Trans. Inst. Indian Geographers
Vol. 8, No. 2 July 1986

REGIONALIZATION OF AN URBAN AREA – AN ECOLOGICAL APPROACH A CASE STUDY OF PUNE CITY

Vrishali Deosthali, Pune

ABSTRACT : A city is not merely an assemblage of buildings made up of bricks and mortar. It is a human phenomenon. The ecological approach which studies regionalization of urban area is based on the strong links between housing and a city's social ecology. Against this background an attempt has been made in the present paper to assess the relationship between various morphological parameters which represent the housing conditions of Pune. Similarly, the socio-economic and demographic status of the households in Pune has also been incorporated in the analysis. The technique of Principal Component Analysis has been applied to understand the relative influence of different variables on the decisions taken by the households regarding their housing. Finally regionalization has been carried out through the means of Cluster Analysis. The writer feels that the planned housing development of a city should be based on its regionalization which helps in identification of problems within an urban area.

INTRODUCTION

Scarcity of housing accomodation is an acute problem in all cities because of the rapid industrialization and consequent large rural-urban migration. The socio-economic personality of the city is reflected in housing pattern of that city. In the present paper an attempt has been made to understand the nature of the socio-economic areas of the Pune City on the basis of the pattern and quality of housing.

Housing problem is generally expressed in terms of excess of demand for houses over their supply. From one city to another, and even within one city, the nature of demand for housing differs. The decision taken by a household regarding its housing reflects the socio-economic and demographic characteristics of that household. In addition to the physical characteristics of a housing unit the decision is influenced by its location in relation to the place of employment, shopping areas, schools, dispensary and so on. Thus, housing has an inescapable spatial context which varies from individual to individual, from time to time, from area to area within a city and from one city to another city. In this paper an attempt is made to demarcate the socio-economic areas of the city to analyse the nature and gravity of housing problem within Pune City.

Housing is one of the key elements which link both material and social aspects of the city. There have been two approaches in the geographical study of the evolution of urban areas – the morphological and the ecological. Morphological analysis has continued to be an important tool in Geography for such studies.

Smails (1953) stated that any geographer's study of town or city should compose differences in either these intimately related aspects of urban morphology, function and form or both, giving a basis for the recognition of urban regions. It is the description of their nature, their relative disposition and their social interdependence that constitutes a geographical analysis of an urban area. There are a number of recent studies which examine structural elements within the city's fabric (e.g. Whitechand, 1967; Johnston, 1969a). However, the morphological approach has not been found to be meaningful.

The approach is suitable for the study of smaller areas. Apart from this, the morphological approach fails to evaluate sufficiently the social processes which govern the spatial forms. Jones (1966) stated that in order to recognise the city as a function of social forces, the study of structures is not enough without studying its society. In demarcating urban regions major characteristics of house type such as age, size, and condition have often been used as evidence. Thus, the role of social processes in the development of urban spatial structure is indirectly acknowledged. It is due to this fact that many geographers adopt ecological approach to the study of urban areas.

The ecologists recognise the strong links between the housing and the city's social ecology. Both the approaches are complementary ways of looking at the same general problem of the evolution of the City's social and spatial structures. The morphologists study the built-form and the distribution of land uses while the ecologists are more concerned with the responses of population to the changes in the physical character of areas. These responses are reflected through the alterations in the quality of the housing stock. Therefore, for such a study, the methods of Economists and Sociologists should be considered comprehensively.

Leslie and Richardson (1961) combined the life-cycle and career – mobility elements for residential mobility. Pritchard, R. M. (1976) applied the life-cycle, career-mobility model along with housing quality to Leicester which is an industrial city in the English Midlands. He used eighty-one Enumeration Districts to form the areal basis for the socio-economic studies of the city. Thirty-two variables were used in the housing and the rest with socio-economic elements especially relevant to the life-cycle, career-mobility model.

In the Indian context, however, this multi-disciplinary and multi-variate approach has been lacking in the study of urban areas. Very few attempts have been made to evaluate the urban structure with a less traditional approach. On this background an attempt has been made in present paper to assess the relationship between various morphological parameters which represent the housing conditions of a city. Similarly, the socio-economic and the demographic status of the households has also been incorporated in the analysis for a more realistic assessment.

The urban area of Pune City has been considered for such a study and all the relevant information and analysis have been carried out for the regionalization. Pune (18^{o} 31' N Lat. and 73^{o} 51' E Long.) is situated on the Deccan Plateau almost on its Western margin. The old town is at an altitude of 615 m. A. S. L. Pune demarcated by Pune Municipal Corporation Limits, has an area of 138.76 sq. kms. According to 1981 census there are 2,28,669 households and 2,19,087 houses. Total population of the city is 12,03,351. Figure 1 shows various wards of Pune City.

METHODOLOGY

The census publications of India do not provide the detailed information regarding the socio-economic status of the households and the housing quality. Hence, the data was collected with the help of questionnaire consisted of a wide range of variables dealing with various aspects of the socio-economic position of the household and the quality of their housing.

The variables used by R. M. Pritchard (1976) in his analysis of Leicester were found to be unsuitable in the study of housing in the Third World city such as Pune. Some of the variables are modified for example, the rent categories, income levels etc., a few have been added such as mopeds, cycles used for going to work while some have been omitted as a house with a garage, lawn, furnished dwellings etc. Thus all necessary precaution and care have been taken to select the variables which are relevant to the Indian environment. The variables finally included in the analysis compose of two distinct categories, one representing the households and their characteristics and the other characterizing their housing conditions. The variables under these two categories have been given in Table 1.

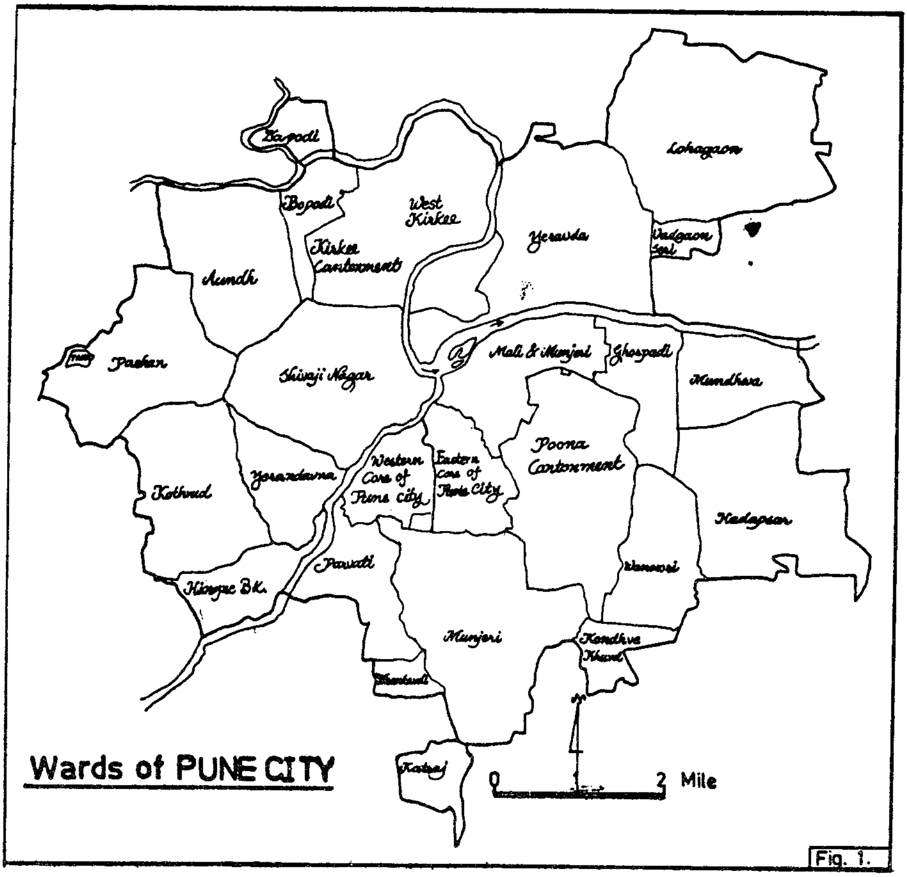


Fig. 1.

TABLE 1 : VARIABLES USED IN THE ANALYSIS

1.	% persons engaged in blue collar jobs	PBC
2.	% persons engaged in white collar jobs	PWC
3.	% persons engaged in sales jobs	PSJ
4.	% persons engaged in personal jobs	PPJ
5.	% persons unemployed	PUE
6.	% persons retired	PR
7.	% population in the age group of 0–4	PAF
8.	% population in the age group of 5–9	PAN
9.	% population in the age group of 10–14	PFO
10.	% population in the age group of 15–19	PNI
11.	% population in the age group of 20–29	PAT
12.	% population in the age group of 30–39	PGT
13.	% population in the age group of 40–49	PGF
14.	% population in the age group of 50–59	PGN
15.	% population in the age group of 60+	PAS
16.	% persons using autos to work	PAW
17.	% persons using bus to work	PBW
18.	% persons using other than bus to work	POW
19.	Average number of nuclear families in one tenement	ANF
20.	% families with 500 rupees monthly income	FM500
21.	% families with monthly income 501–1500 Rupees	FM1500
22.	% families with monthly income 1501–3000 Rupees	FM3000
23.	% families with monthly income 3000 Rupees +	FM3000 +
24.	Average number of family members in one tenement	AFM
25.	% owned houses	POH
26.	% rented houses	PRH
27.	Average number of rooms in one tenement	ART
28.	% rent paid for a tenement	RPT
29.	% cost paid for an apartment	CPA
30.	% tax paid for a bungalow	TPB
31.	% one person household	OPH
32.	% families with power driven vehicles other than car	FPV
33.	% families with bicycles	FBC
34.	Age of the building	ABD
35.	Material used for floor	MUF
36.	Material used for roof	MUR
37.	Material used for walls	MUW

For a micro level evaluation of the spatial variation of the above-mentioned parameters, the study area was partitioned into seventy-five wards. These wards are formally recognized units and, therefore, provide a good basis for analysis and regionalization. Furthermore in view of the three types of housing system namely, the Wada, an apartment and a bungalow. The data was obtained by randomly surveying the three types for a proper assessment of the housing and the household. A Wada is defined as a building either entirely occupied by tenants or shared by landlord alongwith tenants, an apartment is a self-contained dwelling owned by an occupant and a bungalow as an independent single dwelling occupied by the owner. The data finally collected included 1943 household samples which appear to be a good representative of the housing and related problems of the Pune City.

ANALYSIS

The personality of a city is denoted by the demographic and socio-economic characteristics of the population. These variables are inter-related and have a complex relationship. The combined effect of these variables in each part of the city has to be assessed in order to form socio-economic regions. It is impossible manually to obtain a comprehensive structural framework for a large number of variables. Hence, in the present study the technique of 'Principal Component Analysis' has been used to understand the relative influence of different variables on the decisions taken by the households regarding their housing. While selecting the technique of Principal Component Analysis, following points were under consideration:

There is great controversy among the scientists about the reliability of factor analysis. Mather, P. M. (1976) writer of 'Computational methods of multivariate analysis in Physical Geography' says that, until recently, the statistical and mathematical foundations of Factor Analysis have been poorly expressed and the aim of the technique has not been clearly understood. However, R. M. Pritchard (1976) has successfully used this technique to form the socio-economic areas of Leicester. In the present study, the technique has been used to understand the relative influence of different variables on the decisions taken by the households regarding their housing.

RESULTS

On the basis of thirty-seven variables reflecting various aspects of households and housing (Table 1) the Principal Component Analysis was carried out. The analysis has synthesized the thirty-seven variables into fifteen components and the variance traced by these components is about 79.03%. The last seven components are associated with the material used in the construction of all the three housing types in the different wards of Pune City. The construction material was found to be uniform and hence there is no necessity of considering these components for further analysis. Thus the results indicated that the components one to eight are cardinal factors which determine the housing in the Pune City.

The Principal Component Analysis reveals that each of the component is represented by different variables. The loadings for all the eight components are given in Table 2. The component I and II together explain more than one third variance and, therefore, these two have been taken into consideration for further mapping.

On the basis of component scores (See Table 2) obtained by using income-ownership component, two distinct regions are identified. Whereas the first region represents high standard of living the second region represents low standard of living.

TABLE 2

Component I		Component II		Component III	
-.3480	CPA	+.3720	FM1500	+.3094	PR
-.3462	PAW	+.2930	ANF	+.3362	PAS
-.3302	FM3000	+.2751	PUE	+.2969	AFM
-.3103	FM500	+.2682	PGF	+.2937	PGT
-.3327	POH	+.2528	PNI	-.1800	PAF
-.3099	FM3000 +	+.2483	PFO	-.3582	PGF
-.2700	RPT	+.2256	TPB	-.3464	PNI
		+.2031	PAN	-.2281	PFO
Component IV		**Component V**		**Component VI**	
+.4816	PBW	+.3300	PBC	+.4155	RPT
+.4380	POW	+.2920	PBW	+.3308	AFM
+.2418	PBC	-.5798	ART	+.2836	PAN
+.2265	PRH	-.4700	PSJ	+.2726	PRH
+.2228	ART	-.2066	FM3000 +	-.3344	PWC
-.2207	ANF	-.1996	PWC	-.3156	PBW
-.2000	PAW	-.1400	PPJ	-.3120	PPJ
Component VII		**Component VIII**			
+.4139	PGF	+.5710	PPJ		
+.3575	PBC	+.3037	ANF		
+.2000	ART	+.2599	PRH		
-.3715	TPB	+.2500	RPT		
-.2826	AFM	-.3714	PWC		
-.2638	PPJ	-.2900	PFO		
-.2325	PAN	-.2700	AFM		
-.2166	PSJ				

Table 3 indicates the label of each component and its share in the total variance.

TABLE 3

Component No.	Label of Components	Explained Variance
I	Income-ownership	16.08%
II	Stage in life-cycle	15.73%
III	Age composition	8.45%
IV	Mode of conveyance to work	4.74%
V	Types of occupation	4.51%
VI	Occupation and type of ownership	3.86%
VII	Occupation and crowding ratio	3.66%
VIII	Rent and crowding ratio	3.08%

The spatial distribution of the income-ownership component (Figure 2) shows East-West contract clearly. The high positive scores occur in the Eastern half of the old core of the Pune City namely Mangalwar, Somwar, Nana, Rasta, Kasba Wards where poor families are concentrated. On the periphery too in Parvati, Bibwewadi, Mundhawa, Hadapsar, Yerawada, and Lohagaon lower middle class families have settled down. There is only one exception in this pattern. The ward number 64 in Rasta Peth in the heart of the Eastern Core identifies itself distinctly because it is inhabited by immigrants from South India who represent upper economic class.

The highest negative scores are found in these areas which are newly developed like Shivajinagar, Erandavana and Aundh where intra-urban migration from core of the city for better housing has taken place. The households of better economic standard are also observed in Southern wards such as Sadashiv, Narayan, Shaniwar, Shukrawar which had enjoyed considerable importance in the British period.

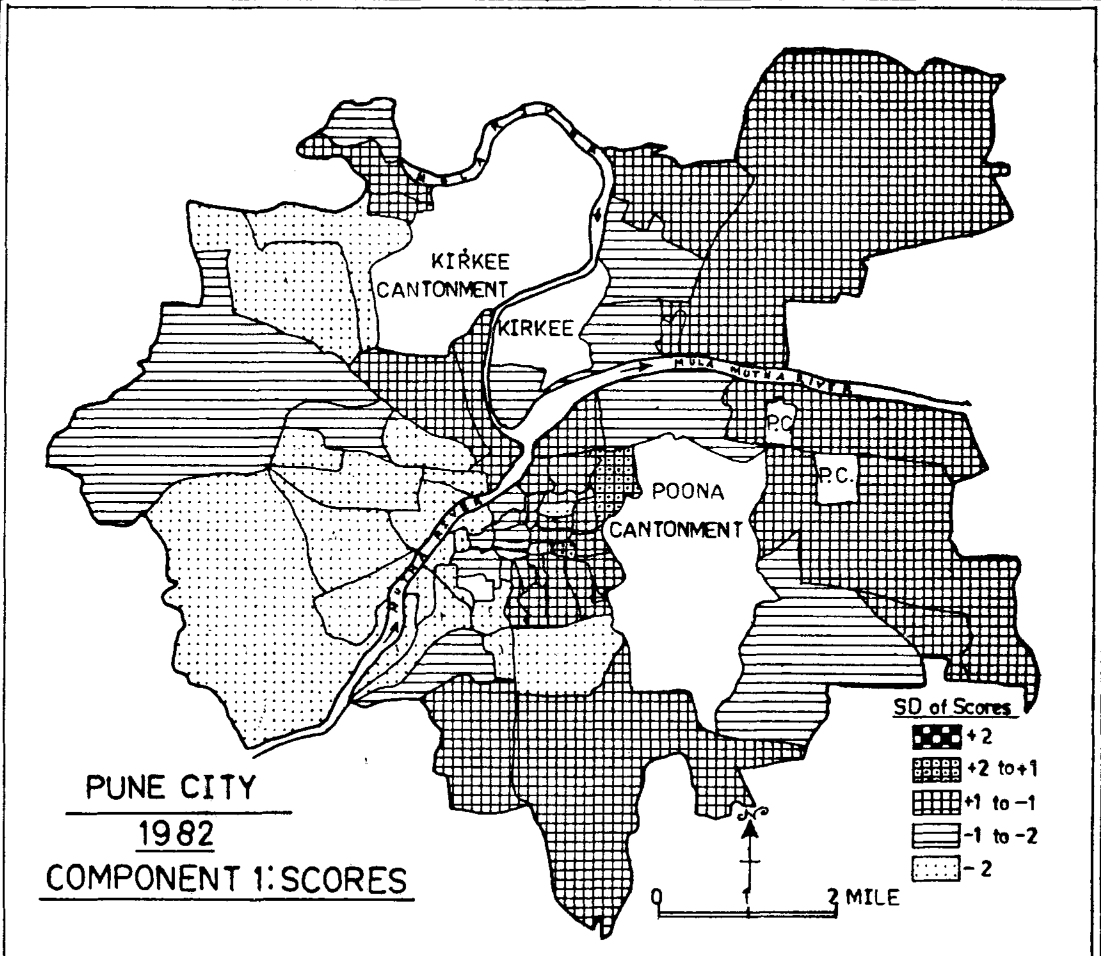


FIG. 2.

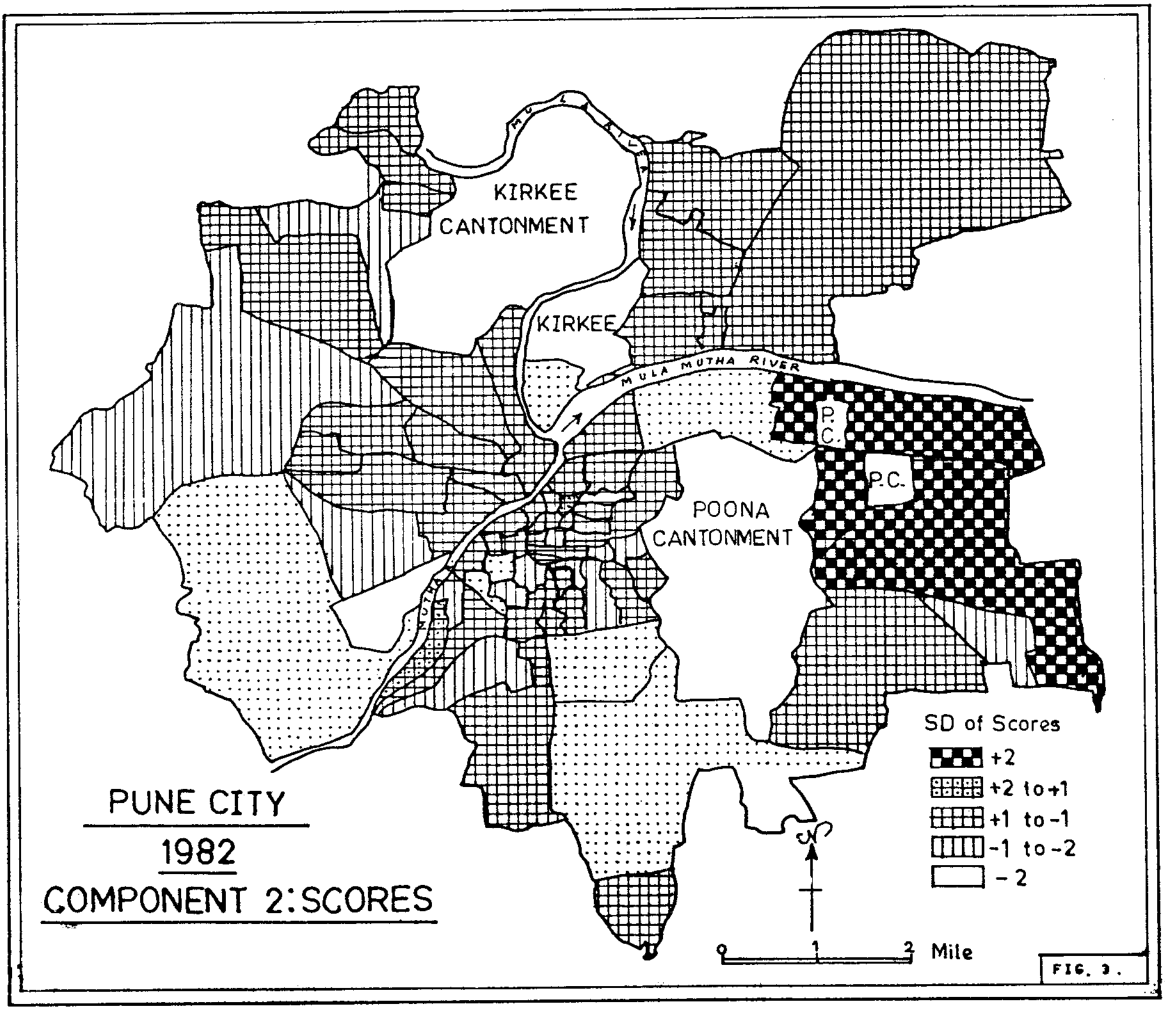


FIG. 3.

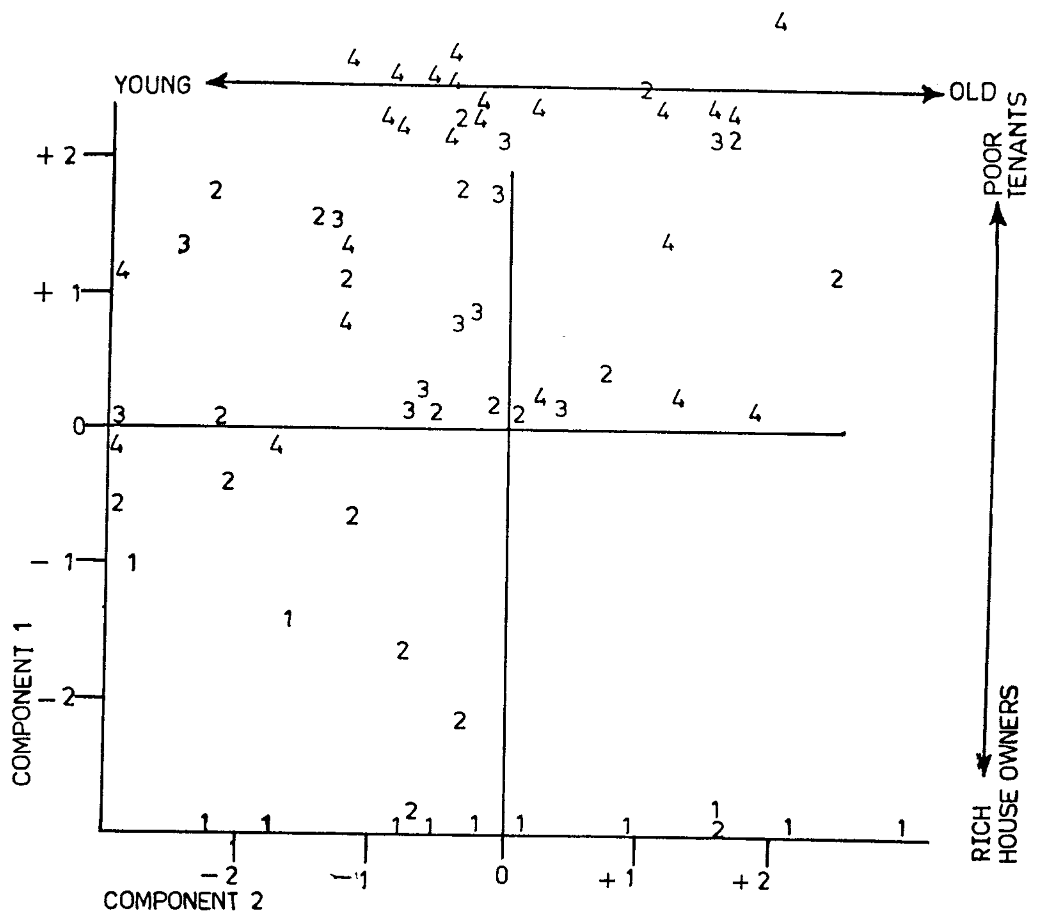
Component II (See Table 2) is largely related to stage in life-cycle. It is also associated with dependent family member which is one of the major determining aspect in the choice of housing. The pattern of scores shows (Figure 3) that a number of dependent family members is less in Erandawana, Pashan, Sadashiv, Gultekdi and Bund Garden areas probably, because of high proportion of nuclear families in these areas. These wards are inhabited by the better educated and economically well-off households who are ahead in their life-cycle. These families have shifted to these wards in the near past.

Highest positive scores are obtained in the rural extensions of Mundhawa, Hadapsar where families are largely engaged in agricultural and allied activities such as dairing and poultry keeping and farming. In these areas proportion of young people is relatively higher.

Thus, the first component consisting of income-ownership and the second one consists of the stage in life-cycle of the households. The remaining six components individually explain very low % of variance and, therefore, it will be unrealistic to include them in mapping and regionalization.

CLUSTER ANALYSIS

Taking into account the socio-economic and demographic aspects of the population and the physical characteristics of the housing accommodation, specific clusters of wards have been formed with the help of 'Cluster Analysis'. The ward algorithm has been used to construct linkage tree (a dendogram) which is based on hierarchical grouping. The dendogram obtained from the analysis has been used to form regions of Pune City. Figure 4 illustrates the relative positions of the areas in four groups defined by their scores of Components I and II which account for a third of the total variance in the original data matrix.



Cluster analysis: Classification groups and Component Scores 1982.

FIG. 4.

SOCIO-ECONOMIC REGIONS OF PUNE CITY

The Cluster Analysis has recognised four socio-economic regions of the city. In accordance with the descending order of preference, the socio-economic regions are named as under P_1, P_2, P_3 and P_4 These clusters are shown in Figure 5.

1) P_1 Socio-Economic Region

It is the most preferred region by the households for the residential purpose. Aundh Road, Gymkhana, area around Vaikuntha Cemetery, parts of Rasta Peth, Mitramandal area, Prabhad Road, Gultekdi and Lullanagar are the calm and well-planned parts of the city with graceful bungalows with lawns and gardens. They command one of the highest prices in housing market. In this area the average income of the households has been found to be above Rs. 3,000 per month and the average crowding ratio is less than 1.5 persons per room. In Prabhat Road area it is the 0.64 which is the lowest recorded in the present sample study.

Upper class bungalow owners who are ahead in their life-cycle resided in these areas. Lullanagar, particularly, is an area where retired army officers have settled down.

2) P_2 Socio-Economic Region

This cluster includes the peripheral areas of Pune city such as Pashan, Gokhalenagar, Wanawari as well as the parts of Sadashiv and Narayan Peth in the old part of the city. The fringe wards are composed of young households. The quality of housing is marked by mixed character because the old gaothans have the old structures. These areas have been recently included in the Pune Corporation limits. At the same time, the well-to-do people who can afford to stay away from the core have built new bungalows.

In Sadashiv and Narayan Wards middle class families in all the stages of life cycle are residing mostly in rented houses. However, the reconstruction of the old wadas into apartments is taking place on a large scale. Hence, proportion of owned houses is steadily increasing. The average crowding ratio and the average income of the households in this region are 2 to 2.5 persons per room and Rs. 2,000 respectively.

3) P_3 Socio-Economic Region

In the graph the Group III represents top left hand corner which shows the characteristics of household as young and poor families staying in rented houses. It inclűdes Bopodi, Dapodi, Northern Shivajinagar area which are located North of Mula-Mutha river. These areas are developed near and around the rail tracks. They accommodate the commuting factory workers and railway workers.

This cluster also includes the parts of Western half of the old core where reconstruction of old buildings is a slow process. These are not purely residential areas. Since these structures are old the rents are low and the quality of housing is poor. The average crowding ratio ranges between 2.5 and 3.00 persons per room and the average income 1,000 to 1,500 Rupees per month.

4) P_4 Socio-Economic Region

Cluster four is concentrated in the top left hand corner of the graph which explains the socio-economic status of the households as young, poor tenants. The Figure 5 shows that the cluster is largely located in the Eastern half of the city core in Bhavani, Nana, Ghorpade wards and in the suburban extensions to the S–W, South and N. E. Kothrud, Hingane, Parvati, Dhankawadi, Yerawada. In the later areas, young households are staying in rented houses. It is obvious that the families in their early stages of life-cycle have to adjust with the inferior locality and sub-standard housing quality. This is due to their limited savings, and large expenditure on growing family. In suburbs, low 'Kachha' houses without an approved plan and basic amenities like water, sanitation are common. These wards show the average crowding ratio as 4.5 persons per room and the average income is less than Rs. 1,000 per month. The highest recorded crowding ratio is 5.6 in Bhawani Ward.

CONCLUSIONS

City is not mere assemblage of buildings made up of bricks and morter, but it is a human phenomenon. In the analysis thirty-seven variables have been reduced to fifteen components which explained 80% of the total variance approximately. In the present study, it has been established that in Pune city, the income and the distance between the house and the place of employment and the number of dependents in a family are the foremost factors controlling the decision regarding houing.

The cluster analysis has been used for regionalization of Pune city. Four regions have been formed on the basis of the socio-economic status of the households. Housing requirement depends upon the nature

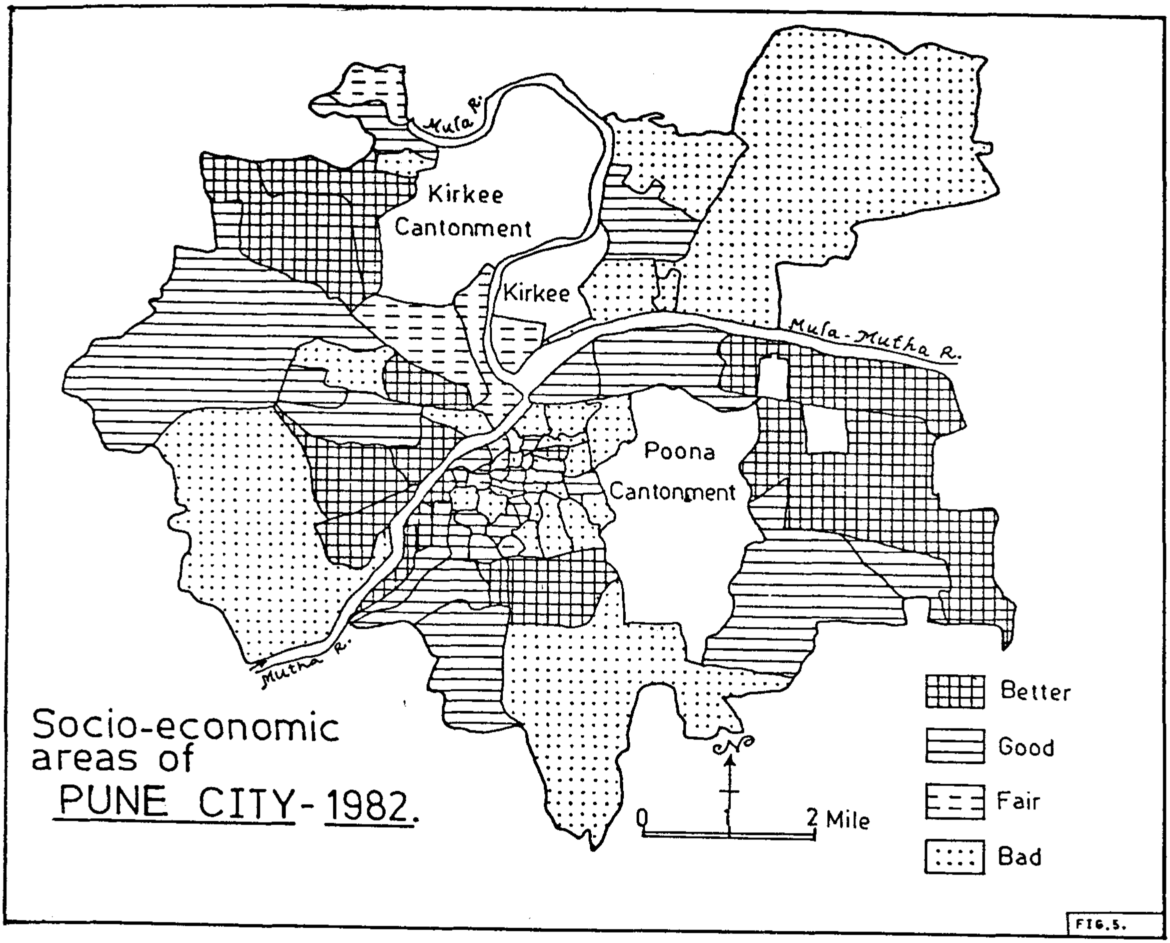


FIG. 5.

of socio-economic and demographic characteristics of a household. In spite of these variations the rules for housing are same for the entire city or for cities according to population size in a state. Supply of any commodity without referring to the nature and quantity of its requirement is wasteful utilization of the resources. Similarly the production of housing stock should be taken into consideration the various aspects of housing demand such as number of rooms, parking spaces, layout of the building in general and a tenement in particular, carpet area of the dwelling etc. In brief, need, choice and place utility of the housing stock should be studied scientifically. Need and choice of the housing depend upon the characteristics of the household. Place utility is defined by Simmons (1968) as a measure of attractiveness or unattractiveness of an area relative to alternative locations as perceived by an individual decision maker. Thus place utility is affected by characteristics of locality such as facilities of shops, markets, schools, public transport and proportion of non-residential landuse of the locality. It has been concluded that comprehensive analysis of households and locality will help to pinpoint the nature and gravity of housing patterns in various parts of a city.

From the analysis it has been found out that the Eastern half of the core of Pune city, is in the awful dilapidated stage. It needs proper attention of the authorities for its reconstruction and planned development. Pune Municipal Corporation has divided Pune City into three zones – Gaothan, Town planning area, and Corporation area. Rules for the housing construction are different for these three zones. Hundred per cent construction in Gaothan and one third construction of the total area of the plot outside, the Gaothan area are permitted. In the Gaothan area, the smallest tenement of about 300 sq. ft. area can be constructed, but in the suburbs the rule permits the horizontal accomodation for forty families, offering 1000 sq. ft. area per family. According to Indian standards and ideas about decent housing, this is not at all necessary. Hence horizontal accomodation capacity should be doubled. Otherwise, those apartments constructed outside Gaothan area will be used as an investment by rich people.

In the P_4 socio-economic region particularly the existing buildings are old and in deteriorating conditions, badly aired and overcrowded. Unplanned growth of city nucleus in the early period has now caused heavy load of traffic on narrow and winding streets. Three or four storeyed buildings, with double rooms – well-lighted and well-ventilated, should be constructed. A toilet block common in two tenements will proide more space for the rooms, without causing much inconvenience. Parking space at the ground floor of each building will help to minimize the traffic pressure on the streets.

Another solution is the planning of the multi-nodal cities. There should be more than one neighbourhood unit. This unit should be provided with all the amenities presently available in the core. In a country where majority of people cannot maintain their own private vehicles and where mass transportation system is not very efficient, distance is going to remain an important consideration while taking decision regarding housing. If such neighbourhood units are constructed people will prefer to stay away from the busy and crowded centre of the city. It will partly reduce the pressure on the core.

Slums, growing uninterruptedly cover large areas because of the absence of vertical expansion. A few buildings with double room tenements can accommodate all slum dwellers in a small part and the rest of the area can be utilized for low cost housing schemes. This measure will serve double purpose – (1) Slum dwellers, will be accomodated in 'Pacca' houses with adequate water and drainage facilities and (2) Slum areas in the central parts of the city will accomodate low income families.

Land Ceiling Act is a so called remedial step undertaken by government to solve the housing problem in Indian cities. According to the act, a person cannot own more than 10,000 sq. ft. land. The act prohibited the exchange and sale of the extra land which has to be surrendered to the Government by owner. Naturally, the supply of clear land declined. However, the demand for housing is increasing. Consequently, the price of the land has been increased and housing became an expensive achievement. Government has yet to take wholesome action about the acquired land from Land Ceiling Act. Low cost housing schemes should be worked out in such areas.

Intra-urban migrations mostly take place twice in the life of any person. Firstly, when family is in the growing stage and secondly, at the retirement age. Three room block for a bachelor and a couple, four room block for a growing family and five rooms for a joint family of a retired household are necessary. In P_1 socio-economic region spacious houses have been built. Apartments having more than five rooms is merely a luxury which not many Indians can afford.

The foregoing analysis is an attempt to study the socio-economic regions and their housing characteristics in Pune city. The author feels that more in-depth study of regionalization of a city should be made.

ACKNOWLEDGEMENT

The author acknowledges the help received from Dr. S. B. Sawant, Reader, and Dr. V. S. Kale, Reader, both from the Department of Geography, University of Poona, Pune 411 007 in preparation of this research paper.

REFERENCES

Brown, L. A. and Londbrake, D. B. (1970). "Migration Flows in Intra-Urban Space : Place Utility Considerations, *Annals*, **60**, pp. 368-384.

Dennis Normán (1978). "Housing Policy Areas, Criteria and Indications in Principle and Practice, *Inst. of British Geographers, New Series*, **Vol. 3**, No. 1.

Jones, E. (1966). *Towns and Cities* (Oxford).

Leslie, G. R. and Richardson, A. H. (1961). "Life-cycle Career – Mobility and the Decision to move, *American Social Review*, **26**, pp. 894-902.

Mather, P. M. (1976). *Computational Methods in Multi-variate Analysis in Physical Geography*, John Wiley & Sons, New York.

Pritchard R. M. (1976). *Housing and the Spatial Structure of the City*, Cambridge University Press.

Sawant, S. B. (1978). *The City of Poona, A Study in Urban Geography*, Poona University Publication.

Simons, J. (1968). "The Changing Residence in the City, a Review of Intra-Urban Mobility", *Geographical Review*, **63**, pp. 622-651.

Smailes A. E. (1953). *The Geography of Towns*, (London).

ADDRESS OF THE AUTHOR

Mrs. Vrishali Deosthali
Lecturer in Geography
Department of Geography
S. P. College, Pune 411 030