering*, 2013, pp. 903–909.
- [6] T. L. Saaty, "Decision making with the analytic hierarchy process," *Int. J. Serv. Sci.*, vol. 1, no. 1, p. 83, 2008.
- [7] R. Bhatt, D. Bhatt, and V. Patel, "Analytic Hierarchy Process Approach for Criteria Ranking of Sustainable Building Assessment: A Case Study," *World Appl. Sci.*, vol. 8, no. 7, pp. 881–888, 2010.
- [8] M. Velasquez and P. T. Hester, "An Analysis of Multi-Criteria Decision Making Methods," *Int. J. Operations Res.*, vol. 10, no. 2, pp. 56–66, 2013.
- [9] T. L. Saaty, "How to make a decision: The analytic hierarchy process," *Eur. J. Oper. Res.*, vol. 48, no. 1, pp. 9–26, 1990.



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