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SOCIO-DEMOGRAPHIC AREA OF DELHI[*]

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This paper evaluates statistically and displays cartographically previously untabulated and unpublished data from the 1971 Census of India for the entire population of Delhi. Data pertain to Delhi's census 'charges' (wards) and were originally tabulated in the form of 348 variables relating to occupational distribution, migration, and non-worker status—each classified separately by gender. Although these data are subject to multiple reporting errors and fallacious ecological inferences, they constitute the largest database yet assembled for comparative analysis of Indian intra-metropolitan patterns and structures. Socio-demographic patterns and areas are identified reflecting the traditional-modern, formal-informal, familistic, and ethnic constituents of the national capital of India.

There are numerous Delhi's which have been variously disclosed in historical and archaeological studies (Frykenberg, 1988; King, 1976; Gupta 1981; Breese, 1974); construed through social and spatial surveys (Rao & Desai, 1965; A. Bose, 1977; Yadav, 1979; Nangia, 1976; Bopegamage, 1957), or storied in imagery of literature and film (Ali, 1973). Each approach bespeaks alternate insights. Each mirrors Delhi through subjectively selected content. This paper presents Delhi as monitored by the 1971 Census of India; its focus is also subjectively defined (constrained by data) by decisions regarding data aggregation, research methodology, and interpretation. This study provides a statistically fabricated, synoptic 'picture' of Delhi in 1971 and conforms exactly to no single individual's personalistically idiographic knowledge of Delhi at that time. However, it is important to recognize that the carto-statistical patterns identified in Delhi represent collectively the legacy of urban design and urban management intitutions interacting with individual residential decision processes in the context of India's richly complex cultural milieu. To the extent that British colonial and post-colonial India's urban processes and institutions (as well as the cultural topography of Delhi) are already familiar, the reader will see reflected aspects of Delhi known in 1971. That which appears unfamiliar to the knowledgeable reader may prove equally valid, however. This study is intended as a platform for future geographical research on Delhi. as a 'way station' towards more complete understanding and towards more useful urban policy-making in India.

Researchers have long been denied access to basic variables useful in comprehending more clearly the internal structure

of Indian cities. That such data have generally been available only for cities outside southern Asia reflects the legacy of census-taking traditions and budgets in India more than any explicit attempt to deny information access to scholarly research. A wide array of studies in India have been forced to rely either on comparatively small-scale social surveys or wide-area data collection programs (N.K. Bose, 1964; Prakasarao & Tiwari, 1979; Mehta, 1969; Brush, 1968). The former provide considerable depth in analysis (but often lack capacity to generalize spatially beyond sampled respondents), while the latter have broad generalization use (but often lack behavioral informational depth). This project opted to asess data already acquired by India's most reliable wide-area data collection agency, the Census of India. The value of this approach (aside from its economic use of indigenous data) lies as much in comparative international urban research as it does in study of Indian urbanization, for many urban studies outside southern Asia have based analysis on analogous variables collected by their respective national census organizations. To know concretely wherein Indian urbanization differs from urbanization elsewhere assists the comparative assessment of urbanization within India also.

RESEARCH DESIGN

Impetus for this study was drawn from the numerous social area analysis carried out for cities worldwide during the late 1960's and 1970's (among many, Berry &

Rees, 1969; Berry & Spodek, 1971; Murdie, 1969; Mehta 1969; Schwiarian, 1974; London & Flanagan, 1976; Davies. 1984). These studies were based characteristically on census enumerations of economic or occupational categories, together with measures of families or households and social or ethnic phenomena. For purposes of comparative urban research, as strict adherence as possible to the distribution of variables above would yield more effective comparison of Indian metropoli with metropoli studied elsewhere. In this respect, it was desired to gather data for the entire functional city (including the residential location of those who work in the metropolis) by small area within Delhi. Ultimately, operationalization of this study depended on the realities of data retrieval and government policy (see below).

DATA

Data originally collected by the 1971 Census of India enumeration formed the study base. Because most of these data had not been tabulated and published by census 'charge' in Delhi, it was necessary to tabulate variables in the Census of India's archives.[1] A request was originally placed with the Census of India to tabulate variables pertaining to occupation, migration, language, religion, and non-workers (by sex) by census 'charge' (local census terminology equivalent to tract, ward, or section) for the metropolis of Delhi. Official permission to tabulate only occupation, migration, and non-workers was granted. For the Delhi Municipal Corporation, New Delhi Municipal Corporation, and Delhi Cantonment

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1 Census of India comptuer tapes contained data only at the charge level ; although these areas contain substantial intrnal heterogeneity because of their substantial populatiens (Bopegamage. 1966, no large-scale censal unit could be used for tabulations,

(the political city of 'Delhi,' excluding two outlying non-contiguous 'charges') some 3,280,000 census records were tabulated by 88 'charges' for 348 approved variables by sex (63 variables for migration by place of birth and place of last residence[2], 104 variables for occupation, and 7 variables for non-workers). These data constitute a 100 per cent count of the population on all variables (the 20 per cent sampling rule for social data in India's states was not invoked for Union Territories). As a result, the data do not contain sampling errors associated with censal post-enumeration data processing; they do contain, presumably, the possibility of errors or enumeration problems associated with the enormity, complexity, and political consequence of the Census of India.[3]

A typology of occupations was established first, in order to reduce the 104 occupations tabulated to a smaller number of generally homogeneous occupational clusters (in terms of skills, education, and income) of approximately equal population size. Too narrowly defined occupational groups might be expected to produce redundant urban spatial distributions and occupational groups with few total members could be expected to demonstrate highly localized spatial distributions. Additionally, it is important

to distinguish between published Census of India employment data, which throughout the twentieth century have reported industry of employment rather than occupation of worker;[4] thus, industry of employment data tend to underestimate the diversity of economic statuses within any urban population because of the few, but occupationally heterogeneous, industry sectors into which workers are classed. Table 1 describes the 21 occupational groups identified for Delhi, together with the relevant occupations (and code numbers of the Indian National Classification of Occupations) comprising them. Of Delhi's total workforce (1,020,000 males and 78,000 females in 1971) almost ninety-eight per cent reported occupations included in this typology.

Non-worker status variables were also articulated for this study (including dependents and infants, students, and those engaged in household duties). These variables are particularly important in that non-workers characteristically account for more than one-half of the population in Indian cities. These new categories isolate broad age cohorts of the population and identify several life-cycle linked pursuits. Many women, for instance, are enumerated as 'working at household duties,' a socially

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2 For Delhi, migration tabulations did not correspond with published, plausible Census of India tabulations of the same data for the DMC, NDMC, and Delhi Cantt. That Census of India coding books inaccurately described the migration variables in each record is likely. This study excludes migration data from analysis, as a result.

3 The task of a national census--the accurate enumeration of its population-- is daunting. Each agency maintains a skilled staff devoted to implementing its own accurate enumerations. The task of the Census of India is all the more daunting because of the number of people to be counted with accuracy (Barrier).

4 For instance, a physician employed in the health care division of a formal sector industrial undertaking would be reported in the Primary Census Abstract as a worker in manufacture rather than as a service worker.

acceptable status (which may ignore the part-time worker status of women in many lower income households, of course). Also, students are identified (although self-reports do not distinguish between actual enrolment in formal schooling and the more traditional 'student' stage of the Hindu life-cycle).

Finally, several variables from published census reports are also included. All variables are expressed in scale-free terms-- as rates or ratios. All variables were screened to ensure that spatially variable patterns were expressed. Altogether 40 variables were articulated for this study to represent social, occupational, familistic and life-cycle related features of urban life in Delhi. Every attempt has been made to avoid closed number systems and other problems noteP for some factorial ecological studies. General social and economic status variables include: (1) workers per household; (2) sex ratio of male workers to females at household work; (3) females at household work per 1,000 households; (4) literate males per 1,000 non-preschool dependent males i.e., per 1,000 males old enough to read ; and (5) literate females per 1,000 non-preschool dependent females. Life-cycle or familistic variables include: (1) students per 1,000 households; (2) preschool dependents per 1,000 females at household or external work (a surrogate child-women ratio); and 3) preschoolers and students per 1,000 population. Functional density variables include: (1) population per household; and (2) non-single family households per 1,000 households. 'Ethnicity' variables include; (1) scheduled caste persons per 1,000 population; and (2) sex ratio of scheduled caste males to females. All remaining variables characterize occupational differentiation of the

workforce and attempt to distinguish the informal from the formal sector, the less educated from the more educated, and the less westernized from the more westernized. In this class of variables are two which describe self-employed males and self-employed females; insofar as many of the occupations associated with self-employment in Delhi fall in the informal sector, these variables constitute (with others such as labourers and vendors) additional description of the informal sector of the city.

Research Methodology

It is axiomatic that 40 uncorrelated (that is, independent) patterns will not be found in this dataset. Therefore, the research methodology aims to identify the most important ('basic') linear patterns underlying the 40 variables. The procedure used is one from the family known as 'factorial ecology'-- which employ some form of factor analysis to isolate independent, empirical continua underlying the data (Berry & Rees, 1969; Berry & Kasarda, 1977; Davies, 1984). The exact procedure used is principal components analysis with varimax axis rotation. Varimax rotated principal component loadings express the degree to which variables in the dataset correlate with the underlying principal components (which are uncorrelated with each other); these loadings can be interpreted in a manner similar to conventional Pearsonian product-moment coefficients of correlation (ranging within ±1.0). See Table 2 for the salient principal component loadings (the correlations of the variab'es with the components). Having identified the basic principal components (each one being more important than any single variable in the original dataset), each 'charge' is located along each principal component's

Table 1

Delhi's Occupational Typology (Indian National Occupational Classification)

I. **Professionals:** (Males=42,484; Females=5,429)

00	Physical Scientists
02	Architects & Engineers
04	Aircraft & Ships Officers
05	Life Scientists
07	Physicians & Surgeons
10	Mathematicians & Statisticians
11	Economists
12	Accountants & Auditors
13	Social Scientists
150	University Teachers
16	Authors & Journalists
17	Photographers & Painters
18	Performers & Composers
19	Others Professionals

II. **Technicians:** (Males=29,936; Females=22,838)

01	Physical Science Technicians
03	Engineering Technicians
06	Life Science Technicians
08	Nursing & Health Technicians
09	Other Technicians
15	Teachers (exc. University Teachers)
14	Jurists & Petition Writers

III. **Public Administrators & Managers (21):** (Males=32,802)

IV. **Corporate Executives & Managers (2 exc. III):** (Males=23,520)

V. **Skilled Clerical Workers:** (Males=68,834; Female=5,407)

30	Clerical Supervisors
32	Stenographers & Typists
33	Bookkeepers & Cashiers
34	Computing Machine Operators

VI. **General Clerical Workers (35-358):** (Males=65,506; Female=4,757)

VII. **Clerical and Building Attendants:** (Males=50,962)

358	Office Attendants, Peons & Daftries
574	Watchmen, Chowkidars & Gatekeepers

VIII. Working Proprietors: (Males = 110,862)

      40   Merchants & Shopkeepers
      45   Moneylenders & Pawnbrokers
      50   Hotel & Restaurant Keepers

IX. Sales Workers: (Males = 51,485)

      41   Manufacturers Agents
      42   Technical & Travelling Salesmen
      43   Sales & Shop Assistants (exc. Street & News Vendors)
      44   Insurance Agents & Brokers

X. Laborers: (Males = 107,426; Females = 11,451)

      99   Laborers, N.E.C.
      971   Loaders & Unloaders
      959   Well Diggers & Construction Workers, N.E.C.

XI. Personal Services Workers: (Males = 71,741; Females = 14,693)

      51   Housekeepers, Matrons & Stewards
      52   Cooks, Waiters & Bearers
      53   Domestic Servants & Ayahs
      54   Sweepers & Cleaners
      55   Laundrymen & Dry-cleaners
      56   Barbers & Beauticians

XII. Public Services Workers: (Males = 28,981)

      57   Police and Fire Services (exc. Chowkidars & Gatekeepers)
      36   Transportation & Communications Supervisors
      37   Transportation Conductors & Guards
      38   Mail Distributors
      39   Telephone & Telegraph Operators
      86   Broadcasting & Audio-Visual Equipment Operators

XIII. Mechanized Transport Equip. Operators: (Males = 33,500)

      98   Transport Equipment Operators (excluding XIV categories)

XIV. Animate Transport Services Operators: (Males = 14,394)

      987   Drivers of Animal & Animal-Drawn Vehicles
      988   Cycle Rickshaw Drivers & Rickshaw Pullers
      989   Transport Equipment Operators, N.E.C.

XV. Mechanics & Repairmen: (Males = 31,814)

      843   Motor Vehicle Mechanics
      844   Aircraft Engine Mechanics

<div style="margin-left:2em">

845   Other Mechanics, Repairmen

854   Radio/TV Mechanics/Repairmen

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XVI. Machine Makers & Assemblers: (Males=85,033)

<div style="margin-left:2em">

83   Metal Toolmakers

84   Machine Fitters, Assemblers & Precision Instrument Makers

85   Electrical Machine Makers

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XVII. Construction Workers: (Males=23,215)

<div style="margin-left:2em">

93   Painters

95   Bricklayers & Construction Workers
(exc. Well Diggers & Construction Workers, N.E.C.)

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XVIII. Basic Manufactures Workers: (Males=16,752)

<div style="margin-left:2em">

72   Metals Processors

73   Wood Preparers & Paper Makers

74   Chemicals Workers

96   Stationary Engine Operators

97   Materials Handlers (exc. Loaders & Unloaders)

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XIX. Textiles, Garment and Leather Products Workers: (Males= 54,436)

<div style="margin-left:2em">

75   Textiles Workers

76   Tanners

79   Tailors & Related Workers

80   Leathergoods Makers (exc. Shoemakers and Shoe Repairers)

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XX. Fabricators: (Males=79,416)

<div style="margin-left:2em">

77   Food & Beverage Workers

78   Tobacco Workers

81   Carpenters

82   Stonecutters

87   Plumbers and Welders

88   Jewellers & Precious Metals Workers

89   Potters & Glass Workers

90   Rubber & Plastics Workers

91   Paper Products Workers

92   Printing Workers

94   Production Related Workers

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XXI. Vendors: (Males=16,433)

<div style="margin-left:2em">

431   Street and News Vendors.

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Source: Author.

Table 2

Delhi, 1971 : Varimax Rotated Principal Component Loadings.

Variable	I	II	III	IV	V	VI	VII	VIII
Self-Employed Females/1,000 Female Workers	0.80							
Female Laborers/1,000 Female Workers	0.80							
Male Laborers/1,000 Male Workers	0.79							
Male Construction Workers/1,000 Male Workers	0.72							
Students/1,000 Households	-0.61							
Literate Females/1,000 Non-Dependent Female	-0.61	-0.53						
Female Technicians/1,000 Female Workers	-0.61							0.44
Scheduled Caste Persons/1,000 Population	0.60							
Dependents/1,000 Female Household & Other Female Workers	0.52							
Female General Clerical Workers/1,000 Female Workers	-0.48	-0.72						
Self-Employed Males/1,000 Male Workers	0.44				0.61			
Female Skilled Clerical Workers/1,000 Female Workers	-0.42	-0.72						
Male Skilled Clerical Workers/1,000 Male Workers		-0.79						
Male General Clerical Workers/1,000 Male Workers		-0.76					-0.58	
Male Technicians/1,000 Male Workers		-0.67						
Male Professionals/1,000 Male Workers		-0.56				0.74		
Females in Personal Services/1,000 Female Workers		0.41						
Male Machinery Workers/1,000 Male Workers			0.86					
Male Basic Metal Female Workers/1,000 Male Workers			0.81					
Male Textile Workers/1,000 Male Workers			0.74					
Male Mechanics/1,000 Male Workers			0.68					
Workers Per Household			-0.65					
Male Fabrication Workers/1,000 Male Workers			0.54	0.42				
Male Workers Per Female at Household Duties			-0.50	-0.58				
Male Transport Equipment Workers/1,000 Male Workers			0.49			0.46		-0.51
Male Administrators/1,000 Male Workers			-0.45	-0.54				
Pre-Schoolers & Students/1,000 Population				0.86				
Females at Household Duties/1,000 Households				0.70		-0.40		
Population Per Household				0.64				
Sex Ratio of Scheduled Castes (M/F)				-0.50				
Male Vendors/1,000 Male Workers				0.47			0.44	
Male Proprietors/1,000 Male Workers				0.43	0.71			
Males in Personal Services/1,000 Male Workers						0.83		
Male Clerical Attendants/1,000 Male Workers						0.71		
Male Animate Trans. Workers/1,000 Male Workers							0.77	
Literate Males/1,000 Non-Dependent Male							-0.48	
Female Professionals/1,000 Female Workers								0.81
Male Sales Workers/1,000 Male Workers								0.72
Non-Single Family Households/1,000 Households								0.50
Percent Explanation	14.4	14.3	12.4	10.1	8.4	8.0	6.9	4.6
Cumulative Percent Explanation	14.4	28.7	41.1	51.2	59.6	67.6	74.5	79.1

Only loadings ≥ ±0.40 are displayed. Male Public Service Workers/1,000 Male Workers showed no loadings greater than ±0.4, and are omitted from the table.

continuum according to the degree to which the 'charge' is characterized by the variables correlated strongly with the component. The location of each charge on a component is expressed as a principal component score, analogous to a univariate z-score (which usually ranges within ±3.0). Principal component scores are mapped in the interpretive section; because each component constitutes a statistical abstraction, the single variable most strongly correlated with the respective principal component is also displayed cartographically to concretely profile the abstract component.[5]

Thus, preliminary insights into the intra-metropolitan patterning of Delhi's metropolitan area are gained by employing newly tabulated and generated variables (describing by place of residence workforce occupations, the non-working populace, together with selected additional demographic and housing data) in a research process designed focus on the interrelatedness of the data and to display cartographically the basic socio-demographic dimensions of the metropolis. The principal components methodology is employed as an initial pattern-sieving procedure. Its use here is not intended to impose a social area model on Delhi *a priori*.

Research Findings

Eight principal component continua (with eigenvalues>1.0) describe nearly 80 percent of the total variance among the 40 variables in the original dataset. See Table 2 where each component is numbered in decreasing order of its importance in describing the data. (Thus, component I accounted for 14.4 percent of the total variance in the data, while component VIII accounted for only 4.6 percent.) Only salient component loadings are displayed; those between ±0 4 show little affinity to a component, and are omitted. Inentification of each component is an important part of interpretation, and is derived subjectively through examination of computational results and maps. Each principal component's structure and spatial distribution is discussed in turn.

Component I. Accounting for more than 14 per cent of the total variation in the data, the first component shows strong positive correlations with male and female laborers, male construction workers, female and male self-employment, scheduled caste persons, and dependents per 1,000 working females. The component shows negative correlations with students per 1,000 households, and an array of female worker variables (mostly clerical and technical) and female literacy. Thus, the component suggests a continuum extending from informal sector employment (labor, construction, and self-employment, together with scheduled caste concentration) on the one hand to formal sector employment (women employed as technicians, and general and skilled clerical workers, where female literacy is also an employment correlate). The basic contrast of the continuum's extremes is between lower status informal sector employment (at the positive extreme) and mid-status formal sector employment (at the negative extreme.) Women's occupations are found at both continuum ends. Informal sector employ-

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5   I am grateful to John Brush and C.S. Yadav for use of the map of Delhi's charges which they reconstructed from the verbal boundary descriptions provided in Delhi's *1971 District Census Handbook*.

ment is also linked to scheduled caste persons and many young dependents per adult woman (suggesting less use of family planning measures among such households and/or maintenance of rural fertility rates in the urban setting).

Map I shows concentration of informal sector attributes (high positive principal component scores) largely around the metropolitan fringes; this is consistent with the notion that construction and labor employment is heavily in demand at the expanding margin of the city and that there is short distance separating work from residence. It also suggests that scheduled caste persons may be more concentrated at the urban fringe, consistent with other findings for smaller towns in north India. The profile map of male laborers (selected because of its high correlation with the component and because there are so many male laborers) shows concentration, 16-33 per cent of male workers, at the urban fringe. However, it also shows concentration of male laborers in or adjacent to Old Delhi, site of considerable employment for laborers. Thus high scores on Map I suggest residence of informal sector workers in close propinquity to their workplaces (probably within walking distance). Extreme negative principal component scores appear in a band starting west of Connaught Place in New Delhi and extending soutward through central government housing enclaves where female technical (teachers, health services) workers reside; additional concentrations are found to the north of Old Delhi near the Civil Lines and University areas, and within certain charges of Old Delhi itself. Secondary associations are with women's clerical employment. These negative scores manifest a part of the Indian urban middle class (educated, with children in schools and women employed in technical fields or middle grades of government service).

Component II. Accounting for an additional 14.3 per cent of the total variance in the data (and uncorrelated with component I) component II shows strong negative correlation with male and female clerical employment, male professional and technical employment, and secondary association with female literacy at one end of the continuum (there are many with these attributes where negative principal component scores exist). At the other, one finds few pepole so employed, and in addition, a secondary association of women employed in personal services (domestic or related services). This component expresses a continuum oest described as a modernized 'white collar' occupational dimension.

Map 3 shows greatest concentration of clerical workers (extreme negative scores) in south Delhi government housing colonies near the Ring Road, and in the Civil Lines area of north Delhi. A corresponding absence of them showed in Old Delhi, Connaught Place and near south Delhi, and the Cantonment area. Man 4 shows the concentration of male general clerical workers (selected because of their large number and strong correlation) constituting 9-16 per cent of male workers in many charges possessing the most extreme negative scores on Map 3. Male general clerical workers are largely absent from Old Delhi, New Delhi immediately south of Connaught Place, and the Cantonment.

Component III. Component III accounts for 12.4 per cent of total variance, and shows

strong positive correlations with male workers in machinery, basic manufactures, textiles, fabricating manufactures, and mechanics and transport equipment workers. It also shows negative correlation with number of workers per household, male workers per female at household duties, and male administrative workers. This suggests predominantly a manufactural employment component, where positive component scores (Map 5) indicate concentrations of manufactural workers with relatively few at work in each household at the extreme of the continuum. At the other extreme (negative component scores) few manufactural workers are found, more workers per household, and men at work per woman at household duties, with some concentration of men working at administrative positions.

Map 5 shows a rather sharp contrast. New Delhi to the south shows little manufactural activity, more administrators, and more men perhaps temporarily posted to service in the capital city (without having brought their families with them). By contrast, west Delhi and trans-Yamuna east show greater concentrations of manufactural workers. This is made particularly evident in Map 6, depicting the distribution of male machinery manufacturing workers, whose virtual absence is New Delhi in conspicuous and whose concentration in west Delhi is 7-20 per cent of all male workers.

Component IV.

Accounting for 10.1 per cent of total variance, component IV is associated with high positive correlations with pre-schoolers and students in the population, women engaged in household duties and persons per household-all of which are familistic or life-cycle indicators. More modest positive correlations show this component associated with male fabrication workers, male vendors and proprietors. Modest negative correlations show between males workers per female working in the household, male administrators, and sex ratio of scheduled castes (males to females). The prevailing feature of this component is indigenous 'middle class' familism. That is, where principal component scores are positive in Map 7 (Old Delhi, far west Delhi, extreme south Delhi, and the trans-Yamuna east) a high degree of indigenous familism is present; households are larger with many dependents and students and many women working at household activities, with a modicum of retail vendors and small shop proprietors in ready propinquity to these households. These areas do not have men working as administrators, but do have few men working per women working within the household and few scheduled caste men relative to scheduled caste women enumerated (who, however, were not inordinately numerous). Where scores are negative, quite the opposite occurs (e.g., small households, fewer dependents and students or women at house-hold duties, more administrators, etc.) These areas are particularly associated with New Delhi's government complex, the Cantonment region, and Delhi northwest of the Shahjahanabad (Old Delhi). The preschool and student population of the city (Map 8) constitute more than one-half of the population in many charges on the 'urban fringe,' a pattern not unlike the familism dimension in many western cities. However, Shajahanabad (the highest density part of the 'central city' area) shows almost as high an incidence of youthful population, indicating simultaneously the existence of pre-modern and modern spatial patterns of urban familism.

Component V.

With 8.4 per cent of total variance, component V is strongly associated with male proprietors and self-employed males, while at the same time displaying a tendency for few women to be at work in the home. This suggests an informal commercial sector of the urban economy, heavily dominated by the self-employed and by those who run their own shops (without their families in attendance). In Map 9, areas with extremely positive scores epitomize this informal commercialism, which focuses particularly on the Old Delhi commercial complex (and immediately surrounding environs). In contrast, most of New Delhi is quite the opposite in character (having few male proprietors and self-employed men). The distribution of male working proprietors (Map 10) makes this contrast particularly clear, where in the Old Delhi area 16-25 per cent of male workers are proprietors and in New Delhi 2-6 per cent are so engaged.

Component VI.

Accounting for 8 per cent of total variance in the 40 variables, component VI is most strongly correlated with male and female personal service workers, and male clerical attendants (including gatekeepers and chowkidars) with a lesser association of male transport equipment workers (possibly chauffeurs, taxi and scooter drivers, etc.) This personal services employment dimension is concentrated particularly (Map 11) in the New Delhi central government and international diplomatic and tourist residential complex; it is least well expressed in Old Delhi, west Delhi, and the Cantonment. Map 12 shows the distribution of Male Personal Service Workers whose heaviest

concentrations (10-34 per cent of male workers) is found in New Delhi and to the north of Shahjahanabad. Elsewhere concentrations were quite low. Personal services workers cluster around central government employment in the public sector and around wealthy residential areas (including diplomatic, tourist, and international business centres) where substantial demand exists for cooks, domestic servants, chowkidars, and vehicle drivers.

Component VII.

Accounting for 6.9 per cent of total variance, component VII is most strongly identified with male vendor and males working in animate transportation jobs; at the same time, this component tends to have few literate males and few male technicians. Fairly clearly, this is an informal entrepreneurship dimension. This dimension captures the lowest male oriented circuit of the informal sector. Prevailingly, (Map 13) informal entrepreneurship is concentrated to the east of the Yamuna river and near the interactional centers of Old Delhi—particularly railroad, warehousing, and shopping districts. Elsewhere they are also found in selected engulfed village sites within New Delhi. They are particularly absent from north Delhi and extreme south Delhi, including the Cantonment. The distribution of male animate transport workers confirms this distribution (Map 14), with concentrations in Shahjahanabad (probably cycle rickshaw drivers and *rehri*-wallahs) and in the trans-Yamuna east (probably bullock and horse carters) of 2-10 per cent of all male workers. These individuals' residences are conspicuously absent from New Delhi west of Ridge Road and south of Connaught Place

through the central government complex to the outer suburban fringe.

Component VIII.

Accounting for 4.6 per cent of total variance, component VIII primarily reflects strong associations with women working in the professions (and secondarily men working in the professions,) men working in sales, and non-single family households (*i.e.*, multifamily households). This component may constitute a 'westernization' dimension of urban residential patterning, in that it is the only component with which professional women (who require high degrees of formal education and training) are correlated. The correlation of multi-family households to this component admits the possibility that a younger generation of westernized professionals tended to reside with an older, not so extensively westernized, generation—at least in statistical terms). Map 15 shows the distribution of areas so characterized to lie toward the accessible center of the Delhi metropolis, in the southeastern part of Old Delhi and adjacent areas along major transport axes. This suggests also the possibility that elite families long-settled in Delhi (by virtue of their central locations in the city) adaptively incorporated westernization without compromising traditional household structure or location. Map 16 shows the distribution of female professional workers, whose concentration can also be seen throughout the residential areas of south Delhi, the Delhi University area, and west Delhi (not all of which showed highly positive scores in Map 15). Thus, some female professionals were clearly associated with nuclear family households instead. In any case, this component is also associated with a high degree of disposable income, and possibly conspicuous consumption (evidenced by many male sales workers).

Towards Further Research

Delhi is a multi-layered society. Only about 80 per cent of the variation contained in the principal components analysis could be captured by eight common orthogonal dimensions in this preliminary study. (Public service workers did not correlate with any of the eight components, which indicates an independent public administrational logic behind the spatial arrangement of these workers' residences.) Although patterns of covariation have emerged which seem plausible generally, the question remains concerning the extent to which these same underlying dimensions can be identified under alternate factor analytical models. Subsequent evaluations of Delhi should take place using various approaches. On the basis of this initiative, all data will be ordinalized and resubjected to principal components analysis later; this is important, owing to the known difficulties of census-taking and the consequent potential for variation in data reliability. Should the same dimensions arise from an ordinalized dataset, one will be reassured that the dimensions identified are not a statistical fictive artifact.

Whether a factor analytic approaches are appropriate at all in this setting needs careful assessment. Delhi is, above all, at least three technological cities in one. It is a walking city for the poorest of the informal sector; it is a public transit city for the middle classes; and it is a private transit city for its various mercantile, governmental, and international diplomatic and tourist

elites. Each of these parts of urban society interacts spatially in complex ways in Delhi. It is not at all clear that a single (albeit multivariate) linear model can capture adequately the complexity of operative relationships. Certainly, alternate approaches to the same data will be made through deployment of such descriptive indices as those of dissimilarity and segregation, long used in urban studies elsewhere.

Comparative assessment need to be made between Delhi and other major Indian metropoli for the same time period. We may ask : Are the patterns identified in Delhi (for instance), by whatever methods employed, replicated in other metropoli ? Or is Delhi in some senses unique within India ? Fortunately, similar data for 1971 permit directly comparative study between the metropoli of Delhi, Calcutta, Bombay, and Madras.[6] Comparative assessments need to be made diachronically as well, however, for the 'explosive' growth of Indian cities suggests that researchers focus on processes of change rather than static spatial distributions and patterns. In future, we shall wish to know to what extent the spatial content of Indian cities is produced by : technological imperatives associated with providing urban services ; policy imperatives associated with planning, taxation, and housing; and/or the legacy of history.

REFERENCES

Ali, Ahmed, (1973) *Twilight in Delhi*, Sterling Publishers, New Delhi.

Barrier, N.G.(ed). (1981) *The Census in British India : New Perspectives*, Manhohar, New Delhi :

Berry B.J.L. and J.D. Kasarda, (1977) *Contemporary Urban Ecology*, Macmillan Publishing Company.

Berry B.J.L. and P.H. Rees, (1969) "The Factorial Ecology of Calcutta," *American Journal of Sociology*, Vol. 74 pp. 445-491.

Berry B.J.L. and H. Spodek, (1971) "Comparative Ecologies of Large Indian Cities," *Economic Geography*, Vol. 47 No. 2 (supplement), pp. 265-285.

Bopegamage A. (1966) "A Methodological Problem in Indian Urban Sociological Research," *Sociology and Social Research*, L (1966), pp. 236-240.

Bopegamage A. (1957) *Delhi : A Study in Urban Sociology.* University of Bombay,

Bose A. (1977) *Studies in Indian Urbanization : 1901-1971*. Tata-McGraw Hill, Bombay.

Bose N.K. (1968) *Calcutta, 1964 : A Social Survey*, Lalvani Publishing House, Bombay :

Breese G. (1974) *Urban and Regional Planning for the Delhi—New Delhi Area*, Princeton, NJ.

Brush J. (1968) "Spatial Patterns of Population in Indian Cities," *Geographical Review*. Vol. 85 p. 362-391.

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6 A preliminary study of Bombay (using the same methodology) was presented by the author at the 1987 annual meeting of the Association of American Geographers in Phoenix, AZ.

Davies, W.K.D. *Factorial Ecology*. Gower Publishing Company Ltd., Aldershot pp. 409.

Frykenberg R.E (ed.) (1988) *Delhi Through the Ages: Studies in Urban History, Culture, and Societies*. Oxford University Press, New York.

Gupta. N (1981) *Delhi Between Two Empires, 1803-1931 : Society, Government, and Urban Growth*. Oxford University Press, Delhi : pp. 260.

King A.D. (1976) *Colonial Urban Development : Culture, Social Power, and Environment*. Routledge & Kegan Paul, London.

London B. and W.G. Flanagan (1976) "Comparative Urban Ecology : A Summary of the Field," in J. Watson and L.H. Masotti (eds.), *The City in Comparative Perspective : Cross-National Research and New Directions in Theory*. John Wiley, New York : pp. 41-66.

Mehta S.K. (1969) "Patterns of Residence in Poona, India, by Caste and Religion : 1822-1965," *Demography* Vol. 6 pp. 473-491.

Mitra A. (1970) *Delhi: Capital City*. Thomson Press, New Delhi : 1970. pp. 129.

Murdie R. (1969) *Factorial Ecology of Metropolitan Toronto: 1951-1961*, University of Chicago Department of Geography, Chicago, II.

Nangia, S. (1976) *The Delhi Metropolitan Region*. K.B. Publications, New Delhi

Prakasarao V.L.S. and V.K. Tewari, (1979) *The Structure of an Indian Metropolis: A Study of Bangalore*. Allied Publishers, New Delhi.

Rao V.K.R.V. (1965) and P.B. Desai, *Greater Delhi : A Study in Urbanisation, 1940-1957*. Asia Publishing House, pp. 479. Bombay.

Schwirian K.P. (1974) *Comparative Urban Structure : Studies in the Ecology of Cities*. D.C. Heath and Co., Lexington, MA :

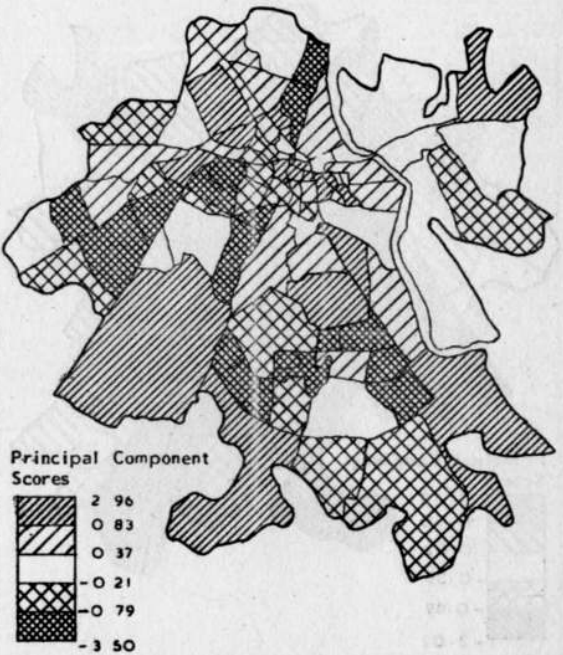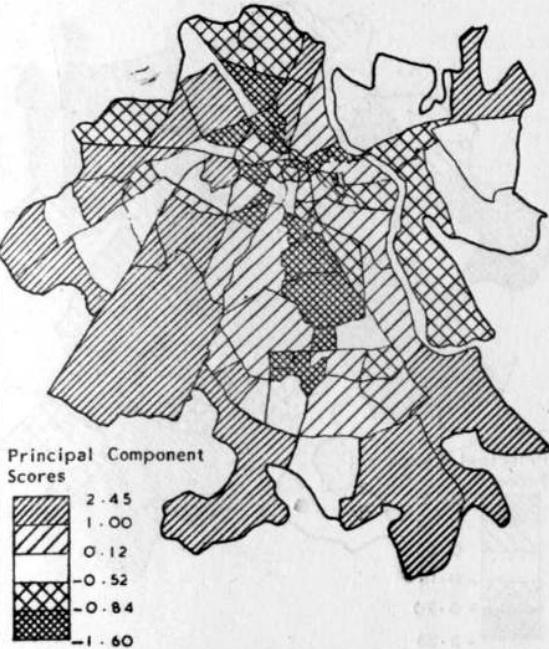Yadav, C.S. (1979) *Land Use in Big Cities : A Study of Delhi* Inter-India, Delhi :
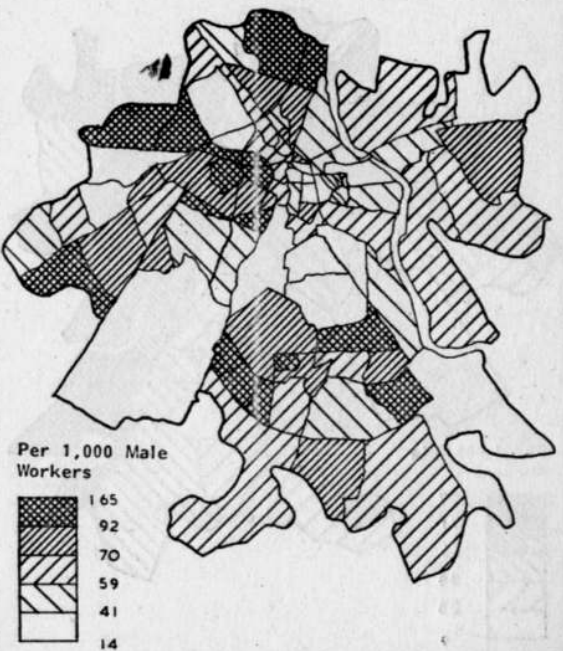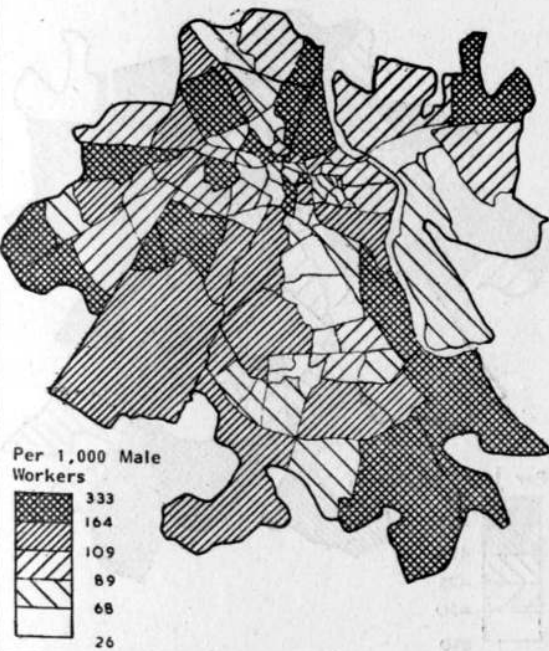
DELHI

MAP 1

COMPONENT I
Informal / Formal Sector I

Principal Component
Scores

	2·45
	1·00
	0·12
	-0·52
	-0·84
	-1·60

MAP 3

COMPONENT II
Modernised 'White Collar

Principal Component
Scores

	2·96
	0·83
	0·37
	-0·21
	-0·79
	-3·50

Male Labourers

Per 1,000 Male
Workers

	333
	164
	109
	89
	68
	26

Male General Clerical Workers

Per 1,000 Male
Workers

	165
	92
	70
	59
	41
	14

MAP 2
MAP 4

DELHI

MAP 5
MAP 7

COMPONENT - III
Manufactural Employment

Principal Component
Scores
3·45
0·50
0·08
−0·39
−0·69
−3·02

COMPONENT IV
Familism

Principal Component
Scores
2·18
0·76
0·23
−0·18
−0·70
−3·33
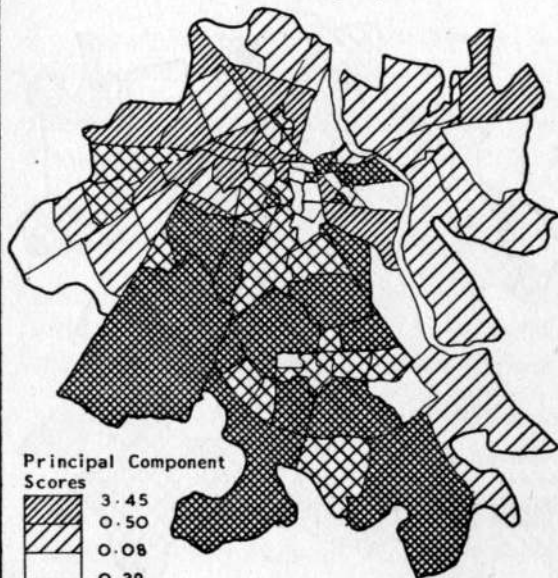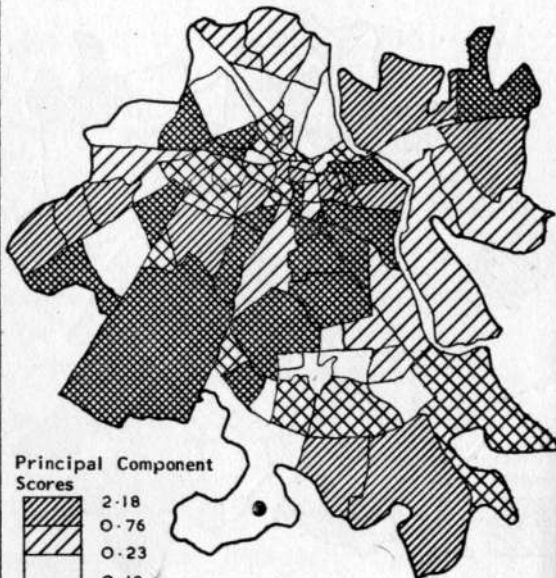
Male Machinery Mfg. Workers

Per 1,000 Male
Workers
207
71
56
38
28
9

Pre-School and Student Population

Per 1,000 Population
515
497
484
475
450
390

MAP 6
MAP 8
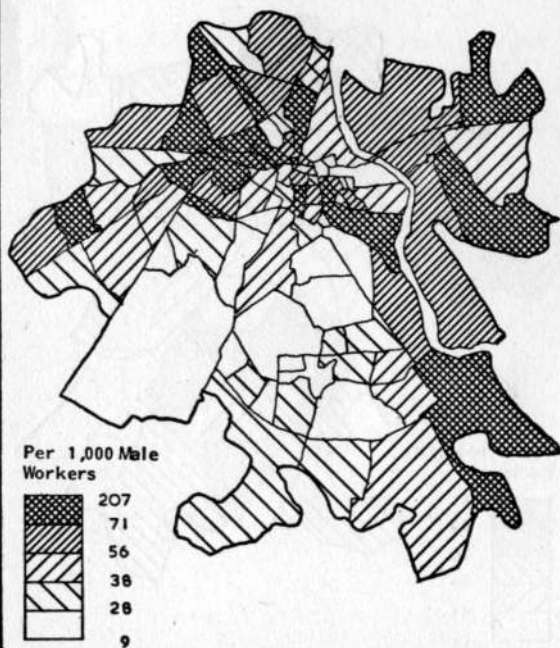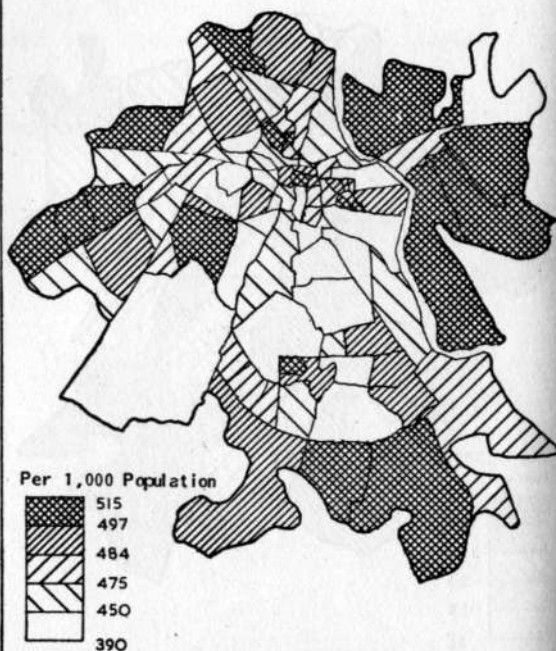
DELHI

COMPONENT V
Informal Commercialism
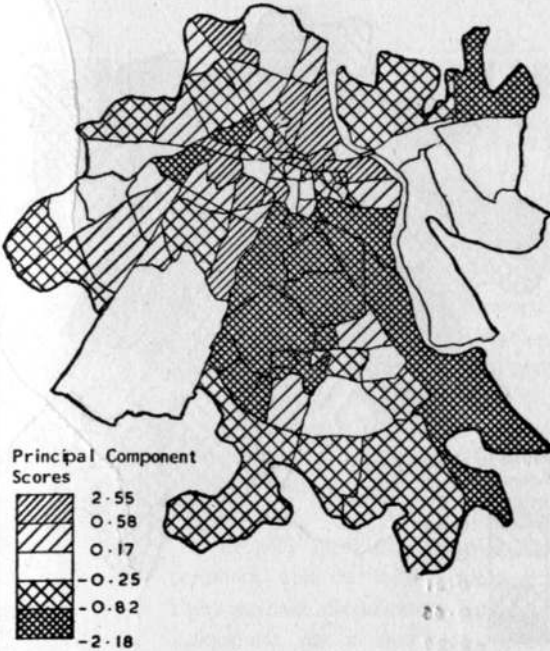
COMPONENT VI
Personal Service Worker

Principal Component
Scores

	2·55
	0·58
	0·17
	-0·25
	-0·82
	-2·18

Principal Component
Scores

	5·85
	0·44
	0·09
	-0·21
	-0·66
	-2·28
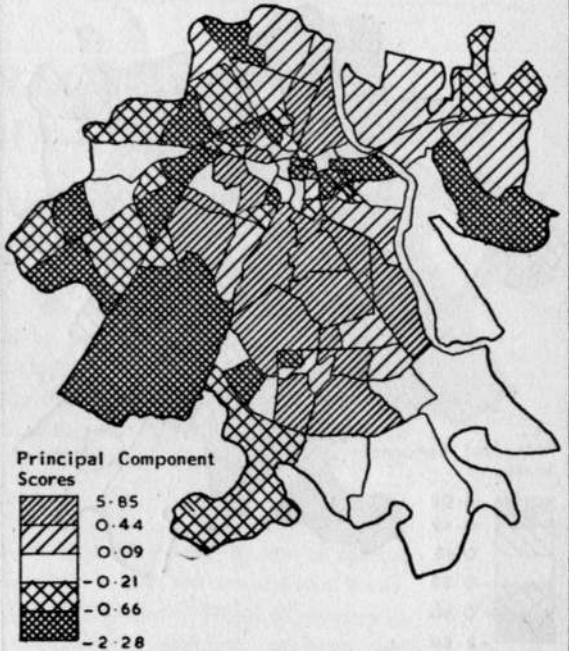
Male Working Proprietors

Male Personal Service Workers

Per 1,000 Male
Workers

	254
	165
	126
	99
	67
	16

Per 1,000 Male
Workers

	346
	94
	65
	53
	41
	22

MAP 10   MAP 12

DELHI

MAP 13

MAP 15
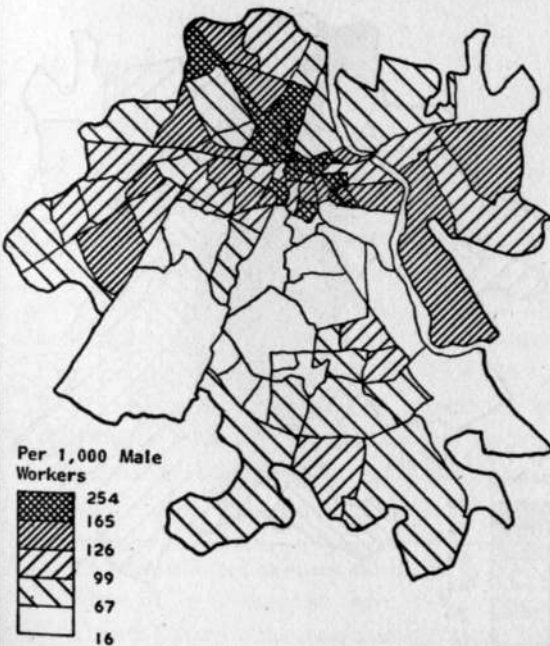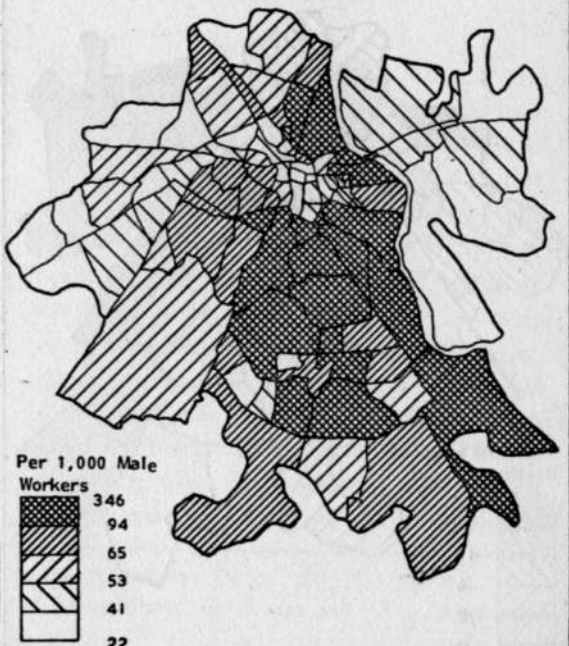
COMPONENT VII
Informal Entrepreneurship

Principal Component
Scores

```
   4·02
   0·49
   0·15
 - 0·23
 - 0·60
 - 2·03
```
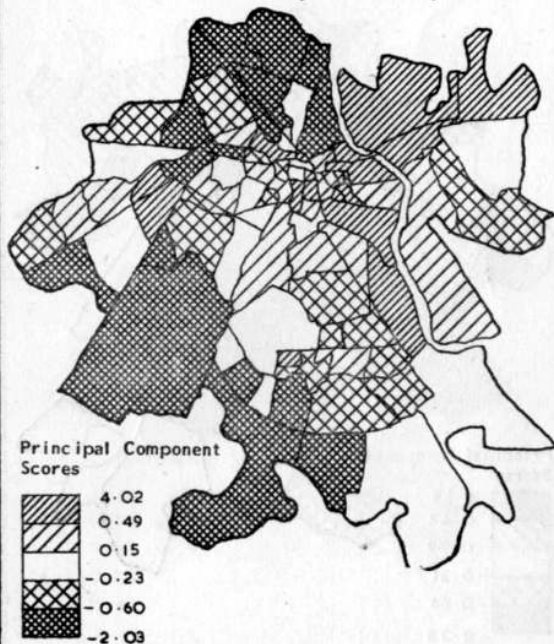
COMPONENT VIII
Westernisation
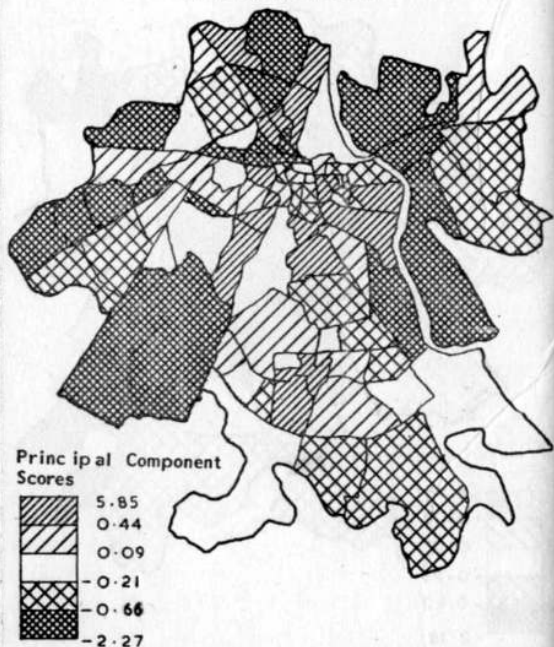
Principal Component
Scores

```
   5·85
   0·44
   0·09
 - 0·21
 - 0·66
 - 2·27
```

Male Animate Transport Workers

Per 1,000 Male
Workers

```
 100
  23
  12
   6
   3
   0
```

Female Professionals

Per 1,000 Female
Workers

```
 540
  85
  60
  44
  30
   0
```

MAP 14

MAP 16
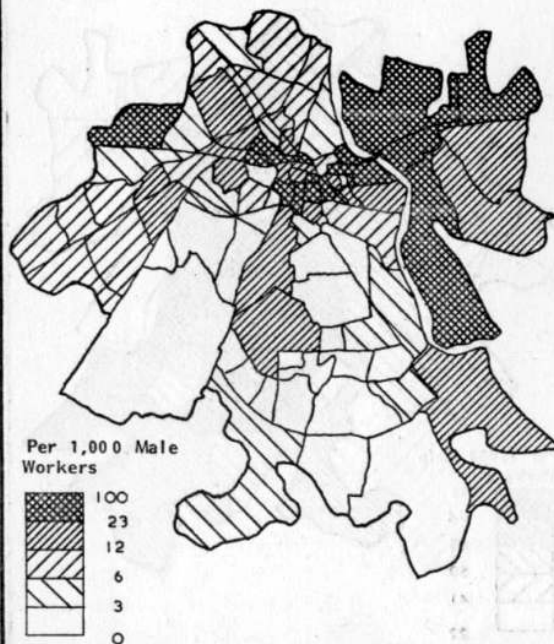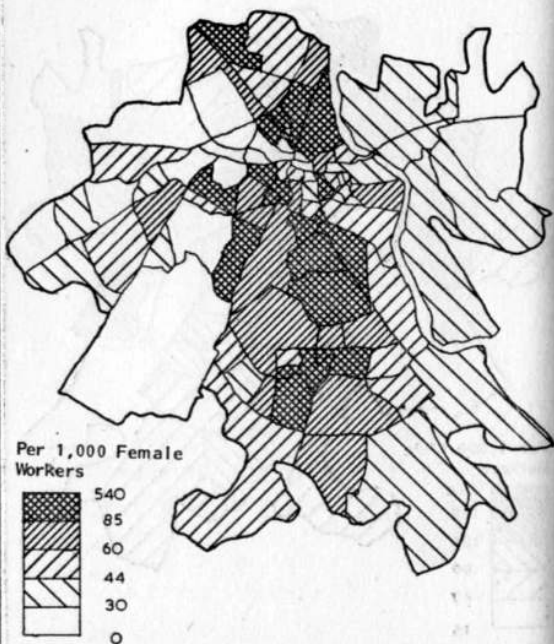
MALE-FEMALE LITERACY DIFFERENTIAL IN INDIA-1981

PREM SAGAR

CHANDIGARH, INDIA

In India, sharp inequalities exist in the literacy rates of male and female population that have a strong bearing on the economic development and social advancement of the country. The present study, therefore, examines (i) the trends of this disparity through history; (ii) the comparative picture of this disparity at meso level; and (iii) the spatial pattern of disparity in India in 1981. Based on 1981 census data by districts, four choropleth maps are prepared to study the regional variation of this disparity.

Broadly speaking, the male-female literacy differential is low in coastal, peripheral and metroplitan areas and is high in inland and mountainous areas. These regional disparities are the product of differences in length of educational background, age at marriage, level of urbanisation, standard of living and proportion of socially conservative and backward sections of society. Thus, to fulfil the consitutional provision of equality among both the sexes, the study in spatial dimension provides a strong base for the removal of sex biased discrimination in society.

Introduction

The disparity in male-female literacy was prevalent in most of the less developed countries of the world. For instance, the female literacy in Afghanistan, Nigeria, Nepal, Pakistan, Mozembique and Bangladesh was only 7.8, 8.6 11.9, 18.6, 2.21 and 22.2 per cent, respectively was against their male literacy rates of 38.9, 19.4, 34.7, 39.9, 54.8 and 43.3 per cent, respectively (UNESCO, 1985, p. 13). India was in line with other developing countries in this regard. In India, the female literacy rate was 24.81 per cent as against male literacy rate of 46.89 per cent. The ratio between male and female literacy was, thus, to the tune of 2:1 in 1981. In historical perspective, this ratio was extremely high (23:1) in 1891 (Table 1). Even until the beginning of present century (1901), only one female in every hundred females and ten males in every hundred males could read and write, giving a ratio of 10:1 and a differential index[1] of 92.98. In 1931, the ratio between male and female literacy was reduced to 6:1. However, after Independence, the female literacy made a considerable progress due to

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1. Differential index has been calculated by using the following formula : $DI = 100 \ [1 - (Y_i/X_i)]$ where DI = Differential Index; Y_i = Percentage of female literacy in an area and (x_i) = Percentage of male literacy in the same area (i) (Sagar, 1990, pp. 9–10).

POPULATION GEOGRAPHY

Table 1

INDIA : Progress of Male and Female Literacy Rates, Differential Index and Ratios

Period/Year	Percentage of literates		Differential Index	Male-female literate ratio
	Males	Females		
Ancient India [1a] (III BC to III AD)	27.00	7.00	74.07	4 : 1
Medieval India [1a] (end of 12th century)	15.00	3.00	80.00	5 : 1
Colonial India [1a] (till 1891 AD)	11.40	0.50	95.61	23 : 1
1901 [2a]	9.83	0.69	92.98	14 : 1
1911 [2a]	10.56	1.05	90.05	10 : 1
1921 [2a]	12.21	1.81	85.17	7 : 1
1931 [2a]	15.59	2.93	81.20	6 : 1
1941 [2a]	24.90	7.30	70.68	3 : 1
1951 [2b]	24.95	7.93	68.22	3 : 1
1961 [2]	34.44	12.95	62.40	5 : 1
1971 [2]	39.45	18.69	52.69	2 : 1
1981 [3c]	46.89	24.81	47.09	2 : 1
1991 [d]	55.65	33.38	40.02	10 : 6
2001 [d]	66.04	44.91	31.99	7 : 5

Source : Calculated from :

1 : Petrov, V. (1985) : *India : Spotlight on Population*, p. 231.

2 : Census of India (1982) : *Provisional Population Totals*, Paper I of 1981, India, Series I, Registrar General, New Delhi p. 43.

3 : Census of India (1983) : *Primary Census Abstract, General Population*, Series I, India (1981), Part II-B (i), Registrar General, New Delhi, pp. 4-27.

a : For undivided India

b : Excludes Jammu and Kashmir

c : Excludes Assam

d : Estimates based on General Population series.

the changing socio-economic conditions in the country, it increased from 7.93 per cent in 1951 to 24.81 per cent in 1981. With the spectacular growth of female literacy, the gap between male and female literacy narrowed down gradually. The male-female differential index also decreased significantly from 68.22 in 1951 to 47.09 in 1981. It is estimated that the male-female differential index would decrease to 31.99 by 2001, when the female literacy is expected to be about 44.91 per cent in comparison to 66.04 per cent of male literacy (Table 1). Thus, the male-female literacy differential in 2001 would be one-third (31.99) of what it was in 1891 (95.61).

Thus, the male-female literacy differential was very high in the beginning of of present century due to very low female literacy. The colonial period in Indian literacy transition represented the black period when literacy was primarily meant for male population. The British administration of pre-Independence days spent very little proportion (1.70 per cent) of the total budget on education that was accessible only to a limited number of wealthy persons of the country (Petrov, 1985, p. 230). Before Independence, the educational institutions were few and far between; and the socio-economic conditions were not too conducive to the growth of education, particularly for females[2]. Undoubtedly, after Independence, the female literacy improved a lot, yet it was far behind the male literacy. However, even after 35 years of Independence, hardly one-fourth of the total female population could both read and write and the male-female differential in literacy was still large. The continuing low level of female literacy in the country was the product of prevalence of prejudices against the females' education; mobility and employment; inadequate schools for females; dearth of female teachers, particularly in rural areas; early engagement/marriage of the females and household responsibilities of the females. Besides, the appalling general poverty and the low degree of participation of females in workforce were the other factors responsible for wide male-female disparity in literacy (Chandna, 1986, p. 175).

The disparity in male and female literacy occurs both in rural and urban areas. However, such disparities are sharper in rural areas in comparison to urban areas. In urban areas, the female literacy does not lag far behind the male literacy. The relatively low disparity in urban male-female literacy may be attributed to the relatively better status of the women; availability of educational institutions equally for males and females; relatively better standard of living; changing value of female education for matrimonial and employment purposes and increasing degree of socio-economic awakening among urbanites (Sagar, 1984, p. 73.) The degree of urbanisation and male-female literacy disparity are negatively correlated. The coefficient of correlation between the two was $r = -0.19$.

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2. During the pre-Independence period, the existence of a superstitious feeling in the Hindu families, that a girl taught to read and write will, soon after marriage, become a widow, had seriously restricted the female entry in schools (Government of India, 1959, p. 14).

As observed earlier, the male-female differential index had been declining gradually from 1951 to 1981 due to the increase in female literacy in the country. The relatively high rate of increase in female literacy was related to the increasing educational facilities[3], increase in the standard of living, increasing participation of females in economically gainful activities, increasing value of female education for matrimony (Chandna, 1986, p. 175), increasing female mobility as a result of waning prejudices against their mobility, increasing availability of female teachers in rural areas and increasing degree of socio-economic awareness. Above all, the increasing male literacy had also stimulated the female literacy as the two were positively correlated ($r = 0.89$). The correlation between the two was highly significant. Thus, in view of close relationship between male and female literacy, the male-female differential was also inversely related with both the male literacy ($r = -0.38$) and the female literacy ($r = -0.35$).

Table 2 reveals that in 1981, the male-female differential index for the country was 47.09. It was highest (68.57) for the state of Rajasthan and lowest (12.66) for Kerala. Among union territories, it was highest (60. 8) for Arunachal Pradesh and lowest (14.04) for Chandigarh. The highest differential in Rajasthan was the product of continued tradition of early marriag ; traditional prejudices against

females' education and mobility; lack of educational institutions; low level of general literacy; low level of urbanisation; and general poverty of the masses. On the other hand, the index was the lowest in Kerala due to its early start in modern education; long history of its contact with the developed countries; high social status of women; adequate educational facilities; high expenditure on education by both the formal and non-formal agencies; impact of missionary activities; high proportion of Christian population and of non-agricultural workers. In Arunachal Pradesh, the disparity index was highest due to low percentage of general literacy; inadequacy of schooling facilities, especially for girls; low social status of women; high proportion of non-Christian tribal population; low level of urbanisation and subsistence nature of economy. The lowest differential index in the highly urbanised union territory of Chandigarh was related with its high percentage of general literacy; availability of educational institutions; most favourable number of female students (15.04) per female teacher (Table 3); high degree of participation of the females in non-agricultural services; high social status of women; inmigration of educated females; high standard of living and high degree of socio-economic awarenses. It is worth mentioning here that the differential in Chandigarh would have been still lower but for the regular inflow of illiterate persons for general labour (for construction work) from Uttar Pradesh/Bihar.

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3. There was a spectacular increase in the number of educational institutions from 25 million in 1951 to 112 million in 1981 in general and from 6 million in 1951 to 40 million in 1981 for women (Government of India, 1985, p. 531).

Table 2

INDIA : Male and Female Literacy Rates, and Differential Index, 1981

India/State/ Union Territory	Percentage of Literates		Differential Index
	Male	Female	
INDIA*	46.89	24.81	47.09
States			
Kerala	75.26	65.73	12.66
Meghalaya	37.89	30 08	20.61
Punjab	47.16	33.69	28.56
Nagaland	50.06	33.89	32.30
Tripura	51.70	32.00	38.10
Tamil Nadu	58.26	34.99	39 94
West Bengal	50 67	30.25	40 30
Gujarat	54.44	32.30	40.67
Maharashtra	58.79	34.79	40.82
Himachal Pradesh	53.19	31.46	40.85
Karnataka	48.81	27.71	43.23
Manipur	53.29	29.06	45.47
Andhra Pradesh	39.26	20.39	48.06
Assam[a]	36.70	18.60	49.32
Sikkim	43.94	22.20	49.48
Haryana	48.20	22.27	53.79
Orissa	47.16	21.12	55 21
Jammu & Kashmir	36.29	15.88	56.24
Madhya Pradesh	39.49	15.53	60.67
Uttar Pradesh	38.76	14 04	63.78
Bihar	38.11	13.62	64.26
Rajasthan	36.30	11.41	68.57
Union Territories			
Chandigarh	69.00	53.31	14.04
Mizoram	64.46	54.91	14 81
Delhi	68.40	53.07	22.41
Goa, Daman and Diu	65.59	47.56	27.49
A & N Islands	58.72	42.14	28.23
Pondicherry	65.84	45.71	30.58
Lakshadweep	65.24	44.64	31.56
Dadra and Nagar Haveli	36.32	16.78	53.80
Arunachal Pradesh	28.94	11.32	60.88

Source : Calculated from : Census of Inida (1983) *Primary Census Abstract, General Population*, Series I, India (1981), Part II-B (i), Registrar General, New Delhi, pp. 4-27)

* : Excludes Assam.

@ : Figures for Assam are calculated from Census of India (1982) : *Provisional Population Totals*, Paper 1 of 1981, India (1981), Registrar General, New Delhi, p. 43.

Spatial Pattern

In 1981, there were wide variations in the male-female literacy differential index in India. The index ranged from 5.75 in Kottayam district of Kerala to 90.27 in Kargil district of Jammu and Kashmir. Spatially, the differential was low in coastal and peripheral districts that had early start of education, high social status of the women and relatively prosperous economy while the differential was high in the interior parts of the subcontinent which had strong apathy towards the female education, poor agricultural economy and almost no exposure to the outside world. Thus, the differential index was high in all those areas that were both socially and economically backward. The male-female literacy differential was inversely associated with per capita income ($r = -0.67$), male literacy ($r = -0.38$), general literacy ($r = -0.36$) female literacy (-0.35), percentage of non-agricultural workers ($r = -0.23$), of urban population ($r = -0.19$), and of Christian population ($r = -0.16$) It was positively correlated with the precentage of scheduled caste population ($r = 0.13$). These apart, a strong negative association between the differential index and the level of socio-economic development could also be observed. In other words, as the general literacy decreases the differential index increases. But since the general literacy usually gets depressed in areas of low female literacy, the differential index in such areas becomes high. Both the general literacy and female literacy are normally low in less developed areas where the differential index becomes high. Thus, the male-female literacy differential index is low in relatively prosperous areas and high in socially and economically backward areas. Following three types of areas can be indentified on Map 1 on the basis of male female differential in literacy :

A. Areas of low literacy differential with an index value of less than 40;

B. Areas of moderate literacy differential with an index value ranging 40 to 60; and

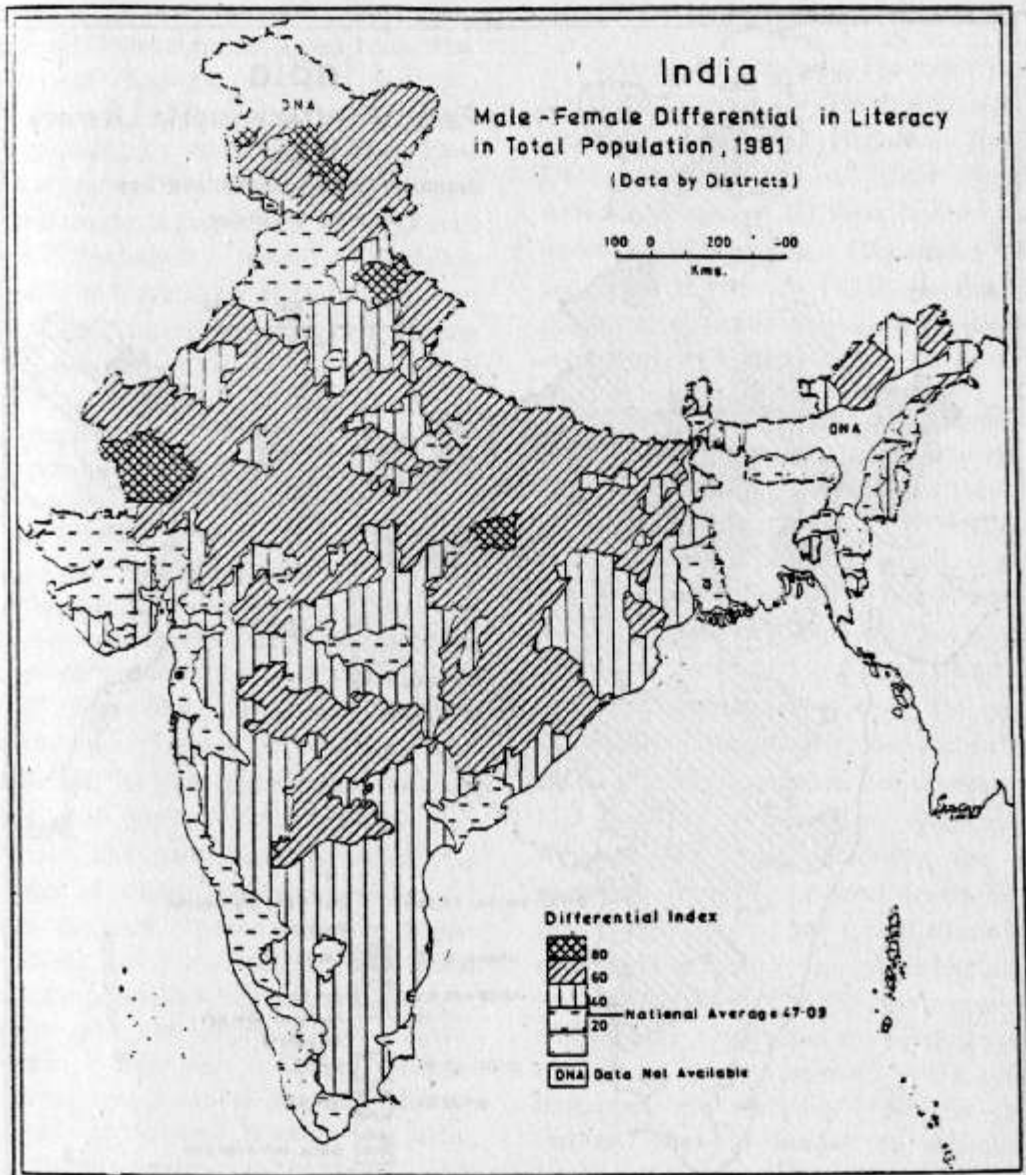C. Areas of high literacy differential with an index value of more than 60.

A. Areas of low Literacy Differential

There were 104 such districts in India that had recorded low index value of less than 40. Of these, only in 27 districts the differential index value was less than half of the national average (Map 2). In all these districts, female literacy was more than 30 per cent.
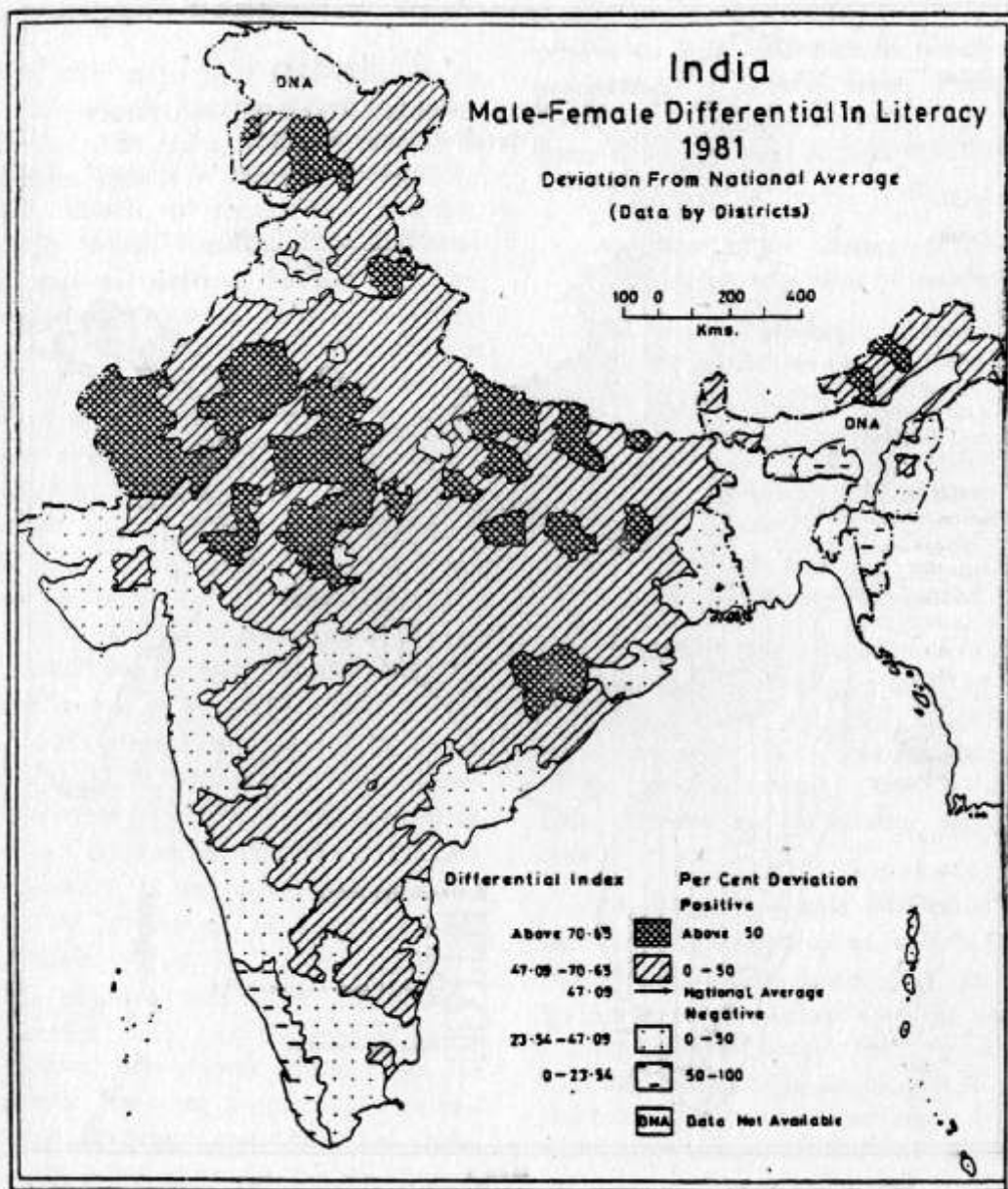
The low male-female differential was found in the coastal areas of western ghats; Punjab plains and adjacent areas; most of northeastern states; deltaic areas of Andhra Pradesh and West Bengal; northern parts of Vidarbha; islands of Andaman and Nicobar and Lakshadweep and some highly urbanised districts scattered all over the country.

(i) The Western Coast

All along the western coast from Cape-Comorin to Rann of Kachchh, the male-female literacy differential was low. The belt covers the entire state of Kerala; the

India

Male - Female Differential in Literacy in Total Population, 1981

(Data by Districts)

100 0 200 -00
Kms.

Differential Index

80
60
40 — National Average 47·09
20

DNA Data Not Available

Map 1

India
Male-Female Differential In Literacy
1981
Deviation From National Average
(Data by Districts)

100   0   200   400
Kms.

Differential Index   Per Cent Deviation
                            Positive
Above 70·65   Above 50
47·09 –70·65   0 – 50
47·09   National Average
                            Negative
23·54 –47·09   0 – 50
0 –23·54   50 –100
                  DNA   Data Not Available

Map 2

districts of Kanniyakumari, Tiruneveli, Nilgiri and Coimbatore of Tamil Nadu; the districts of Kodagu, Dakshin Kannad, Uttar Kannad, Chikmagalur and Shimoga of Karnataka; the districts of Thane, Pune and Ratnagiri of Maharashtra; the districts of Gandhinagar, Ahmadabad, Valsad, Surat, Rajkot, Vadodara, Amreli, Kachchh, Mahesana and Jamnagar of Gujarat and of Mahe of Pondicherry and entire Goa, Daman and Diu. In these districts, the male-female differential was low in both rural and urban areas (Sagar, 1990, p. 59-60). In the entire belt, both general and female literacy rates were very high (more than 40 per cent). In all the districts of this belt educational facilities were made available to more than 80 per bent of the villages (Map 3). The long history of exposure to the western culture had accorded a higher status to the women (Christians, Jains and Parsees), especially with regard to education and employment. Higher degree of urbanisation coupled with higher degree of rural-urban interaction had contributed a lot in the extension of educational opportunities for females as well. Above all, the higher percentage of Christian population, reasonable school population ratio (Map 3) even for girls and greater degree of socio-economic awareness about female education were some of the vital factors that had contributed towards low male-female literacy disparity in the region. It is worth mentioning here that the contribution made by Christian missionaries, emigrants, successive state governments and socially more awakened population in the promotion of educational facilities have been of great significance in this regard.

(ii) The Punjab Plains and Adjacent Areas

This region comprises the entire Punjab state; the districts of Hamirpur, Kangra, Una and Bilaspur of Himachal Pradesh; Dehra Dun district of Uttar Pradesh; Ambala district of Haryana; and the union territory of Chandigarh. Chandigarh (59.31 per cent) and Punjab (33.69 per cent) had the second and fifth position in the country, respectively in terms of female literacy.
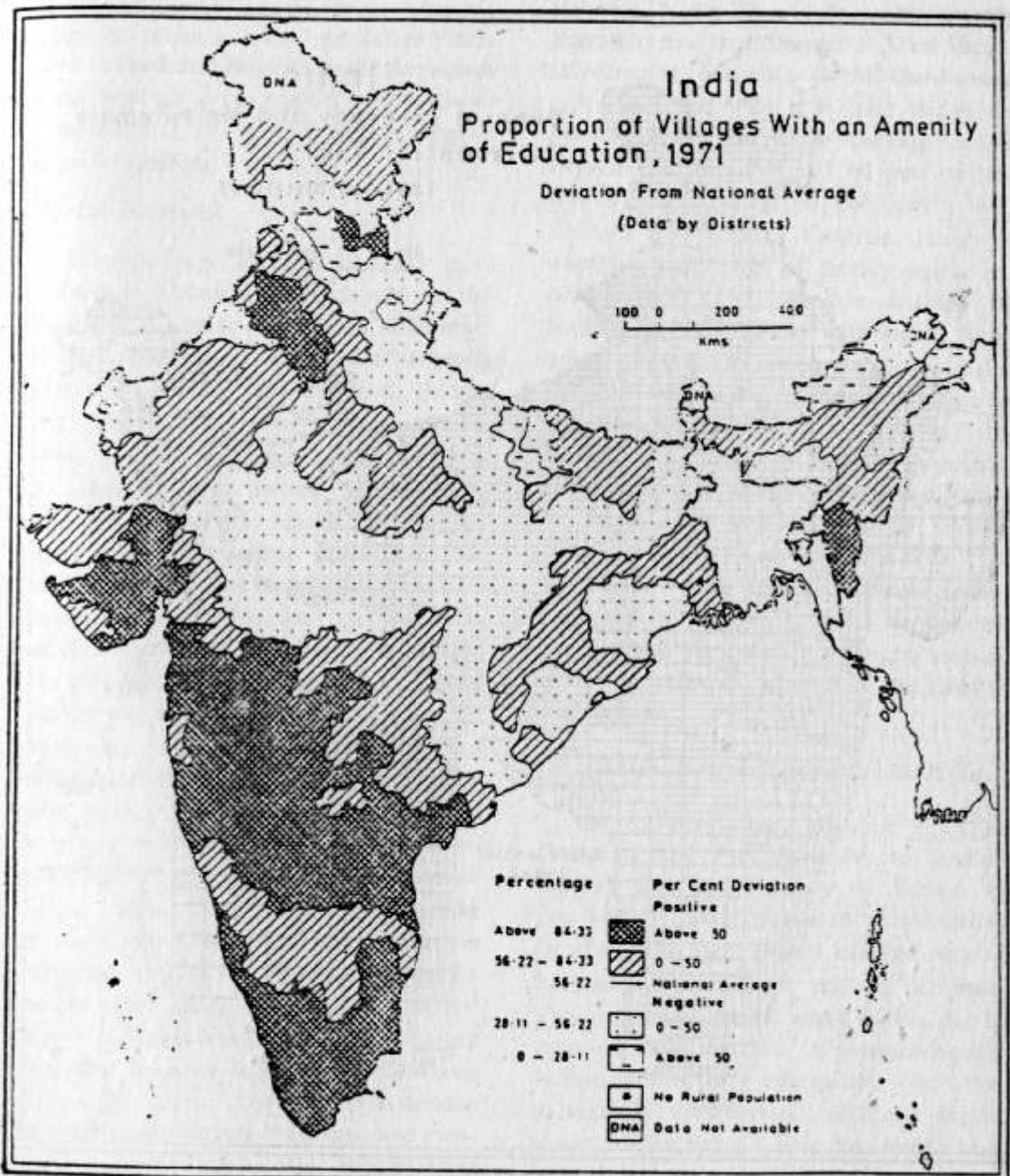
In Punjab, the districts of Ludhiana and Jalandhar had minimum disparity where the differential index value was less than half the national average (Map 2). By and large, Punjab plains formed the largest compact zone of low male-female literacy defferential in the northwestern part of the country. Education here had an early start and facilitated the improvement in the quality of people. The progressive socio-cultural milieu provided a cushion for the relatively high growth of education, even among females. The long tradition of out-migration (largely to defence forces and to big cities) and the continuation of emigration to advanced countries had played its own role in creating socio-economic environment conducive to furtherance of educational accomplishments of the people. Moreover, the relatively high per capita income, adequate number of schools for females, high matrimonial value of female, education, high social status of women among Sikhs and non-Sikhs and high proportion of urban population were the other factors curtailing male-female disparity in the region. However, it may be pointed out here that the male-female differential

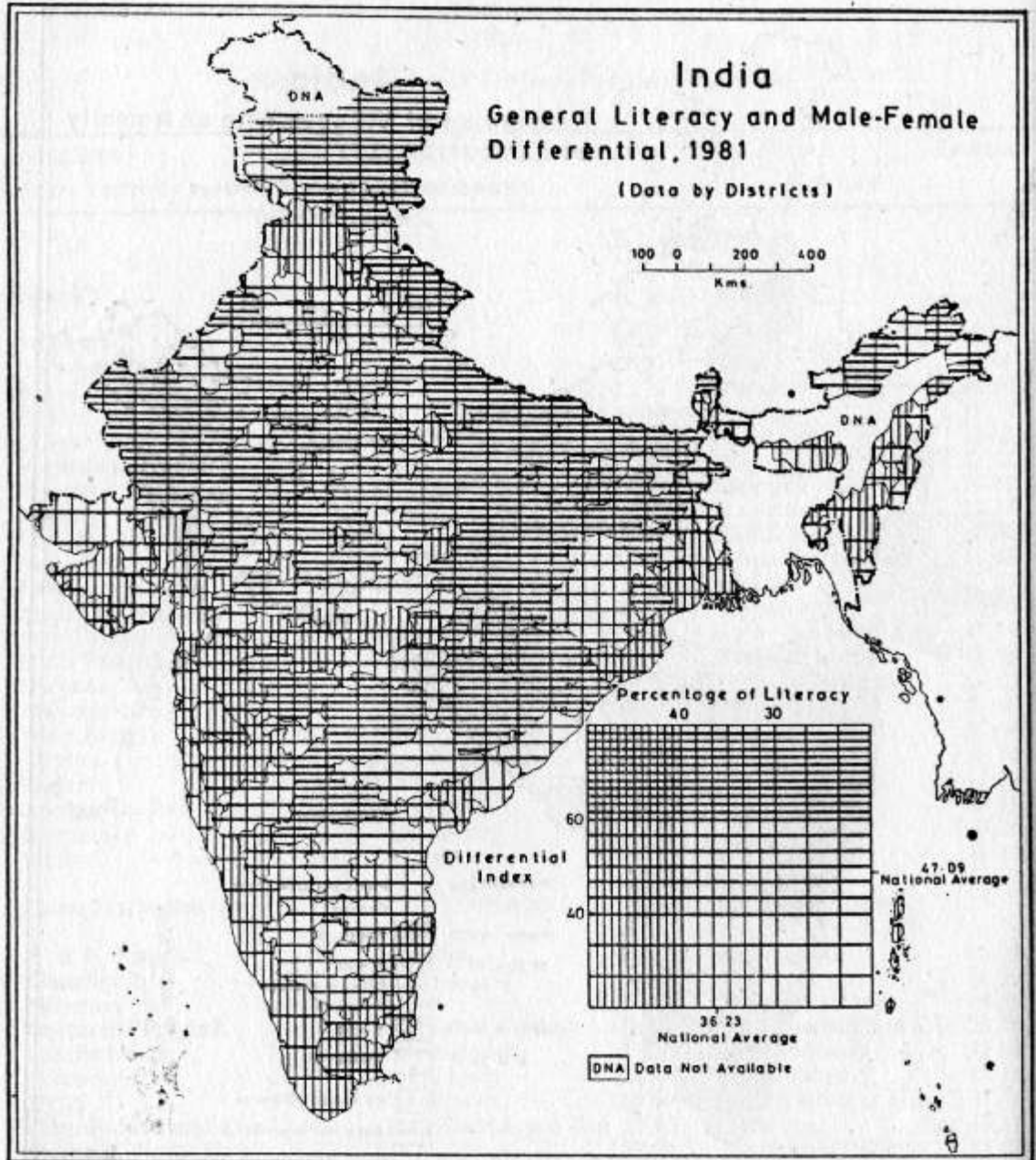POPULATION GEOGRAPHY

Table 3

INDIA : Number of Students Per Teacher, 1981

India/State/ Union Territory	Total	India/State/ Union Territory	Male	India/State/ Union Territory	Female
INDIA	32.38	INDIA	28.21	INDIA	43.87
States		**States**		**States**	
Manipur	17.93	Manipur	12.01	Jammu and Kashmir	20.38
Nagaland	19.06	Nagaland	14.51	Sikkim	25.88
Jammu & Kashmir	20.21	Orissa	18.77	Kerala	28.79
Sikkim	21.21	Sikkim	19.00	Punjab	28.79
Orissa	26.35	Jammu and Kashmir	20.12	Meghalaya	32.07
Meghalaya	26.89	Assam	22.02	Nagaland	33.11
Himachal Pradesh	27.57	Himachal Pradesh	23.38	Haryana	33.62
Assam	29.20	Meghalaya	23.50	Rajasthan	34.13
Punjab	37.10	West Bangal	24.96	Tamil Nadu	35.22
Rajasthan	30.51	Tripura	26.06	Himachal Pradesh	38.68
Kerela	30.72	Madhya Pradesh	27.63	Gujarat	39.37
Madhya Pradesh	31.83	Maharashtra	28.49	Maharashtra	44.95
Tamil Nadu	32.22	Uttar Pradesh	29.02	Uttar Pradesh	47.75
Uttar Pradesh	32.33	Rajasthan	29.57	Madhya Pradesh	48.96
Haryana	32 64	Andhra Prrdesh	29.59	Andhra Pradesh	53 85
Maharashra	33.40	Tamil Nadu	30.34	Manipur	53.96
West Bangal	33.62	Bihar	30.61	Tripura	57.64
Tripura	33.97	Punjab	31.15	Karnataka	58.71
Gujarat	34.67	Karnataka	31.73	Assam	62.77
Andhra Pradesh	35.75	Gujarat	32.18	West Bangal	65.87
Karnataka	38.93	Haryana	32.22	Bihar	66.20
Bihar	41.80	Kerala	32.77	Orissa	89.92
Union Territories		**Union Territories**		**Union Territories**	
A & N Islands	20.20	Mizoram	16.89	Chandigarh	15.04
Chandigarh	20.93	A & N		Delhi	21.93
Mizorum	23.37	Islands	17.70	A & N Islands	24.58
Arunachal Pradesh	24.27	Arunachal Pradesh	18.94	Coa, Daman and Diu	26.28
Lakshadweep	24.88	Lakshadweep	21.30	Lakshadweep	32.61
Pondicherry	26.24	Pondicherry	22.44	Pondicherry	34.16
Delhi	27.00	Chandigarh	28.41	Dadra &Nagar Haveli	37.76
Goa, Daman and Diu	27.95	Goa, Daman and Diu	29.45	Mizoram	42.01
Dadra & Nagar Haveli	36.83	Delhi	32.94	Arunachal Pradesh	57.61
		Dadra &Nagar Haveli	36.28		

Source : Calculated from Government of India (1985) : "Education" *Statistical Abstrabt*, India, Central Statiscal Organisation, New Delhi, pp. 531 and 537,

India
Proportion of Villages With an Amenity
of Education, 1971

Deviation From National Average

(Data by Districts)

Map 3

India

General Literacy and Male-Female
Differéntial, 1981

(Data by Districts)

Map 4

index was also subdued by a constant inflow of illiterate male population from Uttar Pradesh and Bihar to avail themselves of the region's huge employment potential in agricultural sector as a consequence of Green Revolution.

(iii) The Northeast

Low literacy differential was also recorded in the entire Meghalaya state; the districts of Aizawl and Lunglei of Mizoram; the districts of north and west of Tripura; and most of Manipur and Nagaland. Except West Garo Hills, where both general literacy and male-female differential were low (Map 4), the female literacy was invariably high in these states. In Mizoram and Meghalaya, the differential index value was less than half the national average (Map 2). The low literacy differential in this region was largely associated with the region's Christian culture These tribal areas were Christian majority areas. Christianity was devoid of any prejudices against famales' mobility and education (Naik, 1975, p. 18). Normally, there was an inverse correlation between the male-female literacy differential and the status of women. Both, Christian missionaries and the state governments had contributed in their own way to the creation of infrastructure for males 'as well as females' education (Table 3 and 4). In West Garo Hills, the disparity index would have been still higher but for the considerable infiltration of illiterate Muslims and non-Muslims from across the border with Bangladesh.

(iv) Southern West Bengal

This region included the districts of Calcutta, Nadia, Haora. Hugli, Twenty-four Parganas and Barddhaman of West Bengal. Of these, in Calcutta (10,54) the disparity index was very low. By and large, the female literacy in these districts ranged between 30 per cent and 40 per cent and and was more than 40 per cent in both Calcutta and Haora. Calcutta, being the administrative seat of British India and present state capital, had maintained the tradition of literacy and education. Rapid urban-industrial development in the region had not only created job opportunities for males and females but also had led to the expansion of educational facilities in general. All these factors together with in-migration of literate males had significantly brought down the male-female differential index in the region. The differential index would have been still higher, but for the presence of sizeable proportion of backward sections (scheduled castes, tribes and Muslims) of society.

(V) Deltaic Area of Krishna and Godavari

It covered the districts of West Godavari, and East Godavery of Andhra Pradesh and the territory of Yanam of Pondicherry. These areas were characterised by relatively high female literacy varying between 30 per cent and 40 per cent. The differential index was also low due to relatively high standard of living, adequate infrastructure of educational facilities, particularly for females, relatively higher status of females in the Peninsula, high percentage of urban population and the impact of Christian missionary activities.

Low literacy differential was also observed in the highly urbanised districts

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Low literacy differential was also observed in the highly urbanised districts

Table 4

INDIA : Number of Educational Institutions per Thousand of Population, 1981

India/State Union Territory	Total	India/State/ Union Territory	Male	India/State Union Territory	Female
INDIA	162.939	INDIA	201.207	INDIA	118.710
States		**States**		**States**	
Nagaland	252.170	Nagaland	270.171	Nagaland	231.316
Meghalaya	238.826	Manipur	253.308	Meghalaya	230.813
Kerala	233.572	Tripura	252.279	Kerala	221.261
Tripura	225.408	Meghalaya	246.470	Tripura	197.012
Manipur	223.472	Kerala	246.275	Manipur	192.737
Maharashtra	199.082	Himachal Pradesh	236.839	Punjab	174.922
Himachal Pradesh	195.157	Maharashtra	230.827	Tamil Nadu	165.495
Tamil Nadu	193.907	Gujarat	224.505	Maharashtra	165.198
Punjab	191.930	Tamil Nadu	221.662	West Bengal	160.872
Gujarat	190.362	West Bengal	207.037	Gujarat	154.115
West Bengal	185.029	Punjab	206.872	Sikkim	152.774
Sikkim	176.600	Karnataka	202.506	Himachal Pradesh	152.309
Karnataka	172.660	Haryana	201.356	Karnataka	141.652
Haryana	156.011	Sikkim	196.486	Assam	122.204
Assam	152.843	Uttar Pradesh	192.092	Andhra Pradesh	111.615
Orissa	145.483	Rajasthan	186.323	Orissa	106.778
Andhra Pradesh	144.004	Bihar	185.587	Haryana	103.901
Jammu & Kashmir	139.606	Madhya Pradesh	183.862	Jammu & Kashmir	101.331
Uttar Pradesh	137.824	Orissa	183.462	Madhya Pradesh	84.764
Madhya Pradesh	135.827	Assam	180.443	Uttar Pradesh	76.490
Bihar	130.258	Andhra Pradesh	175.594	Bihar	71.761
Rajasthan	125.960	Jammu & Kashmir	173.747	Rajasthan	60.275
Union Territories		**Union Territories**		**Union Territories**	
Lakshadweep	295.461	Lakshadweep	341.905	Lakshadweep	247.836
Goa, Daman & Diu	257.364	Goa, Daman & Diu	282.162	Mizoram	236.616
Mizoram	244.399	Pondicherry	259.238	Goa, Daman & Diu	232.097
Pondicherry	225.946	Mizoram	251.555	A & N Islands	228.940
Delhi	225.935	Delhi	229.528	Delhi	221.489
A & N Islands	223.751	A & N Islands	219.809	Pondicherry	192.138
Chandigarh	188.410	Dadra & Nagar Haveli	200.362	Chandigarh	174.490
Dadra & Nagar Haveli	164.127	Chandigarh	199.116	Dadra & Nagar Haveli	126.933
Arunachal Pradesh	119.784	Arunachal Pradesh	150.037	Arunachal Pradesh	84.689

Source : Calculated from :

1 : Government of India (1986) : *Statistical Abstract, India*, Central Statistical Organisation, New Delhi, p. 526,

2 : Census of India (1983) : Primary *Census Abstract*, General Population, Series 1, India (1981), Part II-B(i), Registrar General, New Delhi, pp. 4-27.

of Madras, Delhi, Hyderabad, Bangalore, Bhopal, Pondicherry, Darjiling, Indore, Kanpur, Thanjavur, parts of Vidarbha and the islands of the country. In all these areas, apart from high percentage of urban population, educational facilities, especially for females, were adequately available; the economy was highly diversified; female participation in non-agricultural tertiary services was high; standard of living was generally high; and social value of female education, particularly for matrimony, was high. Besides, the heavy investment made by Central Government f.r the overall development of union territories (Krishan, 1984, p. 6) had led to the expansion and extension of educational facilities, particularly for females. No wonder the male-female differential was significantly low.

Thus, the differential index was low in the districts with high general and female literacy, good infrastructure of educational facilities, high proportion of urban population, of non-agricultural workers and of Christians, Parsees, Jains and Sikhs. Broadly speaking, areas with high male literacy (more than 60 per cent) were characterised by low male-female differential.

B Areas of Moderate Literacy Differential

All those districts that had registered an index value of 40 to 60 were classified as the areas of moderate literacy differential. There were 137 such districts in all. Of these, only 47 districts had recorded the values less than that of national average. These districts were, by and large, confined to Peninsular India. In the Peninsula, parts of Tamil Nadu,

Karnataka, Maharashtra and Gujarat had moderate male-female differential due to their exposure to external influences, positive impact of Christian culture, and relatively high status enjoyed by the females. In northern India, moderate literacy differential was recorded in Chota Nagpur plateau area; northwestern parts of Haryana and of Uttar Pradesh; peripheral districts of northeastern states; northern parts of West Bengal; middle Ganga-Yamuna doab and some scattered districts in Central India. Broadly speaking, all these areas formed transitional zone between the areas of low literacy differential and that of high literacy differential. Improving standard of living, opening up of large number of schools for females, waning prejudices against females' education and significant growth of urban population were the factors responsible for narrowing down the differences in male-female literacy in these areas particularly in Indo-Gangetic plain. In northeastern states and in Chota Nagpur plateau the missionaries had contributed a lot in the propagation of education. Besides, the recent developmental activities in mining and industry in Chota Nagpur area had raised the purse power of an average family to spare even the female children for studies. It had significantly arrested the male-female disparity in literacy.

C. Areas of High Literacy Differential

In all, there were 161 districts where the male-female literacy differential index was more than 60. The differential index was maximum in 52 districts in which the index value was at least 50 per cent

higher than the national average (Map 2). The index was more than 80 in seven scattered districts of Kargil (90.27), Kupwara (81.97), Barmer (81.54), Uttar Kashi (80.72), Jalor (80.29), Tehri Garhwal (80.27) (Map 2) and Sidhi (80.07) where more than 90 percent of the females could not read and write. Among other districts also, not more than one female was literate after every five females. All these areas were, by and large, having appalling general poverty, high incidence of dropouts among females, low status of women, and the long history of neglect of females' education. Included in this group were large parts of Hindi-speaking zone, former Hyderabad state and the Himalayan region.

Hindi Speaking Zone

It covered the large parts of Bihar, Uttar Pradesh, Rajasthan, Madhya Pradesh, Gujarat and West Bengal, where less than one-fifth of the females were able to read and write. This zone comprised districts in which more than one-half of the villages had no provision of educational facility (Map 3). In this region, the standard of living of the population was low. In order to make both ends meet, the participation of all, old and young, male and female, in economic struggle was essential. Moreover, the tradition of early marriage/engagement, particularly of females, resulted in high incidence of dropouts among females. Even after marriage, the prevalence of traditions like veil, seclusion and limited mobility, dependent status of the women in the family, the socio-cultural apprehensions of largely illiterate male population about the female's education (Krishan and Shyam, 1973, p. 204)

had perpetuated the male-female disparity. These apart, the scarcity of schools for females, dearth of female teachers in remote areas and sizeable proportion of Muslims, among whom female literacy was more depressed, were the other factors responsible for the large differentials in male and female literacy in the region.

Former Hyderabad State and Adjacent Areas

It comprised the districts of Medak Adilabad, Karimnagar, Nizamabad and Mahbubnagar of Andhra Pradesh the districts of Parbhani, Nanded and Aurangabad of Maharashtra; and the districts of Gulbarga, Raichur and Bidar of Karnataka. Here, the differential index ranged between 60 and 65. In these districts, more than 80 per cent of the total female population could not read and write. The appalling poverty of the masses and the low status of the women were the chief deterrents in the way of female education in the region. This region covered those districts where agricultural economy was predominantly backward, administrative neglect of female education was age-old, proportion of urban population was low, schooling facilities for females were inadequate, the development of non-agricultural sector was poor and the proportion of less literate sections (Muslims and scheduled castes) was sizeable. The combination of low level of literacy among the Muslim population was the outcome of psycho-socio-political complexes in which they viewed the modern education as a prelude to conversion to Christianity (Mukerji, 1972, p. 47). These apart, the strong traditional prejudices against females'

education in Muslim society had a great bearing in stimulating the male-female differential index in this area.

The Himalayan Region

High disparity index in male and female literacy was recorded in the Himalayan belt also. The differences were, by and large, more sharp in western Himalayas in comparison to its eastern counterpart. In the entire belt, female literacy rate was also low (less than 20 per cent). The belt comprised the large parts of Kashmir Himalayas (Jammu and Kashmir and Himachal Pradesh), Kumaon Himalayas (Uttar Pradesh) and eastern Himalayas (Arunachal Pradesh and Sikkim). In these areas, the female literacy was low in Kashmir Himalayas where in Muslims and Buddhists predominate. Among these socio - religious groups, the females were accorded very low social status (Burman-Roy, 1981, p. 412). A positive correlation $(r=0.69)$ between male-female literacy differential and proportion of Muslim population had been observed. Similarly, the status of the females was also low in Kumaon Himalayas which were the stronghold of both the traditional and conservative communities of Brahmins and Rajputs (Sopher, 1980, p. 130). The female literacy was also low in the non-Christian tribal region in the eastern Himalayas. The differential index and the social status of women were inversely correlated. Furthermore, these mountainous areas of high literacy differential had few and far between type of location of educational facilities (Map 3), especially for females, low proportion of urban population and poor standard of living in general.

Besides these major regions, the differential index was also high in socially and economically backward district of Mayurbhanj (62.82) of Orissa that had a large proportion of non-Christian tribal population (about 58 per cent).

Thus, high differential in literacy was characteristic of areas where both the general and the female literacy rates were low. It was also high in areas with inadequate educational facilities with high degree of inaccessibility of schools; early age at marriage particularly among girls; traditional prejudices against female education and mobility; low participation of female workforce in non-agricultural activities; low percentage of urban population and high percentage of Rajputs, Muslims, non-Christian tribes scheduled castes etc.

Conculsions

The sex disparity in Indian education was not of recent origin but was more marked in the medieval period. Till[1] Independence, the country had to pass through different phases of colonial rule in which little attention was paid to the propagation of females' education and the literacy was mainly male literacy. Female literacy was practically non-existent during this period. Even after Independence, when the government proclaimed the Republic as a Welfare State and had also made extensive surveys of the educational system of the country from time to time, about three-fourths of females could not read and write as against one-half of such males in 1981. This large difference between the male and female literacy was the product of heavy backlog of illiterate female population; slow and haphazard

growth of educational institutions, especially for females; non-availability of female teachers, particularly in the countryside; prevalence of traditional prejudices against females' education and their mobility; social adherence to the tradition of early marriage; low level of urbanisation and general poverty.

In 1981, the male-female literacy differential index in India was 47.09. The differential index was high in the areas with poor agricultural economy and was low in the areas with more diversified and prosperous economy. By and large, an inverse association between the differential index and the level of socio-economic development can be observed in the country. The differential index was negatively correlated with general literacy, male literacy, female literacy, per capita income, percentage of urban population, of christian population and of non-agricultural workers. It was positively correlated with the proportion of scheduled caste population and of Muslim population.

The male-female literacy differential index contrasted sharply in both urban and rural areas. The index in urban areas (26.81) was almost half of that in rural areas (55.99). The relatively low literacy differential in urban areas was associated with availability of educational facilities for both males and females, relatively better avenues of employment for females, relatively high social status of women, and education being considered matrimonial necessity in case of females. These apart, better standard of living and high degree of socio-economic awakening among urban dwellers were the other factors responsible for low male-female disparity.

Spatially, there were wide regional variations in the male-female differential index. Broadly speaking, the Peninsular India recorded low literacy differential in comparison to the interior parts of the country. In Peninsular India, the more literate western coast displayed low literacy differential than the relatively less literate eastern coast. Similarly, in north India, the peripheral areas of northeast and northwest exhibited the similar trends of low literacy differential. It had been found that areas exposed to outer influences through their coastal or peripheral location or a sustained tradition of emigration to foreign countries and those characterised by high proportion of Christian population, high social status of women, high proportion of female workers in non-agricultural activities and high level of socio-economic development portrayed low literacy differential. On the other hand, high male-female literacy differential was largely observed in the central and mountainous parts of northern India and large parts of old Hyderabad state in southern India. It was high due to the low base of female education; rigidity of religious customs and traditions about females' education and employment; low standard of living and a sizeable proportion of socially conservative and economically backward sections of society.

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REFERENCES

Burman-Roy, B.K. (1981) : "Population and Society", in J. S. Lall and A.D. Moddie (eds.); *The Himalaya : Aspects of Change*, Oxford University Press, New Delhi, pp. 403-433.

Census of India (1982) : *Provisional Population Totals*, India, (1981), Paper of 1981, Series I, Registrar General, New Delhi.

Census of India (1983) : *Primary Census Abstract, General Population*, Series I, India (1981), Part II-B (i), Registrar General, New Delhi, pp. 4-27.

Chandna, R.C. (1986) : *A Geography of Population*, Kalyani Publishers, New Delhi, pp. 171-186.

Government of India (1959) : *Report of the National Committee on Women's Education*, Manager of Publications, New Delhi, p. 14.

Government of India (1985) : *Statistical Abstract, India*, Central Statistical Organisation, New Delhi, pp. 523-540.

Krishan, G. (1973) : "Spatial perspective on the progress of female literacy in India, 1970-71", *Pacific Viewpoint*, Vol. 14 pp. 77-80.

Krishan, G. (1984) : "Regional disparities in India", in M. J. Rice (ed.) *Geographical Perspective of Development in India*, University of Georgia, USA, pp. 15-36.

Mukerji, S.N. (1972) : *Secondary Education in India*, Orient Longman, New Delhi, pp. 45-50.

Naik, J.P. (1975) : *Status of the Women in India (A Synopsis of the Report of Committee (1971-74)*, ICSSR, New Delhi, pp. 1-60.

Petrov, V. (1985) : *India : Spotlights on Population*, Progress Publishers, Moscow, pp. 204-243.

Sagar, P. (1984) : *Changes in Female Literacy in India, 1951-81*, An M. Phil. Dissertation, submitted to the Department of Geography, Panjab University, Chandigarh, pp. 3-75.

Sagar, P. (1990) : *Spatial Patterns of Literacy Differentials in India : 1981*, A Ph. D, Thesis, submitted to the Department of Geography, Panjab University, Chandigarh p.

Sopher, D.E. (1980) : "Sex disparity in Indian literacy", in David E. Sopher (ed.), *An Exploration of India : Geographical Perspective on Society and Culture*, Cornell University Press, Ithaca, New York, pp. 130-187.

UNESCO (1985) : *Statistical Year Book*, 7, Place de'Fontenoy, 75700, Paris, p. 1.3.

PERCEPTION OF SUBURBAN POPULATION OF AHMEDABAD

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The residents develop certain images in their mind regarding their own city. These images are mainly based on their perception of areas The choice of residential area depends to some extent on the images. The image of a place can change in the mind of a resident either owing to the changing situation, or changes in the thought process of the resident.

The growth and development of suburbs in India depends on various factors. There are different social, cultural and economic barriers which control the growth of a city. The composition of population in suburbs is of mixed type. So, there are differences between the perceptions of the residents of different origin.

The perception and interaction of the suburban residents have been compared through qualitative means in this article. The total assessment of both physical and behavioural aspects by residents and investigator have been defined as 'Perception Index of Residents' or 'Investigator'

The original city of Ahmedabad was established to the east of river Sabarmati in 1411 A D. The city was one of the main centres of industrial development in India. The study area is situated in the western side of Ahmedabad city. The landuse of the study area is mainly residential The study area like many other suburbs of precolonial cities of India has different types of housing structure, i.e. core villages and housing societies.

The perception of residents is closely associated with the particular environment they live in their socio economic back ground and their exposure. The perception of environmental phenomena vary among the residents of the suburbs.

Introduction

In every day interaction with the environment, residents develop certain images in their minds regarding their own place of residence as well as other parts of the city and the suburbs. These images are based on their perception of the areas as they move from one part of the city to another for work, education, shopping, by

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reading newspapers about various problems of the city or by hearing from relatives and friends about their experiences of problems in the locality, or a combination of all these. The process of development of an image in the mind of residents gets further complicated by factors like time, need, value etc. However complicated the process may be, its understanding is an essential part of explaining human behaviour in space. The decision of the people to be located at a certain place depends to some extent on their image or evaluation of that particular place. A resident may like to be located at a place due to amiable physical environment, social environment, or both. But the same place may be disliked by another resident having a different image of it. Reality is viewed differently by different people and perhaps differently at different times by the same person. The image of a place can change in the mind of a resident either owing to the changing situation in the existing environment, social or physical, or changes in the thought process of the resident through information or exposure to a better or worse environment. If the resident is not capable of getting adapted to a situation, then the question of migration arises. The actual movement or interaction over space will take place if the resident is economically and socially capable of moving out.

The growth and development of suburbs in India depends on various physical, social, cultural and economic factors. The interplay of these factors is not simple. Economic barrier is obviously the major factor which controls the growth of an area. Due to high land value, everyone is not capable of moving into a desirable area of suburbs. This is not the only barrier—caste, religion, language and life-style are important socio-cultural barriers of growth. Pockets of communities based on caste, religion, language have developed not only in the city centres but also in new suburbs in India. The composition of population in suburbs is of mixed type as the origin of residents is varied—some have outmigrated from the city, some have inmigrated from various parts of the state and the country and along with them are the original residents of the core villages. So there are differences between the perceptions of the residents of core villages and those of the new suburban areas.

Objectives of the Study

The main objectives of this paper are :—

i) To explore the reasons which make the suburban residents like or dislike their own area of residence;

ii) To understand the images of the city and the suburb among the residents;

iii) To find out whether there is difference among residents about evaluation of environmental quality of their own area; and

iv) To evaluate the residents' attachment to their own areas.

Methodology and Data Aspects

The perception and interaction of the suburban residents have been depicted and compared through qualitative means. The general physical and behavioural quality of

LOCATION OF THE STUDY AREA WITH RESPECT TO AHMADABAD CITY

SCALE

1   0   1   2   3   4 KM

INDEX

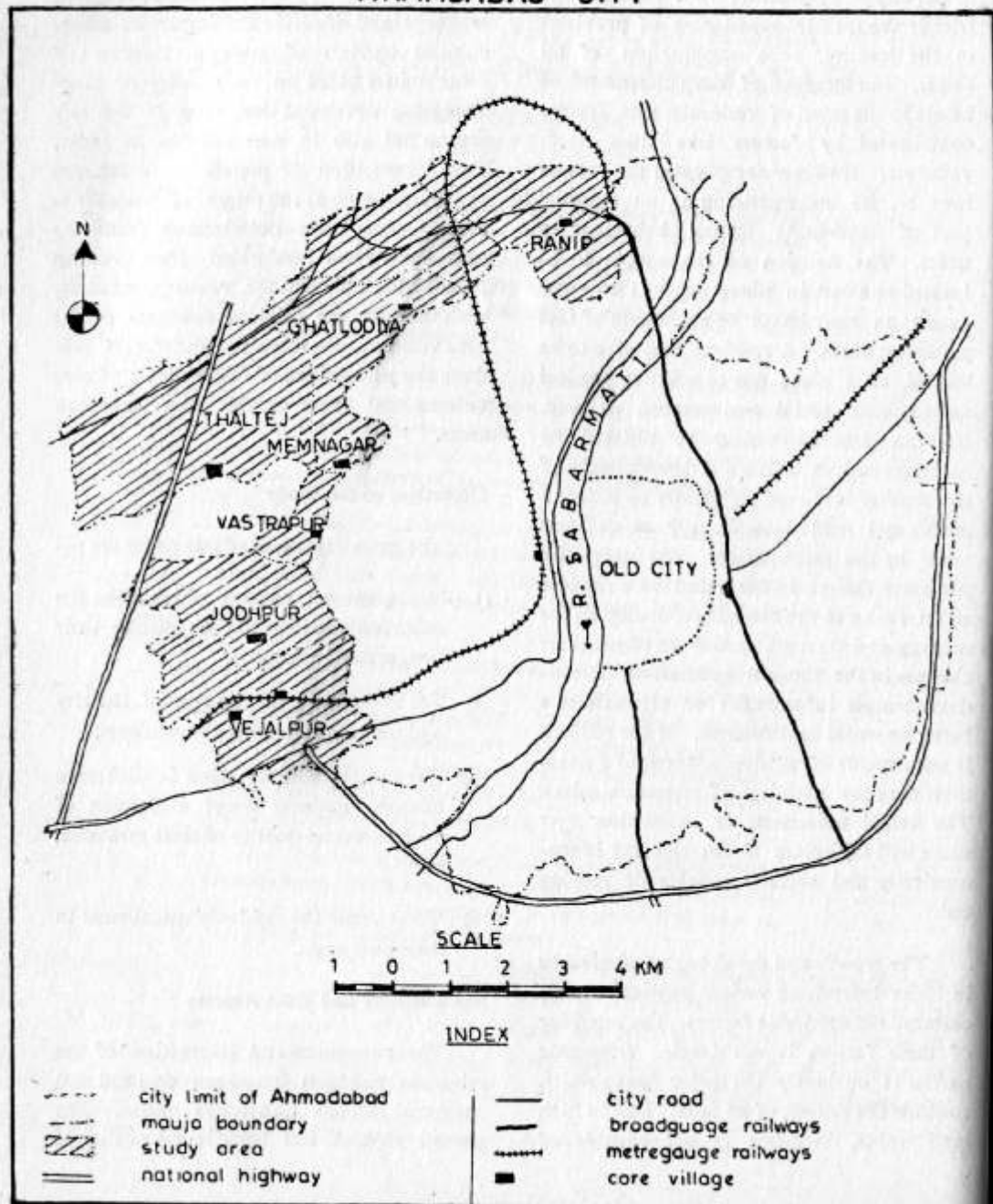|			
city limit of Ahmadabad		city road	
mauja boundary		broadguage railways	
study area		metregauge railways	
national highway		core village	

Fig. 1

each household and its surrounding area has been given score on a five point scale, both by residents and by investigator (author in this case) based on predetermined qualitative norms. The total assessment of both physical and behavioural aspects has been defined as a 'Perception Index of Residents' or 'Investigator' (P.I.R. or P.I.I.) and is based on variables like type of locality, shopping facility, amenities and behaviour aspects of residents. Various uni-variate and bi-variate tables have been prepared to analyse images of residents regarding different parts of Ahmedabad city as also the study area. Additionally tables have also been made for analysis reasons for liking and disliking of neighbourhoods by the residents.

This study is solely based on the primary data collected from field work. In all 1500 households have been surveyed, which is nearly 6 per cent of the total households in the study area in 1981.

The Study Area

The study area is located in the western side of Ahmedabad city. The original city of Ahmedabad was established to the east of river Sabarmati in 1411 A.D. This city grew up at different stages. The industrial growth was responsible for its initial development. Textile mills with residential quarters of industrial labour were established in the east.

Table 1

Residents' perception about their own locality,

Nature of perception (responses in percentage)

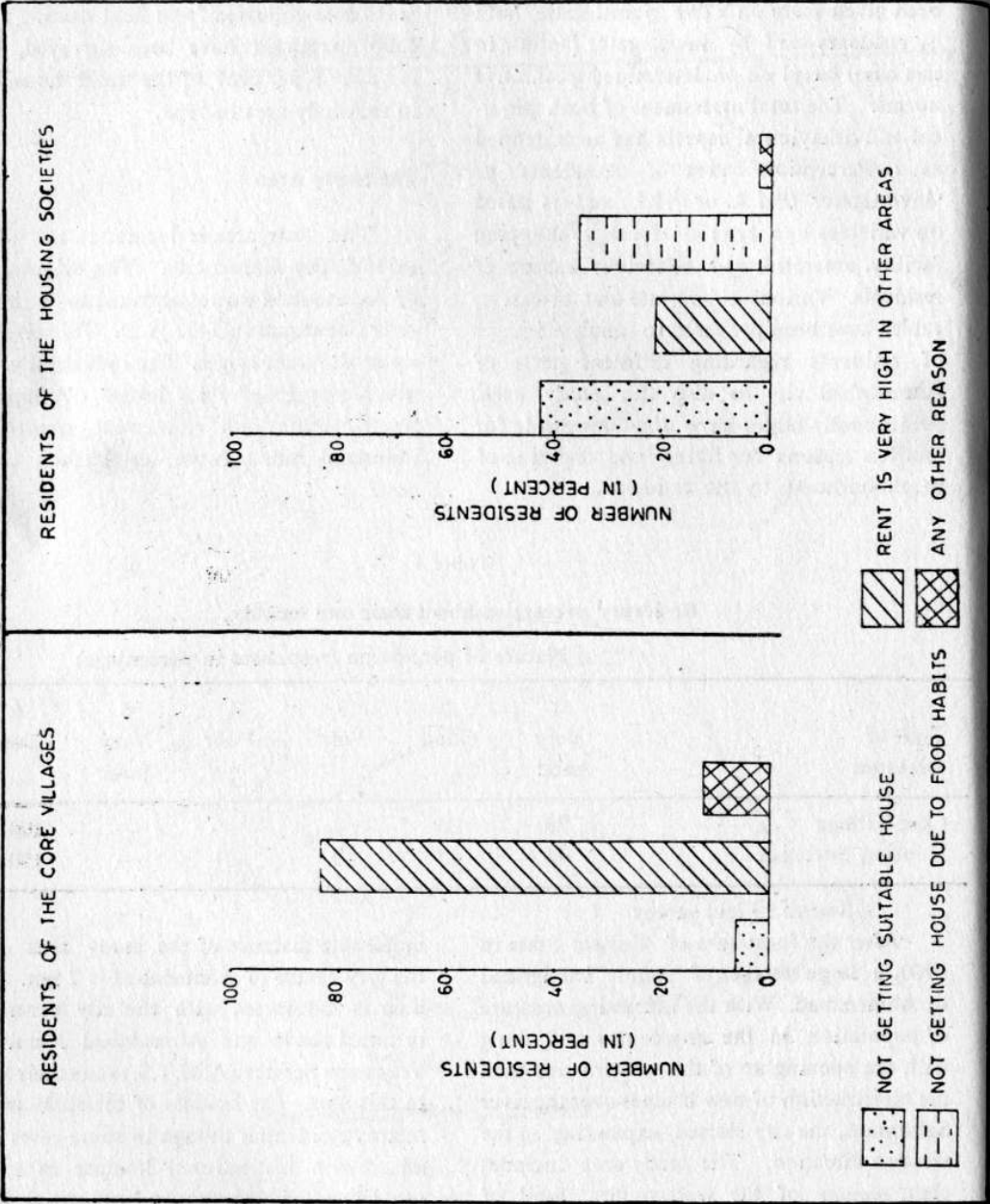| Type of residence	1 Very good	2 Good	3 Fair	4 Poor	5 Very poor	6 Total
Core Village	79	20	1	—	—	100
Housing Societies	41	43	15	1	—	100

Source : Field survey

After the formation of Gujarat State in 1960, a large number of people inmigrated to Ahmedabad. With the increasing pressure of population in the city centre and along with the opening up of the western side with the construction of new bridges over the river Sabarmati, the city started expanding in the western direction. The study area includes eight *maujas* of the western city limit of Ahmedabad city (Fig. 1). The average

motorable distance of the study area from the city centre of Ahmedabad is 7 km. This area is connected with the city centre by metalled roads and Ahmedabad Municipal Transport Service (A.M.T.S.) runs their buses in this area. The landuse of the study area is mainly residential though in some cases it is mixed with institutional landuse as in the central area (Vastrapur) and industrial landuse in the north (Ranip). The study area is

REASONS FOR NOT CHANGING THE HOUSE
1981

RESIDENTS OF THE HOUSING SOCIETIES

RESIDENTS OF THE CORE VILLAGES

NUMBER OF RESIDENTS
(IN PERCENT)

NUMBER OF RESIDENTS
(IN PERCENT)

RENT IS VERY HIGH IN OTHER AREAS

ANY OTHER REASON

NOT GETTING SUITABLE HOUSE

NOT GETTING HOUSE DUE TO FOOD HABITS

CHOICE OF RESIDENTIAL AREA
1981

1. IMMIDIATE AREA WITHIN CITY AREA.

2. OTHER AREAS IN WESTERN PART OF SUBURBS.

3. AREAS IN EASTERN PART OF THE CITY.

4. CORE CITY.

TYPE OF RESIDENTS

CORE VILLAGE

HOUSING SOCIETY

NUMBER OF RESIDENTS (IN PERCENTAGE)
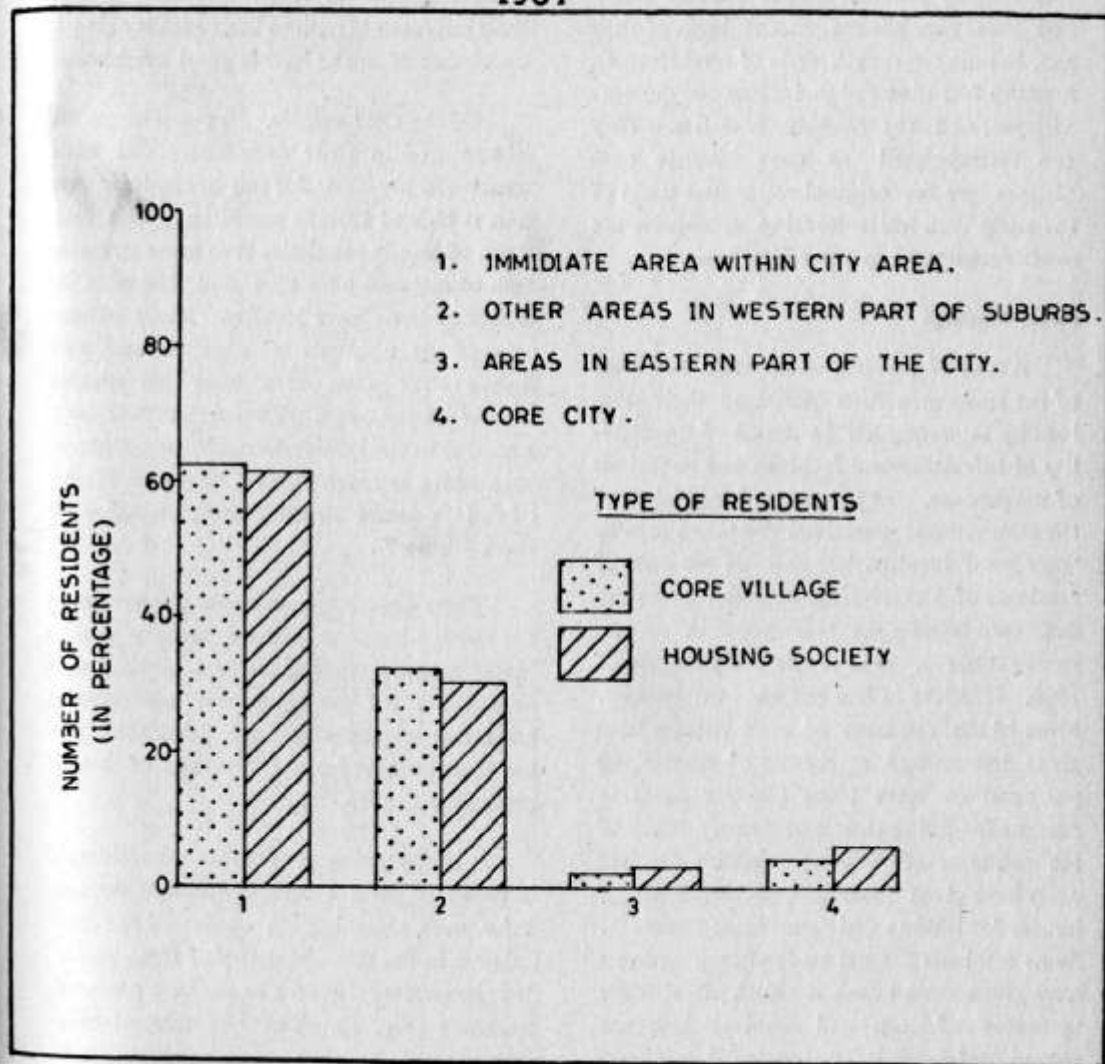
100
80
60
40
20
0

1   2   3   4

Fig. 3

not just merely a complex organisation of social life.   Like many other suburbs of pre-colonial cities of India, the study area shows difference in the types of housing structure. The housing structure here is broadly classi-fied into two groups on the basis of their age, building material, style of architecture, housing facilities and maintenance—(a) core villages, and (b) housing societies. They are distinguished as such because core villages are the original residential parts of the study area while housing complexes are made recently on co-operative basis.

Main Findings

About 47 per cent of the total residents of the study area have perceived their own locality as 'very good' in terms of availabi-lity of infrastructural facilities and behaviour of neighbours.   79 per cent of residents of the core villages perceived their own area as 'very good' locality, but only 41 per cent of residents of the housing societies perceiveo their own locality as 'very good' in all res-pects (Table 1).   Out of the total sample of 1500, 1125 like to live in their own locality. Most of the residents of core villages have given first rank to ownership of houses (49 per cent) or birth place (32 per cent) as reasons for liking their own areas.   Most of the residents of housing societies (72 per cent) have given first rank to ownership of houses for linking their own areas (Table 2). Some residents (38 per cent) of core villages have given second rank to 'birth place' while 'nearness to friends and relatives' also gets second preference by residents (39 per cent) of core villages.   Most of the residents of housing societies (50 per cent) have given second rank to 'good neighbours' and

'spacious accommodation' (28 per cent) as reasons for liking their own areas.   It is clear that the residents of core villages like their own area as it is their place of birth. while residents of housing societies, who have migrated here, like their locality due to ownership of house having good neighbours.

Of the total sample, 20 per cent do not like to live in their own area.   The main reason (80 per cent) for not liking their own area is lack of various amenities.   The resi-dents of housing societies give more stress on lack of different amenities and facilities for disliking their own locality.   Most (80 per cent) of the residents of core villages who dislike their own area have no specific reason (75 per cent).   They do not like own area due to the inmigration of the people of high status as neighbours.   They are afraid of their cultural identity being engulfed by them (Table 3).

These dissatisfied residents (80 per cent) are not leaving their present locality due to higher rents in other areas, not getting suit-able house (42 per cent) and not getting house due to non-vegetarian food habit (35 per cent) (mainly for the residents of hous-ing societies) (Fig. 2).

It is interesting to note that the residents of core villages and housing societies do not differ much regarding the choice of residen-tial area in the city.   Majority of them prefer their immediate city area as the best place of residence (Fig. 3).   The residents of core villages and housing societies have little difference regarding their perception of various parts of the city. They prefer walled city for shopping and Ashram Road for

Table 2

Reasons for liking own area of residence (in percentage), 1981

A—First Rank

(Responses in percentage)

	1	2	3	4	5	6	7	8
				Reasons				
Type of residence	Own house	Birth place	Low rent	Closer to friends and relatives	Spacious accommo- dation	Good neighbour	Peaceful area	Total percen- tage
Core Villages	49	32	3	16	—	—	—	100
Housing Societies	72	—	18	5	3	1	1	100

B—Second Rank

	1	2	3	4	5	6	7	8
Core Villages	—	39	—	39	5	17	—	100
Housing Societies	—	—	—	16	28	50	6	100

Source—Field survey

entertainment, e.g. cinema, restaurant, etc. Navrangpura area for education. They prefer Ashram Road and Ellisbridge area as the best locality of Ahmedabad city (Table 4). Suburban people consider the walled city and industrial areas in the eastern parts as congested, dirty and noisy.

Table 3

Reasons for disliking own area of residence 1981

A—First Rank

	Reasons		(response in percentage)		
Type of residence	1 Lack of various amenities	2 Lack of sanitation, removal etc.	3 Not matching with the residence of neighbour	4 No specific reason	5 Total percentage
Core Villages	17	3	3	80	100
Housing Societies	50	13	35	2	100

B—Second Rank

Core Villages	10	7	75	8	100
Housing Societies	—	67	14	19	100

Source—Field Survey

It is interesting to note that the residents of core villages and housing societies do not differ much with regard to the choice of residential area and perception of different parts of the city but they differ considerably regarding their own locality with respect to various aspects like availability of amenities, shopping facilities in the locality, behaviour of neighbours, etc. The residents of core villages have very high opinion about their own locality. This is mainly due to their greater attachment to their places of birth than the residents of housing societies. The suburban population, due to their attachment to their own areas, have over-rated their own areas. They have high opinion about their area compared to that of the investigator (Table 5 and 6).

Table 4

The preference of residents of various parts of Ahmedabad city for different activities (in percentage), 1981

A—Core Villages

	Parts of city								
	1	2	3	4	5	6	7	8	9
Type of activities	Walled City	Ashram Road	Navrangpura etc.	Narangpura	Paldi	Maninagar Kankaria	Shahibag	Mill area	Total percentage
1. Shopping	99	1	—	—	—	—	—	—	100
2. Entertainment	48	52	—	—	—	—	—	—	100
3. Education	12	13	75	—	—	—	—	—	100
4. Residential	—	—	32	38	8	6	16	—	100
5. Best area	—	75	17	2	2	—	4	—	100

B—Housing Societies

	1	2	3	4	5	6	7	8	9
1. Shopping	88	8	2	1	1	—	—	—	100
2. Entertainment	39	59	—	—	—	1	1	—	100
3. Education	10	22	69	—	—	—	—	—	100
4. Residential	2	6	32	28	26	4	2	—	100
5. Best area	—	77	12	7	3	—	—	1	100

Source : Field Survey

Table 5

Evaluation of of environmental quality of their own locality, *by residents* 1981

Name of Maujas	Types of residents	
	Core villages	Housing societies
1. Vejalpur	0.96	0.87
2. Jodhpur	0.97	0.86
3. Vastrapur	0.91	0.75
4. Memnagar	0.88	0.91
5. Ghatlodiya	0.94	0.68
6. Thaltej	0.98	0.78
7. Chandlodiya	0.88	0.96
8. Ranip	0.85	0.97

Scale of perception index

1.	More than 0.95	Very high
2.	0.91 to 0.95	High
3.	0.86 to 0.90	Average
4.	0.81 to 0.85	Low
5.	Less than 0.81	Very low

Source—Field survey by the author.

$$\text{Perception index} = \frac{\text{O.P.}}{\text{M.P.}}$$

O.P. = Obtained point
M.P.= Maximum point

Note —Perception index has been measured with respect to the evaluation of residents of their own area regarding available amenities, housing characteristics and overall nature of the area.

Conclusions

The empirical study of the residents of the core villages and housing societies brings out clearly that the perception of residents is closely associated with the particular environment they live in, their socio-economic background, the exposure to various parts of the city or the region, information available at hand and the capability of using such information.

It is not surprising that residents of core villages have over-rated the environmental qualities of their respective neighbourhoods. They like to live in the core villages as the life style is based on primary relationship and personal identity. In addition to these social reasons, economic reasons are also important for them to stay there, e.g. own house, nearness to the place of work, etc. Being satisfied on socio-economic grounds, residents of the core villages have adjusted to the physical problems of the environment.

Table 6

Evaluation of residents and the investigator about suburban environment, 1981

Name of Maujas	Type of residents	
	Residents	Investigator
1. Vejalpur	0.88	0.56
2. Jodhpur	0.83	0.42
3. Vastrapur	0.71	0.38
4. Memnagar	0.67	0.38
5. Ghatlodiya	0.62	0.41
6. Thaltej	0.82	0.25
7. Chandlodiya	0.71	0.28
8. Ranip	0.70	0.33

Scale of perception index

1.	More than 0.80	Very high
2.	0.71 to 0.80	High
3.	0.61 to 0.70	Average
4.	0.51 to 0.60	Low
5.	Less than 0.51	Very low

Source—Field survey by the author.

$$\text{Perception Index} = \frac{O.P.}{M.P.}$$

O.P. = Observed points
M.P. = Maximum points

Note — Perception index has been measured with respect to the evaluation of residents and the investigator of a locality regarding available amenities, housing characteristics and general appearance of the area.

There is no doubt that perception of environmental phenomena vary among the residents of the core villages and the housing societies. The residents of housing societies like their present location because they have built houses, the area is clean and peaceful and there are cultured and educated neighbours.

To conclude, perception varies by community in a particular environment. But the image changes among people of the same community when they are displaced to a different environment.

REFERENCES

Brookfield, H.C. (1969) : "On the environment as perceived" in Board C., et al. (eds); *Progress in Geography Vol. I* Ed. Arnold, London, pp. 51-80.

Desai, A. (1980) : "The environmental perception of an urban landscape, The case of Ahmedabad", *Ekistics* Vol. 47, No. 283.

Downs, R.M. and Sica, D. *eds.* (1973): *Image and Environment Cognitive Mapping and Spatial Behaviour*, Aldine, Chicago.

Klein, H.J. (1967): The delimitation of the town centre in the image of its citizens," in E.J. Bril *(eds) Urban Core and Inner City*, University of Leiden,.

Saarinen, T.F. (1969) . Perception of environment," *Commission of College Geography*, Resource Paper No. 5, Washington DC.

Tuan, Yi-Fu (1974) : *Topophilia : A study of Environmental Perceptions, Attitude and Value*, PrenticeHall, Englewood Cliffs, New Jersey.,

PROCESS OF CHANGE, URBANIZATION AND PHYSICAL QUALITY OF LIFE IN NORTH–WESTERN REGION : AN EMPIRICAL STUDY*

A.C. JULKA AND P.K. SHARMA
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Accepting urbanisation as a conscious and conditioned adjustment of societies to their changing environment, the paper explores the dynamics of urbanisation in the North–Western India. Population Census data from 1901 to 1981 are deployed to statistically test the 'replacement hypothesis'. A very high degree of explanatory power of the model and statistical significance of the estimates vindicate the replacement dynamics. Given the reliability of the estimated function, population projections for the 21st century are made. Further, assuming urban transformation as a change from agrarian to an industrial service society, the paper also examines the socio-economic correlates of this change and explains the inter–district variations in urbanisation in terms of the activity mix. The consequences of the fast pace of urbanisation are gauged through variability in the physical quality of life. The results of a cross–section exercise strongly indicate a deteriorating quality of life in the uaban centres. Going by the existing budgetary allocation and linear responses to the individual constituents of PQLI, it is contended that the present rates of urbanization, if unattended, would spell gloom if not doom for the urban masses of the region.

The process of economic development and societal change are co-generic. Both are rooted in the continuous interplay of division of labour, specialization and technical change. These changes manifest conscious or conditioned adjustment process of societies to their environment.[1] In some basic sense, it is the continuous intercourse of goods, ideas and groups (placed in an environment), and the changing environment itself that determine the nature, spread, and speed of these processes. A gradual change either remains unnoticed or is accepted as the norm. It is only when there is some sort of a quantum leap that explanations are sought.

Urbanisation is one such process which recorded a jump and hence attracted much attention. Initially accepted and promoted as an index of national prosperity/human progress, its phenomenal rise in the Third World has met with disapproval and alarm.[2] It is called 'pseudo' by virtue of the fact that

it does not square with the one that occurred in the advanced countries at their comparable stage of industrialization and economic growth. Little attention is paid to the fact that what used to be the outcome of mainly an endogenous dynamics is now considerably shaped by exogenous designs[3]. Moreover, a late starter, fascinated by outer covers of changing reality, often displays a tendency to over-shoot. And, that seems to be the case of the developing world showing urban primacy.

Naturally, in this transitional phase, prior to the emergence of a fully integrated space economy,[4] several imbalances and frictions are bound io appear. At this stage, the charge that 'the urbanisation process in the Ihird World has neither the economic strength of developed capitalist nations nor the systematic playing of socialism. It has the worst of the other two worlds., at least with respect to urbanization' (Dwyer, (1975) quoted in Verma (1989; p. 23)), need not be dismissed as a reactionary thought. Neither it is necessary to join issues with the 'over urbanisation thesis'. As Mathur (1988) put it, 'In our view, the desirability or otherwise of the urbanisation process is less of an issue now than it was in the past. The issue is how we can facilitate the future course of urbanisation. The issue is how we can design policy responses so as to provide better interface between the urban and the national economy'[5].

Therefore, it is pertinent to examine the future trends in urbanization, study its casuative correlates, and estimate likely pressures on urban activity-mix and available amenities. This becomes all the more important in the Indian context because rather than strengthening a rural-urban continuum, it is the rural-urban divide which is played upon here[6].

In any such bid, study of long-term growth of Urban Population marks the first essential step. Natural increase in population, migration flows and appearance of new urban centres contribute towards this growth. Each of these contributing factors is, in turn, inter-linked with economic growth and accompanying structural change. While the nature, strength and interaction of these constituents are moot points in themselves, even the direction of causation is not a safe bet. it is now generally believed that while economy-wide growth surely influences the rate of urbanisation, urbanization may also influence aggregate growth (Killey and Willanison, 1982 p[7])

Against this back-drop, we are inclined to look for an alternative to the traditional Demographic or Demo-Economic models of urbanization for making urban growth projections. While we fully endorse logical consistency and Realism as the test of a theory, it is the Friedmanian predictive ability that we look up to for the present purpose.[8]

Accordingly, in this paper, we explore the dynamics of urbanization in the North-Western India on the basis of the 'replacement hypothesis'. This hypothesis was successfully used by Fisher and Pry (1971) to describe the replacement of an old technology by a new. The rationale for such a hypothesis flows from a model of a self-organizing system governed by Lotka-Volterra equations[9]. (for details See Fisher and Pry, 1971). It is visualized that the society

as a whole and its numerous subsets operate like learning systems. Consequently, technological and social evolutions can be seen as a sequence of replacement of one technique by another.

Hermann & Montroll (1972) argued that in an economy undergoing industrial transformation the changing proportion of workers in agricultural/non-agricultural sectors corresponds to the replacement of one activity by another. Jain and Karmeshu (1982) extended the same idea to study the urbanization process in India. Rao *et. al.* (1989) successfully tested the hypothesis using time-series data on urbanization for eleven countries. Since in all these works the reported fits were remarkably good, a sceptic might attribute these regularities to the cancelling of errors effect in the study of aggregates. Therefore, the paper re-examines the working of those processes at a much lower level of aggregation. In this vein, we retain their model for estimating the trends in urbanization at lower levels of aggregation for the study area. A brief description of the model is reproduced here :—

Let $U(t)$ = the urban population at time t,

$R(t)$ = the rural population at time t,

and, $T(t)$ = the total population at time t, in an area.

Define $X(t) = U(t)/T(t)$, as the 'urban growth'

The variable $X(t)$ satisfies the differential equation

$$dX(t)/dt = bX(t)\ldots\ldots\ldots(1)$$

Integrated both sides, we get

$$\text{Log } X(t) = a + bt \ldots\ldots(2),$$ where a is Log X (O) and b is the constant replacement parameter. The parameters a and b can be easily estimated by using time-series data on X for an area applying linear regression.

Using secondary data from population census reproduced in statistical abstracts of Haryana, Himachal Pradesh, Punjab and the Indian Union, the two parameters of the stated model have been estimated for the four states and the Indian Union. The results are presented in Table-1

Obviously, our equation-(2), summing the replacement dynamics, fits the data very well at both the levels of aggregation. The results very strongly vindicate the 'replacement hypothesis' even at the sub-economy level. In spite of the geo-cultural and socio-economic variability of these units, a near stability of the relationship is striking. Plots of log $X(t)$ against time (See Figure) don't produce straight line but we do observe straight stretches. A slide down or a slide up, showing deflection from the straight line path, can be visualized as the non-internalized exogenous shock or stimulus. The departures from log linear path are more pronounced for the decade 1941-51. That was the period of transition for the nation as a whole but the brunt was borne by these states. After the adjustments, the growth path resumed its course. It is not a mere rationalization of the observed. Our familiarity with this region prompts us to associate these departures with partition, re-organization and re-adjustments.

Table—1

Estimated parameters of the Time-Series Regression

State	Period	a	b	R²
Haryana	1901-1981	1.2321	0.0420 (4.37)*	0.88
Himachal Pradesh	1901-1981	0.7020	0.0520 (10.63)*	0.85
Jammu & Kashmir	1901-1981	1.1922	0.0548 (6.83)*	0.96
Punjab	1901-1981	1.3307	0.0612 (4.57)*	0.96
India	1901-1981	1.2358	0.0560 (6.72)*	0.97

Figures in brackets are 't'—values
*denotes significant at 1% level.

Thus, given our inability to statistically reject the replacement hypothesis, we proceed to project the urban population of these states for four points of time. Results of this exercise are reported in table 2.

On comparing these forecasts of urbanization with those given by the National Institute of Urban Affairs,[8] we find that the replacement dynamics holds a better promise. Therefore, the policy makers can estimate the derived demand for various services in the urban centres of this region by relying on this simple forecasting procedure.

The results in table-1 bring another significant point to the fore: similarity of response should not be confused with uniformity of response. We observe considerable variations in the estimated parameters across states. One can find an explanation of these variations in the varied production structure of these economies and suggest policy packages. However, in the present exercise, we refrain from that and instead focus our attention on the socio-economic correlates of this change across districts of this region. Given the recent policy thrust on District planning, this exercise would be of immediate relevance. Taking district as the unit of analysis, five sets of rank-correlations were obtained (Table 3).

This rudimentary exercise reveals some basic facts of urbanization in the region. We observe that both in Punjab and Haryana urbanization and economic growth have moved together but the same can not be said about the Hill-Economy of Himachal Pradesh. Moreover, this wave of urbanization is positively associated with the process of industrialization but the expansion of services presents a sorry state of affairs. It seems to be the weakest spot of our urban revolution.

The history of urbanization suggests that a healthy development of these new structures depends, in the main, upon the availability of rural surpluses. There have to be sufficient surpluses not only to foot
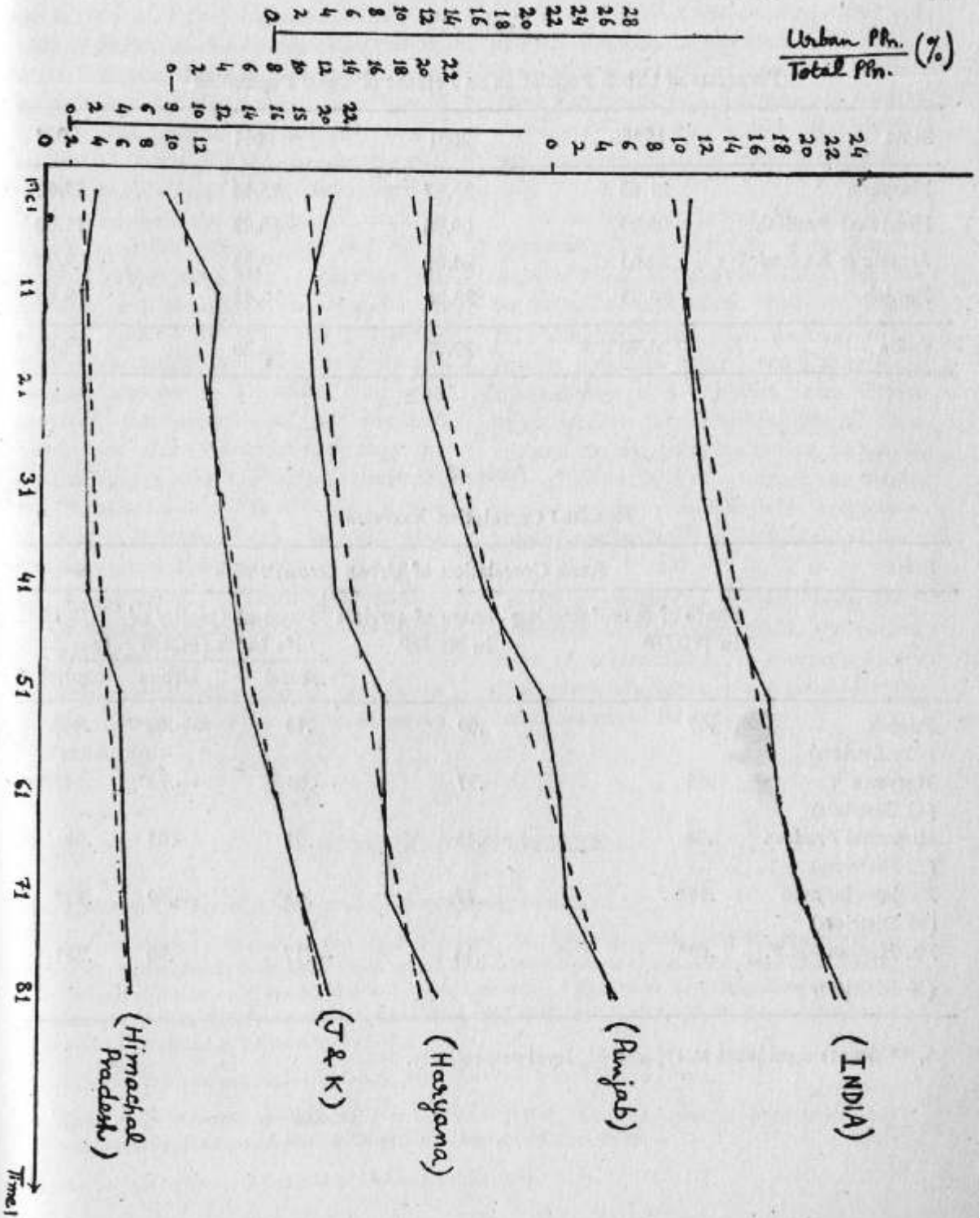
Table—2

Forecasts of Urban Population as Percent of Total Population

State	1991	2001	2011	2021
Haryana	21.68	23.37	25.14	27.00
Himachal Pradesh	08.39	09.36	10.43	11.60
Jammu & Kashmir	22.63	24.92	27.35	29.93
Punjab	30.23	33.28	36.48	39.80
India	24.70	27.20	29.80	32.60

Table—3

Results : Correlation Exercise

State	Rank Correlation of Urban Growth with				
	Share of manufacturing in NDDP	Share of services in NDDP	Physical Quality of Life Index (PQLI)		NDDP (per capita)
			Rural	Urban	
Punjab (12 Districts)	.47	.09	.13	—.62**	.81*
Haryana (12 Districts)	.46	.37	—.03	—.72*	.66**
Himachal Pradesh (12 Districts)	.38	—.13	.21	—.05	.08
Punjab-Haryana (24 Districts)	.55*	.37	.63*	—.59	.83*
Pb.-Haryana-H.P. (36 Districts)	.69*	—.14	—.17	.30	.78*

*, ** denote significant at 1% and 5% level respectively.

the bill for their own requisites but also to support and sustain the entire chain providing linkages between specialisms and spatialisms. A failure on that count would mean a fast deterioration not only in the quality of urban life but in the physical quality of life itself in the urban areas[9]. Table-III offers strong empirical evidence in that direction. It is found that in the case of urban areas, the coefficients are negative and statistically significantl. In contrast, atleast for the rural Punjab-Haryana, a positive and significant association is observed. Therefore, one can conclude that in spite of the so-called 'urban-bias' of our development strategy, the physical quality of life in the urban segment has registered a significant decline during the process of urbanization. One can read two messages in this result :

(i) A movement of the 'poor quality' human resource/areas into the urban fold; and,

(ii) Mis-matched allocation of public resources, to the utter neglect of urban settlements.

In case this diagnosis is correct then our District Planners are cautioned to be watchful. Having committed themselves to the current trends in urbanization, as a natural outcome of economic growth, they cannot escape the responsibility towards urban life.

If we consider Infant Mortality, Life Expectancy and Literacy, the three components of PQLI, and their individual response to budgetary allocations then we cannot help being pessimistic. On the basis of the present trends in efforts, and attainments, the fulfilment of a cherished urban dream might require a patient waiting time of over a century. Or else, there has to be a mammoth flow of resources in this segment, an option that is politically ill-affordable and economically non-viable.[10]

Thus, irrespective of India being over-urbanized or under-urbanized, the present rates of urbanization, if unchecked, are likely to spell gloom, if not doom, for the urban masses of the region.

NOTES AND REFERENCES

1. V. Gordon Childe (1951) has systematically developed this theme.

2. Besides the over urbanization thesis in this context, the following quote from Hagmuller (1970; p. 40), 'urbanization in the third-world tended both cause and effect of continued under-development and increasing poverty', can be seen as a typical statement. For details see, Hagmuller (1970) and also Mc Gee (1968). For trends in urbanization, refer to United Nations (1980), Rogers (1982) and National Institute of Urban Affairs (1988).

3. This view is based on Childe (1951) and, Alan Gilbert & Joseph Guglar (1981).

4. For a stage theoretic approach, refer to Friedman (1966). However, essential details and ciarctil comments on the same are given in Gilbert and Guglar (1981) pp. 31-35.

5. c.f. preface to National Institute of Urban Affairs (1988).

6   Eversince Michael Lipton (1980) promoted this line of thought, the theme clicked very well with politicians and researchers alike. Mid eighties saw a mushrooming of literature on the subject. One can refer to Westley (1986) as a bibliographic source.

7.   M. Friedman (1953) asserted that predictive performance is the most important criterion of the validity of a model.

8.   This observation is based on the better proximity of our results to the observed rates of urbanisation for 1981 than those predicted in National Institute of Urban Affairs (1988), p. 72.

9.   Physical Quality of Life Index (PQLI) is supposed to capture the standards of education, health and child care and provision of basic amenities. For details regarding computation and justification of the PQLI see, Morris (1974). For a description of the state of affairs in the Third World, refer to Gilbert & Guglar (1981) and also D. Frick (ed. 1986) for pathetic state of being in urban centres in general.

10. If the present linear trends continue then we, eexpect to achieve the desired life expectancy of 78 years by 2014 A.D.; zero infant mortality by 2087 A.D.; and, full literacy by 2093 A.D. Assuming a linear expenditure response of the individual components an estimated 6772.71 crores of rupees (1950–51 prices) are required for attaining an average life expectancy of 78 years. The corresponding expenditures for the desired infant mortality and literacy standards comes to Rs. 10220 crores and 30780 crores respectively. This assertion is based on an empirical study got conducted by the first author. For details see, Mandip S. Sandhu (1989).

Childe, V. Gordon (1951): *Man Makes Himself*, Mentor books, New York.

Dwyer, D.J. (1975): *People and Housing in the Third World, Cities*, Longman, London.

Fisher, J.C. and R.H. Pry (1971), 'A Simple Substitution Model for Technological Change', *Technological Forecasting and Social Change*, 3, pp. 75-88.

Frick, Dieter (ed.; 1986): *The Quality of Urban Life*, Walter de Gruyter Berlin, New York.

Friedman, J.P. (1966): *Regional Development Study : A case study of Venezuela*, MIT Press, Cambridge.

Friedman, J.P. (1966): Regional Development Policy : A case study of Venezuela, MIT press, Cambridge.

Friedman, Milton (1953): *Essays in Positive Economics*, Chicago University Press.

Gilbert Alan and Joseph Guglar (1981): *Cities, Poverty and Development : Urbanization in the Third World*, ELBS, Oxford University Press, Oxford.

Hagmuller, G. (1970): *A Noose Around the City*, Ceres.

Hermann, R and E.W. Montroll (1972), 'A manner of characterizing the development of countries', *Proceedings of the National Academy of Sciences of the United States of America*, 69, pp. 3019-24.

Jain, V.P. and Karmeshu (1982): 'On projections of urbanisation of India : An application of replacement dynamics', Unpublished manuscript.

Helley, Allen C and Jaffrey G. Williamson (1982): *What Drives Third World City Growth ? A Dynamic General Equilibrium Approach*, Draft 1982.

Lipton, Michael (1980): *Why Poor People Stay Poor : A Study of Urban Bias in Development*, Heritage, New Delhi.

Mc Gee, T.G. (1968): *The South-East Asian City*, Fredrick, A. Praeger, New York.

Morris, D. Moris (1974): *Measuring the Conditions of the World's Poor : The Physical Quality of Life Index*, Pergamon, New York.

National Institute of Urban Affairs (1988), *State of India's Urbanisation*, New Delhi.

Rao D.N. et al. (1989): Dynamics of urbanisation : the empirical validation of the replacement hypothesis', *Environment and Planning B : Planning and Design*, 16, pp. 483-506.

Rogers, A (1982): 'Sources of urban populatton growth and urbanization, 1950-2000 : A democraphic accounting ; *Economic Development and Cultural Change*, 30, pp. 483-506.

Sandhu, Mandip S. (1989): *The Welfare State : A Jig Saw Puzzle*, Unpublished thesis, Deptt. of Economics, P.U., Chandigarh.

Shukla, Vibhooti (1988): *Urban Development and Regional Policy in India : An Econometric Analysis*, Himalaya Publishing House, Bombay.

United Nations (1980), 'Patterns of urban and rural population growth', *Population Studies No. 68*, Deptt. of International Economic and Social Affairs, New York.

Verma, S.S. (1989) *Urbanization and Regional Development in India*, Chugh Publications, Allahabad.

Westley, John R. (1986), *Agriculture and Equitable Growth : The Case of Punjab-Haryana*, Westview Press, Boulder & London.

DEMOGRAPHIC CHARACTERISTICS OF THE ENVIRONS OF TARAPUR ATOMIC POWER STATION

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The paper examines the demographic characteristics of the environs of Tarapur power station in a specific context. The two basic objectives of the study are (i) to evaluate the suitability of the Tarapur power station for establishing additional nuclear power generation units, and (ii) to understand the impact of any accident on the demography of the region in close proximity of the station. The paper makes use of the census data as far as the demographic aspect of the region is concerned. It also makes use of the weather station data of Tarapur, particulary wind speed and wind direction data. The study reveals that the 5 km. sterilized ring around the Tarapur Atomic Power Station (TAPS) is not devoid of human settlement, though the governments' determination to keep it free of habitation is reflected in the zone's declining densities. It also reveals that due to high speed and inland direction of the winds, any accident of even minor nature can cause dispersal of radio active emmissions with serious implications. The paper, thus, establishes the unsuitability of the Tarapur plant for further expansion of its nuclear power generation capacity.

Introduction

The accident at the nuclear power station at Chernobyl in April 1986 focussed public attention on the atomic power industry (Ramberg, 1986, Greenwald, 1986, Barnathan 1986, Lean, 1986). While nuclear scientists, on the one hand, were trying to understand the sequence of the events which led to the accident so that appropriate measures could be enforced to ensure better safety, social scientists, on the other hand, were concerned with the impact of such accidents on the environment and habitation (Flavin, 1987 & Sarma, 1987).

No analysis of impact can be made without a detailed study of the demographic and land-use characteristics in and around a nuclear power station so that the consequential effects on the neighbourhood can be better comprehended. Such independent studies would be of help to further the activities of the Regulatory Authorities.

India went nuclear in 1956, when the first research reactor at Trombay went into operation. However, it is the Tarapur Atomic Power Station (TAPS) which marked the introduction of nuclear power generation in the country. The two units at

Tarapur (TAPS I & II) in Maharashtra were the first to go on stream in 1969.

The choice of Tarapur as a site for a nuclear power plant was a judicious one in the context of the 1960s. By established standards such a site should have an exclusion zone of 1.6 km radius around the plant. This area is owned by the Government and reserved exclusively for nuclear power operations or related activities. The area is out of bounds for the general public and therefore has no human habitation. In addition a zone of 5 km radius is declared as a "sterilized" zone where only natural growth is permitted. The siting criteria also stipulates that the nuclear power stations be away from large population centres (Abraham, 1987).

TAPS is sited on a low promontory which juts out 250 metres into the sea. 1.6 km to the north and north-east are two villages while to the south is the village of Akkarpati at about the same distance. Tarapur village is located 4.8 km away in the north-east direction (Bhat, et. al. 1972). It is quite obvious that human occupancy is not altogether absent in the vicinity of the plant. TAPS is situated about 110 km away from Bombay along the Western Railway route.

Following the establishment of the nuclear power station, a large industrial estate has developed during the last 15 years close to the Boisar railway station. This industrial estate attracts a very large number of personnel from Bombay and along with the colony of the power station and other nuclear facilities constitutes a larger density of human habitation than was ori-

ginally envisaged in the early 60s. Otherwise the region around TAPS is essentially agricultural in nature (Agarwal, 1986).
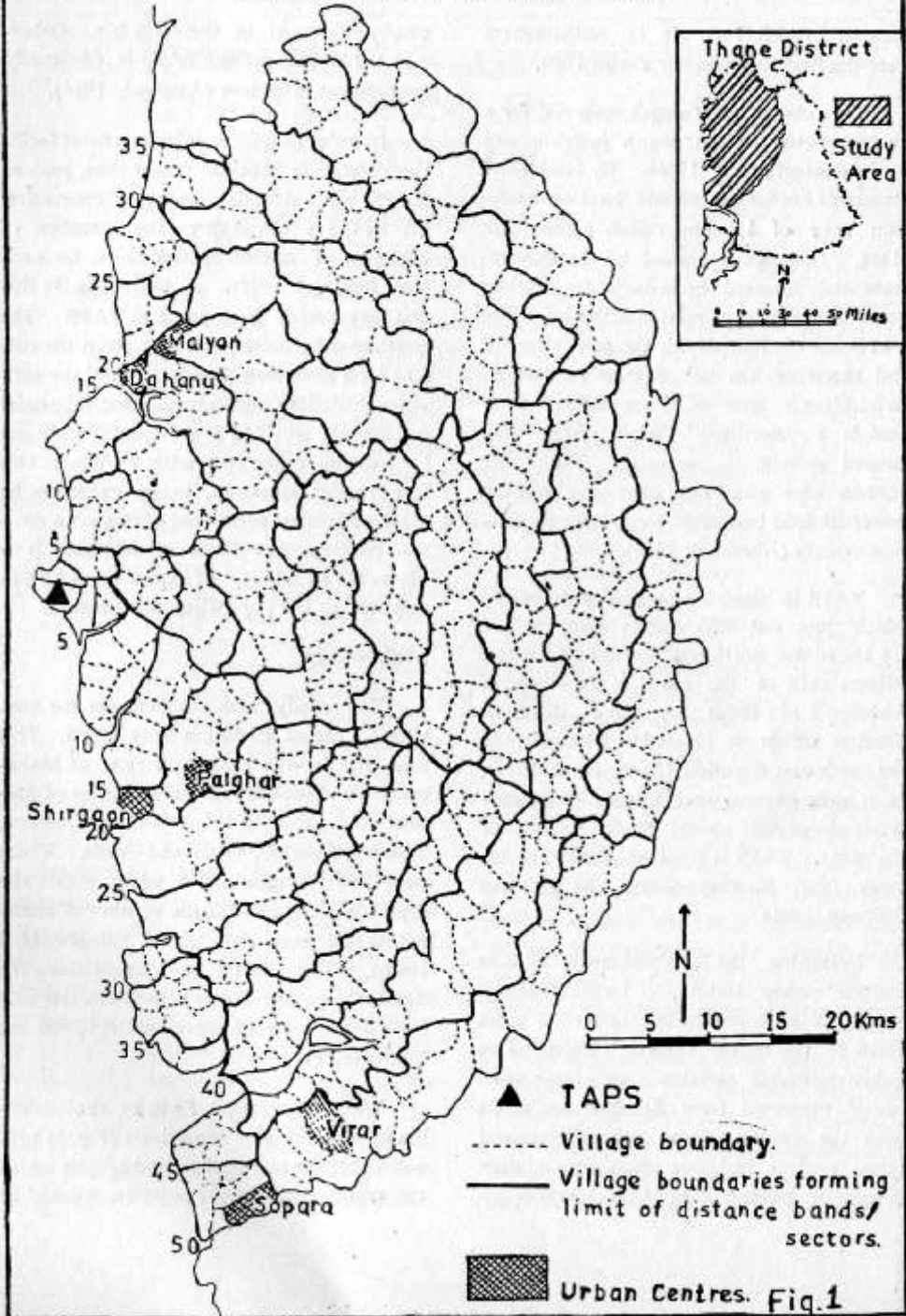
In order to utilize infrastructural facilities created at nuclear power sites, such as TAPS, the Atomic Energy Commission (A E. C.) is envisaging the creation of a cluster of nuclear power units, i,e. each site having 4 units. A beginning to this end has already been made at TAPS The question now arises, whether given the current level of human habitation and the activities including agricultural and industrial occupation, will TAPS still qualify as a site for locating other two units ? While this is a broader question, being examined by all the agencies connected with such a decision making, the focus of this study is to assess the suitability of expanding TAPS in relation to the population distribution.

Methodology

The study area encompasses the area within a radius of 50 km from TAPS. This area lies in the Thane district of Maharashtra and includes the entire taluka of Palghar and parts of the talukas of Dahanu, Talasari, Jawahar, Vasai and Vada. There were 454 villages and 5 towns within the region in 1971; in 1981 the number of settlements had increased to 534 villages and 6 towns. Since TAPS is located along the coast, the region forms a semi-circular unit having an area of approximately 2900 sq. km. (Fig. 1)

The topographical features such as uplands, coastal areas and rivers (Fig. 2) provided the physical background against which the spatial pattern of population could be

The Study-Area
TAPS and its Environs

Thane District

Study Area

▲ TAPS

------- Village boundary.

———— Village boundaries forming limit of distance bands/ sectors.

▨ Urban Centres. Fig.1

Malyan
Dahanu
Palghar
Shirgaon
Virar
Sopara

interpreted. Physically the region had two almost distinct parts: a narrow coastal plain about 10 to 15 km wide, east of which is an inland hilly area dissected by streams. The major transport arteries run parallel to the coast and have a north-south alignment viz. the Western Railway line and the Bombay-Ahmedabad National. Highway. The State highways are basically east-west and connect the railway stations to the interior villages.

In order to analyse the population distribution of the area in relation to TAPS, concentric circles at intervals of 5 km were drawn centred on TAPS; thus 10 distance bands were delineated. Since the direction and rate of radiation dispersion depends on wind, it is important to consider direction when studying impact of radiation. In order to incorporate this variable the the region was divided into sectors of 45° centered on the cardinal directions. Due to Tarapur being on the coast, some of the sectors fall on the sea and hence 5 sectors are differentiated viz. north, north-east, south-east and south. The data recorded by the weather station at Tarapur with respect to wind speed and direction was utilised.

The base map was prepared showing the village boundaries. The problem that arose in this respect was that changes had taken place in village boundaries between 1971 and 1981. This was largely due to the increase in the number of settlements. On closer scrutiny it was found that the increase in number was due to the bifurcation of original settlements. Whenever the bounderies for 1981 were not available for these new settlements they were adjusted

to the boundaries of 1971. Each village was categorised on the basis of the ring and sector in which the greater part of the village was situated. This resulted in villages being classified into 43 sector-segments, since 7 lie in the Arabian Sea.

The population size and density of population of each of the settlements was analysed for the decadal years 1961, 1971 and 1981 (Figs. 3 & 4). This data was utilized to derive the distribution of population in each ring and sector as well as sector-segments. This enabled the analysis of the distribution of population as a function of distance and direction from TAPS in each of the years. When this distribution is related to the direction of the prevalent winds it gives an indication of the population that would be directly affected in case of an accident.

Population of the Study area

The study area had a population of 4.9 lakhs in 1961; it increased to approximately 6 lakhs in 1971 and 7.2 lakhs in 1981. This indicates growth rates of 20.6% for the decade 1961-'71 and 21.7% for 1971-81. This is below the State growth rate of 24.5% (1971-81) and the national figure of 25% but much higher than the rural growth rate 17.6%. in Maharashtra.

The distribution of population for 1961, 1971 and 19. 1 shows that the largest settlements are naturally the urban centres and settlements along the railway line which have populations exceeding 5000 and in some cases over, 10,000 e.g. Virar and Palghar in 1981 (Fig. 3). The large rural settlements (2 00-5000) are situated along the

TAPS and its Environs:
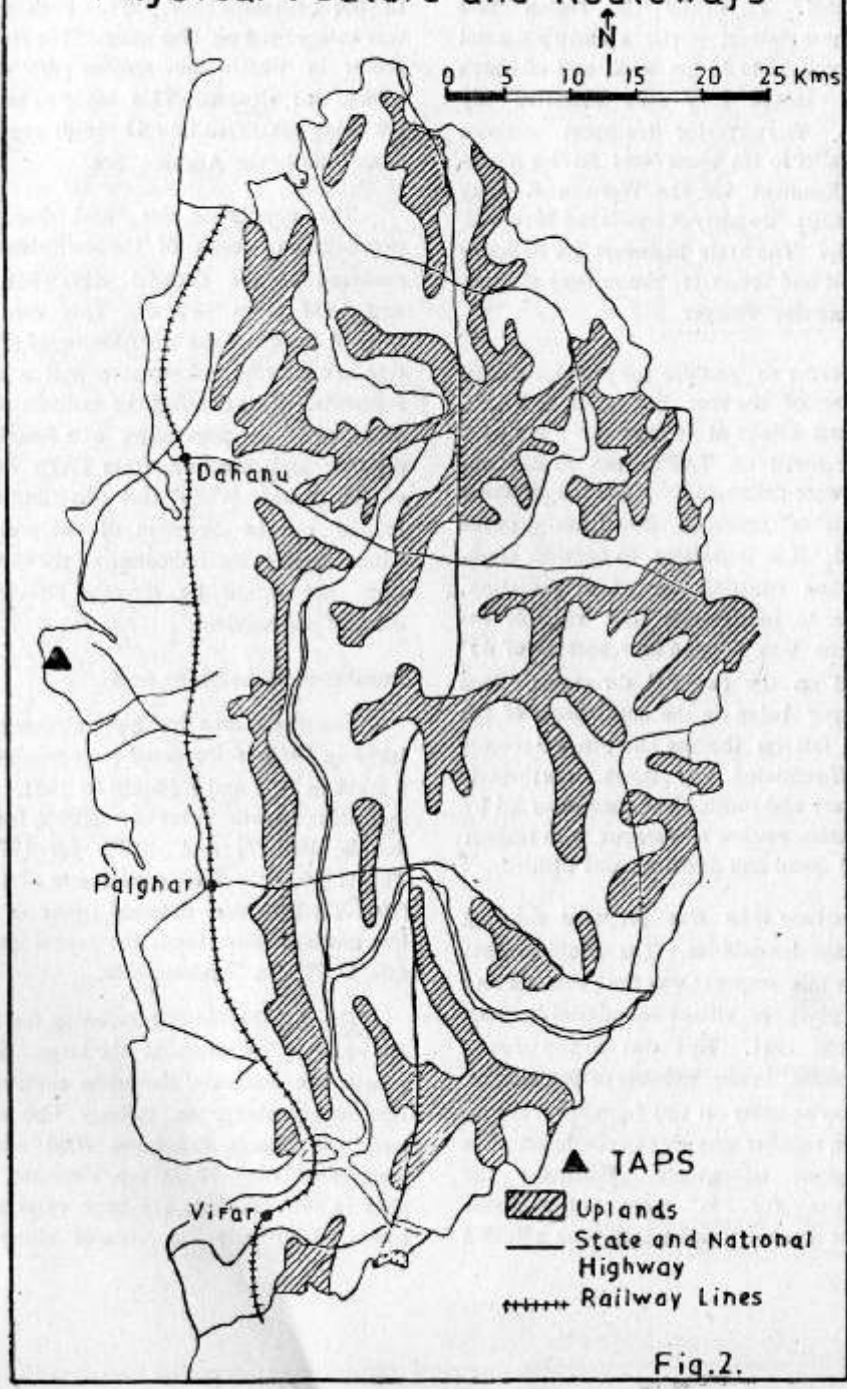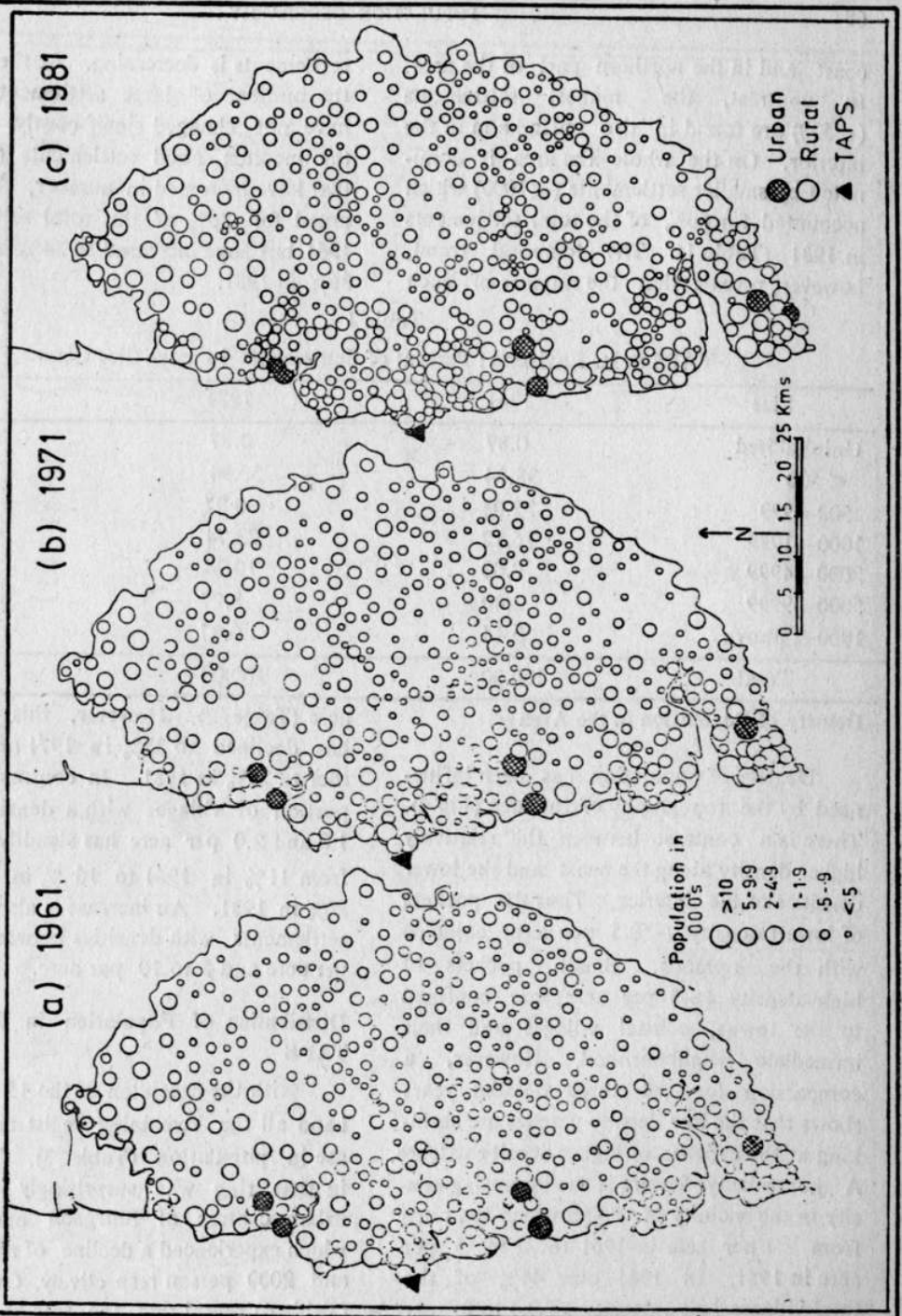Physical Feature and Routeways

0   5   10   15   20   25 Kms

Dahanu

Palghar

Vitar

▲ TAPS
///// Uplands
— State and National Highway
+++++ Railway Lines

Fig.2.

Fig.3. TAPS and its Environs:
Distribution of Population

(a) 1961.   (b) 1971   (c) 1981

Population in 000s
○ >10
○ 5-9.9
○ 2-4.9
○ 1-1.9
· .5-.9
· <.5

● Urban
○ Rural
▲ TAPS

N ←

0 5 10 15 20 25 Kms

coast and in the northern part of the area. In contrast, the mallest settlements (<500) are found in the upland and in the interior. On the whole the area is dominated by smaller settlements (<1000) which accounted for 60% of the total settlements in 1981 (Table 1). The temporal trend, however, reveals that the number of such settlements is decreasing. At the same time the number of large settlements (>5000) have not changed significantly. It is thus the medium sized settlements (1000-5000) that have increased in number. They accounted for 26% of the total settlements in 1961 but have increased to 34% in 1971 and 36% in 1981.

Table 1

TAPS & Its Environs : Percent of Settlements in each Size Class

Size	1961	1971	1981
Uninhabited	0.87	0.87	0.56
< 500	38.34	30.94	24.63
500—999	32.03	30·07	35.18
1000—1999	16.12	23.74	24.63
2000—4999	9.08	10.24	11.48
5000—9999	2.40	3.27	2.78
1000 & above	0.44	0.87	0.74
Total	100.00	100.00	100.00

Density of Population in the Area

Density of population has been influenced by the topography of the area (Fig.4). There is a contrast between the relatively higher density along the coast and the lower densities of the interior. Thus the pockets of lowest density (<0.5 per acre) coincide with the uplands. Small pockets of high density (>5 per acre) are confined to the towns, coastal villages and their immediate neighbourhood. However, a comparsion for the three decadal years shows that the low density patches are shrinking at the expense of higher density patches. A noteworthy feature is the increasing density in the vicinity of TAPS which has risen from <1 per acre in 1961 to 2 to 5 per acre in 1981. In 1961 over 44% of the total villages had a density of 0.1 to 0.5 per acre (Table 2). However, this proportion has declined to 32% in 1971 and still further to 25% in 1981. In contrast, the proportion of villages with a density between 1.0 and 2.0 per acre has steadily increased from 11% in 1961 to 16 % in 1971 and 20% in 1981. An increase is also evident in settlements with densities between 2 and 5 per acre and 5 to 10 per acre.

Distribution of Population in Relation to TAPS

With the exception of the 15 to 20 km band all the remaining registered an increase in population (Table 3). The decline in that ring was surprisingly due to the urban centres of Shirgaon and Dahanu which experienced a decline of about 10,000 and 2000 person respectively. Growth rates (Table 4) reveal that the rate of population

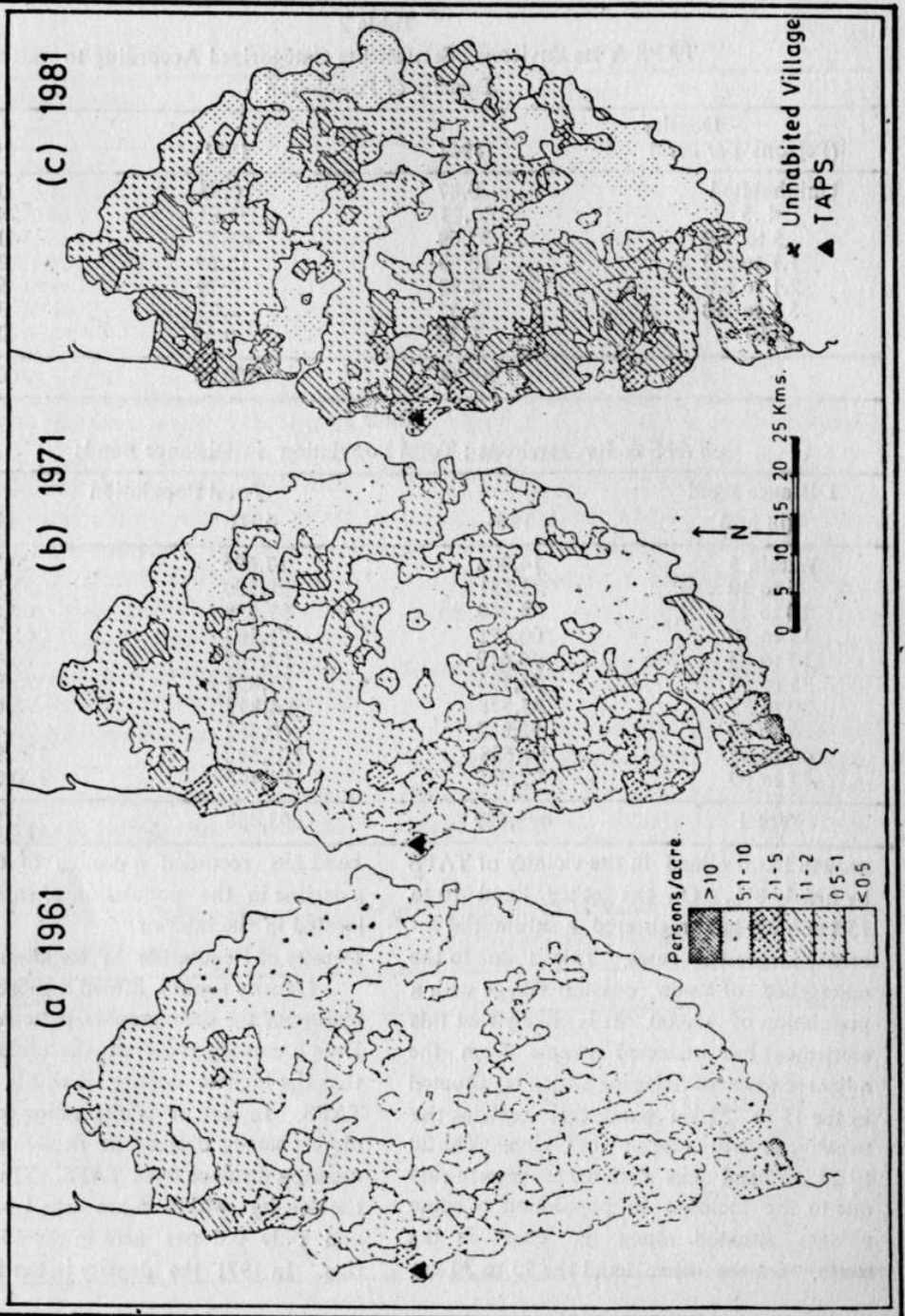Fig.4. TAPS and its Environs: Density of Population

(a) 1961　(b) 1971　(c) 1981

Persons/acre.
>10
5·1-10
2·1-5
1·1-2
0·5-1
<0·5

× Unhabited Village
▲ TAPS

N

0　5　10　15　20　25 Kms.

Table 2

TAPS & Its Environs : Settlements Categorized According to
Density of Population

Density (Persons per acre)	1961	1971	1981
Uninhabited	0.87	0.87	0.56
< .5	44.23	31.81	24.90
.5 to 1.0	37.69	43.57	41.08
1.1 to 2.0	10.89	15.69	20.07
2.1 to 5.0	4.58	4·79	9.48
5.1 to 10	1.52	2.62	3.72
> 10	0.22	0.65	0.19
	100.00	100.00	100.00

Table 3

TAPS & Its Environs : Total Population in Distance Bands

Distance Band (in km)	Total Population		
	1961	1971	1981
Within 5	14,208	17,695	20,729
5 to 10	23,131	28,350	35,126
10 to 15	29,250	37,258	62,532
15 to 20	60,271	71,103	65,735
20 to 25	46,612	53,955	70,412
25 to 30	54,394	63,831	70,920
30 to 35	55,378	64,897	78,653
35 to 40	52,852	60,562	73,474
40 to 45	84,658	103,592	125,928
45 to 50	72,935	94,165	120,873
Total	493,689	595,408	724,382

growth has declined in the vicinity of TAPS by nearly 8%. On the other hand 10 to 15 km band has registered a substantial increase in growth rates. This is due to the emergence of a new coastal village with a population of 15,000. It is likely that this settlement has attracted people from the adjacent town of Shirgaon which is situated in the 15 to 20 km band; this explains the negative growth rate in that ring. The 20 to 25 km band has doubled its growth rate due to the increase in population of some villages situated along the coast in the south. On the other hand the 25 to 30 km

band has recorded a decline of 6% due to a decline in the population of some villages located in the interior.

Density of Population in Relation to TAPS

Density figures afford a more realistic picture of the demographic pattern (Table 5). Even a cursory glance at the table indicates that the highest density is within 5 km of TAPS. In fact it is interesting to note the almost steady decline in densities with increasing distance from TAPS. Thus in 1961 the density within 5 km was 1.43 per acre and only 0.6 per acre in the 45 to 50 km ring. In 1971 the density in the first 5 km

Table 4

TAPS & Its Environs : Growth Rate of Population in Distance Bands

Distance Band (in km)	Growth Rates	
	1961—'71	1971—'81
Within 5	24.54	17.15
5 to 10	21.62	23.90
10 to 15	27.37	67.84
15 to 20	17.97	—7.54
20 to 25	15.75	30.50
25 to 30	17.35	11.11
30 to 35	17.19	21.20
35 to 40	14.59	21.32
40 to 45	22.37	21.56
45 to 50	29.11	28.36

band was 1.78 per acre while in the outermost zone it was 0.77 per acre. In 1981 again the density in the inner most band was 2.08 per acre while it was only 0.99 per acre in the outer-most one. Obviously in every decade the density in the area nearest TAPS is more than double the density of the outer-most band. The spatial pattern between 1961 and 1971 is remarkably similar; 1981 shows a departure due to the decline in Shirgaon's population.

The temporal trend indicates a steady increase in density between the years 1961 and 1981. It is only the 15 to 20 km band that has experienced a decline in density between 1971 to 1981 (Table. 5). It is evident that the inner band of 5 km radius has not only high densities of population but has also experienced a substantial increased in density.

Sectoral Distribution of Population

To bring out the sector-wise distribution of population the percent of sectoral population to the total population has been computed (Table 6). The south-east sectoral

Table 5

TAPS & Its Environs : Density of Population in Distance Bands

Distance Bands   Density (persons per acre)

(in kms)	1961	1971	1981
Within 5	1.43	1.78	2.08
5 to 10	1.13	1.36	1.71
10 to 15	0.84	1.07	1.80
15 to 20	1.10	1.30	1.20
20 to 25	0.74	0.86	1.12
25 to 30	0.69	0.81	0.90
30 to 35	0.59	0·69	0.84
35 to 40	0.51	0.59	0.73
40 to 45	0.62	0.76	0.92
45 to 50	0.60	0.77	0.99

POPULATION GEOGRAPHY

Table 6

TAPS & Its Environs Percentage of Population in Each Sector-segment

Sector/Distance Band (in km)	Year	North	North-east	East	South-east	South	Total
Within 5	1961	0.42	1.21	0.21	0.10	0.94	2.88
	1971	0.35	1.13	0.33	0.11	1.06	2.98
	1981	0.30	0.99	0.43	0.09	1.06	2.87
5 to 10	1961	—	2.40	0.85	1.44	—	4.69
	1971	—	2.24	1.12	1.40	—	4.76
	1981	—	1.95	1.52	1.38	—	4.85
10 to 15	1961	1.75	1.24	0.85	2.08	—	5.92
	1971	1.76	1.35	1.12	2.23	—	6.26
	1981	1.70	1.32	1.52	4.28	—	8.64
15 to 20	1961	1.95	2.99	1.84	5.42	—	12.20
	1971	1.62	2.77	1.77	5.78	—	11.94
	1981	1.01	2.07	2.06	3.93	—	9.07
20 to 25	1961	1.17	2.66	2.09	3.52	—	9.44
	1971	1.11	2.80	1.88	3.27	—	9.06
	1981	1.40	3.23	1.80	3.30	—	9.73
25 to 30	1961	2.16	2.40	2.29	3.44	0.74	11.03
	1971	2.13	2.36	2.29	3.33	0.65	10.72
	1981	1.78	2.21	2.10	3.12	0.59	9.80
30 to 35	1961	2.35	2.02	2.60	2.92	1.33	11.22
	1971	2.08	1.98	2.55	2.94	1.34	10.89
	1981	1.43	2.23	2.77	3.19	1.22	10.84
35 to 40	1961	0.08	4.25	2.98	2.30	1.10	10.71
	1971	0.08	3.95	2.93	2.19	1.02	10.71
	1981	0.09	4.05	2.83	2.29	0.89	10.15
40 to 45	1961	—	4.08	3.90	3.56	5.60	17.1[a]
	1971	—	4.46	3.58	3.54	5.82	17.40
	1981	—	4.53	3.51	3.69	5.66	17.39
45 to 50	1961	—	3.21	3.12	4.73	4.71	14.77
	1971	—	3.29	3.27	5.26	4.00	15.82
	1981	—	3.27	2.98	6.51	3.92	16.68
Total	1961	9.88	26.46	20.73	29.51	13.42	100.00
	1971	9.10	26.33	20.65	30.05	13.89	100.00
	1981	7.71	25.85	21.32	31.78	13.34	100.00

has 32% of the total population of the area. This sector is relatively less hilly and a considerable area borders the coast. The east sector has only 21% of the population because it lies in the interior and away from the coast. The north-east sector with 26% of the population is topographically not as favourable as the south east nor as disadvantaged as the eastern sector. The north and south sectors have one-fifth of the total population though they togother account for only 12% of the area. Both these lie along the coast. It in interesting to note that the south-east sector has experienced an increase in the relative concentration while the north-east sectors have registeree a decrease from 1961 through 1971 to 1981. The sectoral growth rates (Table 7) show that it is the south-east and eastern sectors which are growing rapidly. The north-east and souih have had moderate growth rates while the north is stagnating.

Table 7

TAPS & Its Environs : Growth Rates of Sectors

Sector	1961-71	1971-81
North	10.94	3.00
North-east	19.94	19.56
East	20.33	25.52
South-east	22.76	28.63
South	24.70	17.04

Sector-segment Population

A more detailed picture is provided by calculating the proportion of the total population in each sector-segment (Table 6). In the individual rings, beyond 10 km. it is interesting to note that the south-east sector-segment accounts for the highest proportion of the population of each ring.

The only exceptions are the 40 to 45 km band in which the south sector accounts for the major share of the population of the ring and the 35 to 40 km band in which the north-east sector-segment accounts for the highest proportion. The relativelv higher percentage of population in the south and south-east sector-segments may be attributed to the fact that these lie near the metropolitan cenere of Bombay.

The growth rates for 1961-71 and 1971-81 of the sector segments also throuws light on some pertinent featurds Table 8). Firstly within 5 km all the sectors have either low or declining growth rates indicating that in the immediate neighbourhood of TAPS population growth has been arrested. Thus while the density shows an increase in population within 5 km, growth rates reveal that the rate of increase is relatively low. Beyond 5 km it is the east sector-segments upto 20 km which have the highest growth rates in their respective rings. This is due to the Tarapur—Boisar industrial belt which has attracted people. High growth rates are also present in the south-east sector-segments of the outer rings which is evidently due to the urban sprawl of Bombay. In addition the Western Railway and Western Highway both traverse this sector. In contrast low, negative and declining growth rates may be observed in most of the coastal and also the north-east sector-segments within 20 km of TAPS.

Poputation Distribution in Retation to Wind Direetion

The predominant direction of wind between May to September is from the south-west having a speed of 6 to 30 km/

TAPS & Its Environs : Growth Rates of Rings & Sector-segments

SSector/ Distance Band (in km)	North	Northeast	East	Southeast	South	Total
Within 5						
1961-'71	—0.82	12.68	94.21	26.56	35.71	24.54
1971-'81	4.26	6.25	57.10	2.07	21.99	17.15
5 to 10						
1961-'71	—	12.86	58.32	17.60	—	21.62
1971-'11	—	5.93	65.51	19.53	—	23.90
10 to 15						
1961-'71	20.76	30.32	32.89	28.96	—	27.37
1971-'81	17.45	19.65	74.82	133.81	—	67.84
15 to 20						
1961-'71	— 0.12	11.48	16.39	28.64	—	17.97
1971-'81	—23.79	— 0.09	41.01	—17.31	—	7.55
20 to 25						
1961-'71	14.13	27.04	0.09	12.04	—	15.75
1971-'81	53.17	40.54	16.03	22.57	—	30.50
25 to 30						
1961-'71	17.29	18.50	20.66	16.91	0.06	17.35
1971-'81	2.92	14.10	11.46	13.83	11.41	11.11
30 to 35						
1961-'71	6.91	18.62	18.44	21.43	21.44	17.19
1971-'81	—16.27	36.92	32.09	32.24	11.22	21.20
35 to 40						
1961-'71	29.11	11.95	19.06	14.40	12.14	14.59
1971-'81	31.52	24.69	17.35	27.34	6.04	21.32
40 to 45						
1961-'71	—	32.64	10.85	19.84	25.22	22.37
1971-'81	—	23.69	19.09	26.63	18.37	21.56
45 to 50						
1961-'71	—	23.56	26.35	34.14	29.83	29.11
1971-'81	—	21.06	10.79	50.62	19.47	28.36

hr. In October the wind blows fairly uniformal from all directions. Between November to March the predominant direction of wind is from the north-west with a speed ranging between 6 to 22 km/hr. The frequency of calms i.e. a wind speed less than 3 km/hr. is not significant (Bhat & others). Rainfall also plays an important role in radiation impact since it aids the deposition of nuclides. The TAPS weather station recorded an average of 175 cms to 250 cms per year which occurs during the Monsoon seasons from the second week of June upto mid-September.

The south-east sector has the highest proportion of population as well as the highest growth rate. In the event of a fall-out between November and March this would be the most vulnerable sector to radiation as the prevailing wind in this season is from the north-west.

Conclusions

The study was undertaken with two main objectives in mind. The first one was to evaluate the locational suitability of Tarapur for establishing additional nuclear power generation units. Secondly, the study is also aimed at understanding the impact of an accident from the demographic point of view.

The following are the main findings of this Study :—

The study region is still basically rural but has a high and rising population. This is evidenced by the high total population of 7.2 lakh, a high density of over 1 person per acre, a growth rate of 22% much above the State rural average 17.6%), a 10%

increase in the proportion of medium-sized settlements as against a 13% decrease in small settlements between 1961—81 and a rise in the proportion of higher density (1 to 10 per acre) villages as against a decline in the percentage of lower density villages.

The "sterilized" zone within 5 km is far from being devoid of human habitation. In fact his area has the highest density among all the rings around TAPS. Fortunately the growth rate in this zone has declined which may indicate a Governmental control on habitation in this area.

The south-east sector has the highest proportion (32%) of the total population of the area, as well as the highest growth rate (29%). Between the months of November to March this sector is most vulnerable due to the direction and speed of the prevailing winds. On the other hand in the period June to September the Monsoon rains would highten the deposition of nuclides. The most susceptible sector in this season would be the north-east sector which has about a quarter of the total population of the region.

As a result of urban sprawl around Bombay, along the Western Railway there are growing suburbs and fringe settlements such as Virar and Sopara within 45 km of TAPS. Further inland the Bombay—Ahmedabad National Highway has attracted population centres. Thus while population distribution was originally influenced by physical factors today transport appears to be more significant.

The Tarapur—Boisar industrial belt within 10 km of TAPS also attracts people

since the industries provide job opportunities. Thus the sector-segments east of TAPS have registered high growth rates.

Tarapur located 110 km from Bombay in a rural setting along the coast seemed to be ideally situated for the location of a nuclear power station in the 60s. Presently due to the interplay of several dynamic factors Tarapur no longer appears as remote as it was originally meant to be. This is partly due to the spread of population along the two major transport arteries, which are near to TAPS, due to urban sprawl resulting from Bombay s growth. Secondly the mushrooming of industries in a belt within 10 to 15 km of TAPS has been an additional incentive to population growth. Thus the area surrounding TAPS may be expected to grow further in population and industrial development.

Due to the speed and direction of the winds an accident of even low probability in any season might cause dispersal of radioactive emissions, Moreover the winds blow inland which implies that a sizable population and a vast cultivated area is likely to be affected. The frequency of calms, is in fact very low and wind speeds are generally high.

In the light of these findings it is evident that TAPS is no longer a suitable site for potential expansion of nuclear power generation in that area. The demographic pattern, nature of economy and climatic factors all lend support to this conclusion.

REFERENCES

Abraham, P. (1987) : "Safety in nuclear power operation", *Advertisers Supplement, Times of India*, Bombay, Oct. 16, p. 23.

Agarwal. Y. (1986) : "How safe is Bombay", *Bombay*, May 22—June 6, p. 34-37

Barnathan, J. *et. al.* (1986) : "The Chernobyl syndrome", *Newsweek*, May 12, p. 21-26.

Bhat, I. S., Kamath, P. R. & Ganguly, A. K. (1972) : "Dispersal and uptake of radioactive elements in the Tarapur environment", *Government of India, Atomic Energy Commission.*

Flavin, C. (1987) : "After Chernobyl", *Science Age*, July, p. 49-57.

Greenwald, J. (1986) : "Deadly meltdown", *Time*, May 12, p. 7-15.

Lean, G. (1986) : "The Monster in our midst", *The Times of India*, Sept. 5.

Ramberg, B. (1986/1987) "Learning From Chernobyl", *Reprinted from Foreign Affairs*, Winter, p. 1 & 6.

Sarma, M. S. R. (1987) : "Nuclear plants and safety steps in India", *Free Press Journal*, July 4.

POPULATION POLICY AND THE FIVE YEAR PLANS*

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India has emerged as the nation that contributes maximum to the world's growing population. The process of demographic transition that began in the country in the early decades of the present century is nowhere near its completion. Unfortunately the mortality rate has been dominating the country's demographic scene for far too long. However, of recent, some welcome signs in the country's demographic situation have been observed. The mortality decline has sharply decelerated while the fertility decline is getting gradually established, and in certain areas it is getting accelerated.

Although India was the first developing country to adopt a positive population policy as back as 1951-52, yet its score card on fertility control has been far from satisfactory. The annual rate of population growth, which was around, 1.3 per cent during the three decades preceding Independence, was at its peak (2.25 per cent) during 1961-71 The charge against the country's planners in this regard is that the population policy has not received the same degree of seriousness as say our food production programme. That has cost the country very dearly. The paper traces the evolution of our population policy through various Five Year Plans. It highlights the casual nature of treatment given to such serious problem in our earlier plans and raises certain basic issues for the consideration of the framers of our Eighth Five Year Plan. The success of India's population policy, however, depends largely upon how for our planners succeed in bridging the gap between their concept of rationality and that of the common man in the countryside in this regard.

Introduction :

With a total fertility rate of 4.4 children per woman (1980-85), India has emerged as the leading contributing nation to the world's teeming billions. The process of demographic transition that started in India in the early decades of the present century is nowhere near its completion. Although the western world, where the demographic transition originated, also took around a century or so to complete the

process, yet those were the times when the Church was opposed to the fertility controls, the State was indifferent to the cause, and the technologies were yet developing and were more confined. The examples of acelerated transition in East Europe, Japan and China were more recent and nearer home. In these countries the time span between the mortality decline and fertility decline was too short which accelerated the demographic transition process. In India, the mortality rate has been dominating the demographic scene for far too long while the fertility has been stubbornly unobliging. Consequently, the country has been experiencing explosive growth of population for a long time.

India is a fairly large-sized country with wide horizontal as well as vertical inequalites in the levels of its socio-economic development and hence in its domographic scene. Thus, while Kerala with its fertility rate of 22.4 and mortality rate of 6.6 in 1985-87 was promising to enter into the final stage of the transition model, Uttar Pradesh with its fertility rate of 37.5 and mortality rate of 16.1 in 1985-87 was far behind. Unfortunately, the large as well as populous states of Uttar Pradesh, Madhya Pradesh, Rajasthan and Bihar were still in the explosive stage of the demographic transition. Not only their fertility rates had defied climb downs but also the war on their mortality rates had yet not been won. These interstate disparities in the fertility revolution are to be viewed in the context of their differences in age at marriage of the females, average spacing between children, degree of diffusion of education especially among women, infant mortality rate, degree of

university of marriage among girls and extent and nature of female employment (Gosal, 1989). What is significant is that the contributions of such large states as Uttar Pradesh, Bihar, Madhya Pradesh and Rajasthan in the fertility revolution of India are going to be much more crucial for the country in the years to come because their mortality rates still hold a promise of substantial fall while the decline in their fertility rate is yet to get established (Chandna 1989, p. 64). Similarly, vertically too there are clearly identifiable segments of India's society which lag far behind the mainstream in terms of their total fertility rate. The major task before the planners is to identify the target areas as well as segments of society that are more critical and warrant immediate attention as far as the fertility control is concered. The country shall have to concentrate its effots on these critical targets.

Although India was the first developing country to adopt a positive population policy in 1951-52, yet its achievements in controlling its numbers have not been satisfactory, The country's annual rate of population growth, whioh was around 1.3 per cent during the three decades preceding Independence, was at its peak (2.25 percent) during 1961-71, The latest estimates, however reveal a downward trend in the country's growth rate. It was estimated to be 1.99 per cent during 1980-84. Though much of the explanation for India's increasing rate of population growth during post Independence period may lie in the corresponding fall in the death rate as a result of improving general health and sanitation conditions and tightening grip over abnormal

deaths, yet that is not all. It is in this context that a brief review of the country's population policy through various Five Year Plans becomes imperative

The First Five Year Plan (1951-56) recognised that the trends in population growth cannot be altered quickly. The reduction in birth rates may be neutralised by the corresponding decline in death rates. It observed that the pressure of population in India was already so high that a reduction in the rate of growth must be regarded as a major desideratum. The plan enunciated that the programe for family limitation and population control should : (a) present an accurate picture of the factors contr-buting to the rapid population increase in India; (b) discover suitable techniques of family planning and devise methods by which knowledge of these techniques could be widely dissiminated; and (c) give advice on family planning as an integral part of the service of government hospitals and public agencies (World Bank, 1980, p. 7). While expecting some fall in the growth rate as a result of improvement in living standards and propagation of edu-cation especially among women, the First Plan emphasised the necessity of the positive measures for inculcating the need and tech-niques of family planning among the masses. The focus in the beginning remained on pro-moting the safe period method and a gradual popularisation of mechanical and chemical contraceptives, especially the foam tablets. The meagre First Plan provision of Rs. 0.65 million far the family planning programmes was too little to yield any far reaching results.

The population policy during the Second Five Year Plan (1956-61) remained virtually unaltered except that the voluntary steriliza-tion scheme was introduced in 1956. However the plan outlay for family planning programmes was raised to Rs. 50 million of which only Rs. 23 million were actually spent to open some 1,649 family planning centres all over the country. The family planning programme made a-notable progress during the second plan (Goverment of Ind a, 1960, p. xiv).

The gravity of the situation became more obvious when 1961 census counts surpassed the highest estimates and the framers of the Third Five Year Plan (1961-66) appreciating fully the urgency of the situation, came out with more pronounced population policy.

It amounted to a major shift in the population policy, whereby the basically clinical approach of the first two plans was replaced by an extension education appro-ach aimed at bringing the messages and services to the people in the far off areas of the country through a network of primary health centres. Thus, creation of social climate in favour of small family norms, provision of readily accessible services, adoption of effective family planning methods by all eligible couples (about 90 million), stimulating such social changes as increasing marriage age, education and employment of women, accelerating overall economic development, and continuous research and evaluation, became the guiding principles of popula-tion policy during the Third Plan. The Third Plan which took pains to spell out the programmes, means and logistics of mounting the family planning movement

succeeded in motivating about one million people (983,064) to accept sterilization. About Rs. 250 million out of a plan outlay of Rs. 270 million were actually spent on various family planning programmes and a a total of 7,075 family planning centres were opened during the Third Plan period. By the end of Third Plan about 1.5 million couples had accepted sterilisation and about 1.5 million persons had been covered by other methods such as I.U.C.D. (812, 713) and conventional contraceptives (582, 141).

The population policy became more positive during the Fourth Five Year Plan (1969-74) which referred to family planning as 'the kingpins of the plan and to limitation of family as 'an essential and inescapable ingredient of development'. The most distinctive feature of the Fourth Plan was that it set a time-bound target of reducing the birth rate from 39 per thousand to 23 per thousad by 1978-79. To achieve both short and long range objectives, an organisational set up from central to peripheral level was established as a part of the existing medical and health services to reach each couple in the reproductive age-graup all over the country. No wonder, the outlay for the Fourth Plan was raised to Rs. 2860 million about twelve times that of the expenditure during the Third Plan. Consequently, by the end of the Fourth Plan over 8.7 million couples were covered under sterilisation, and about 6 million couples were covered by other methods. About 6.9 million births were estimated to have been averted during the Fourth Plan period in comparison to about 0.6 million births averted during the preceding plan.

The Fifth Five Year Plan (1974-79)

apart from enhancing the outlay for family planning programme to Rs. 5,000 million also brought about a basic change in the population policy by integrating the family planning services with welfare services covered under the rubric of Minimum Needs Programme. The programme sought to integrate most of the basic social services, including education and public health services with family planning and nutrition for children, expectant and nursing mothers. The introduction of element of compulsion, monetary incentives and penalities, and legalisation of abortion during the course of the Fifth Plan, of course, added another dimension to the population policy of India.

In the Sixth Plan (1980-85), the family welfare continued to be accorded a high priority in the socio-economic development plan (Goverment of India, p. 235). The strategy during the plan was to integrate health, family welfare and nutrition services at all levels. Enhanced cash compensation for voluntary sterilisation and full rebate in income tax for specified donations for welfare purposes were some of the incentives offered by the government. The target of a birth rate of 30 per thousand was to be achieved by the end of Sixth Plan 1982-83. For this purpose the plan targeted to protect 36 per cent of the couples in the reproductive age group against conception (United Nations, 1982, p. 162).

The population policy during the Seventh Plan (1985-90) took a significant turn. Apart from setting statistical targets in much more areas, it envisaged to make family planning programme more effective. The specific objectives sought to be achieved during

1985-90, however, included (i) increasing the mean age at marriage for females to over 20 years, (ii) promoting 'two-child family' norm (iii) protecting over 42 per cent eligible couples by way of variety of contraceptives, (iv) enhancing child survival rate by keeping the infant mortality rate under 90 per thousand live births through universal immunisation of infants and pro-specting mothers, (v) bringing down the crude birth rate to 29.1 per thousand and crude death rate to 10.4 per thousand, (vi) generating environment for fertility decline through relevant socio-economic in-terventions, (vii) promoting female literacy and employment programmes, and (viii) providing population education to all chil-dren in 11-15 age group and also to those out of educational institutions through Adult Education and Non-formal Education programmes (Government of India, 1985). All this was to be achieved by effectively involving the people in general. The re-search focus during the Seventh Plan, how-ever, has been to develop more acceptable techniques and to improve the acceptability of existing techniques.

The family planning programes seem to have made an impact, though not very powerful, on the people's attitudes, practice of contraceptives and on the average ferti-lity rate. It was officially claimed that about 16 million births had been averted during 1961-74. The truthfulness of these official claims was, however, put to hard test of reality when 1981 census counts unfolded the figures. The birth rate still soared as high as 33.0 (1980-85). The poor score card of the country on the achieve-ment front has been mainly due to the fact that all the plans have been content with merely setting the desirable targets of the rate of population growth only and have refrained from discussing the possible ways of manipulating the demographic variables of birth, death, and migration and the prin-cipal and economic means of influencing them. Few lessons have been drawn on the possible effects of economic and social factors or of migration on the fertility be-haviour. The population policy has been over-emphasising the role of positive mea-sures (such as contraception, sterilisation, abortion, etc.) to keep the numbers under control without paying adequate attention to the dynamic interaction between the de-mographic structure and the economic and social development and implications of such interaction for limiting the rate of popula-tion growth. For instance, the higher indi-dence of female mortality at specific ages, the education for girls at primary and secondary stages, the informal and formal instructions for young women in vocation, the opportunities for females to work, the population education, the family planning and other such special subjects, have suf-fered a pitiable neglect in receiving the attention of our planners, although these surely have an important bearing on the acceptance of family planning. It is only through a thorough understanding of the relationships existing between various demo-graphic elements themselves and between the demographic and non-demographic (socio-economic) elements of a regional structure that a sound population policy can be formulated. The population policy of a nation can no longer confine itself to the reduction of birth rate alone; it must be all comprehensive strategy for overall improve-

ment of social, economic, and demographic fabric of a nation, Thus, the strategy for containing rate of population growth, limiting the numbers in the young and reproductive age groups, ennhancing employment potential both for males and females, diversifying economy, improving literacy and educational standards, making urban rural ratios more reasonable, and balancing male-female ratios, all constitute vital elements of our population policy.

There are two distinct approaches to the family welfare planning programes. One, advocating long term measures with a view to improving overall social, economic and demographic structure of the nation and two, short term measures with a view to reaping immediate results by way of averting the number of births. The long term measures include well conceived population education, increasing, the age at marriage, preventing the children from entering the labour market, compulsory education and adult literacy campaigns. restricting the maternity benefits to small families, providing security in old age, introduction of new life insurance policies carrying special benefits for those having small families, reconstructing the rural landscape by developing intense network of small scale industries based upon agro-livestock raw material and utilising scheduled caste and scheduled tribe manpower, diversifying economy by way of rapid urban-industrial development, and better health, education and employment facilities particularly for females. The long range approach recognises that the fertility behaviour is a complex phenomenon and has to be dealt within the context of overall socio-economic structure of a society. A well conceived population education policy can help in (i) improving the quantitative and qualitative characteristics of human populations, (ii) preparing the young for adult life, (iii) building the attitudes and values at an early age, (iv) preparing the individuals for roles as community leaders, and (v) making the citizens as more responsible parents. The increase in the marriage age would obviosuly reduce the reproductive span and, thus, would affect the fertility apart from offering more chances of getting education and perhaps employment to the females. Similarly, preventing childern from entering the labour markets will also strengthen fertility education and would also be a step in the direction of controlling fertility. Education, particularly of girls is of special significance. A definite inverse correlation between education and fertility was observed by the 16th round of National Sample Survey when it discovered that, on an average, the number of children born to a women was 2 if she had passed intermediate examination, 4.6 if matriculation, 5.0 if middle school examination and 6.6 if illiterate or primary examination (Chandna, 1979, p. 338). Similarly, if the maternity benefits are restricted to only small families it may restrict the number of children at least among the working families. The provision of old age pension/security, introduction of new insurance policiies, etc. may also help in containing our numbers. No other long term measure holds such prime significance as the rapid economic development of the country holds. It is rightly remarked that the best contraceptive for controlling India's population is rapid socio-economic development.

On the other hand, the various short term measures suggested to bring down the birth rate immediately may include temporary and permanent methods of preventing child birth such as contraceptives, voluntary/compulsory sterilization, abortion after the birth of second/third child in the family and social and economic benefits/penalties for small/large famil es, respectively. No population policy, whether long range or short term, can make a headway as long as it remains a bureaucratic measure imposed from above. Moreover, the people will accept a policy only if it fits into their concept of rationality. Once it happens so, it shall develop into a self generating process. The success of a population policy lies in how far is it able to make the population programme a self generating process.

The most pertinent questions for discussion in this regard would be : (i) which of the two types of measures should precede the other, i.e. should socio-economic development precede the short term measures or could this process be reversed ? (ii) how could the result yielding capacity of long term measures be accelerated ? (iii) what should be the order of priority among various long term measures ? (iv) should there be any element of compulsion ? (v) should we adopt any legislative measures ? (vii) should the critical targets be only those who are considered to be more receptive to new ideas or those who are in the dire need of restricting their numbers ? (viii) how to make our family planning movement more effective in rural areas ? and (ix) how to bring the concept of rationality of the common man in the countryside close to the planner's concept of rationality ? The main features of India's population policy lie hidden in the answers to these vital questions.

These are the questions which are more easily raised than answered. The moot question in India's context, however, would be - can India afford to wait until further socio-economic development takes place ? It seems more appropriate in Indian contoxt to follow both the approaches simultaneously so as to reap short as well as long range benefits. With regard to increasing the result-yielding capacity and the order of priority among various long term measures, a list of all such variables which have negative effect on fertility be prepared and the population policy be formulated in the light of these keeping those variables on the top in whose case the correlation is the strongest and whose contribution in the declining fertility is the largest. The most crucial question in our population policy is about the elment of compulsion. The gravity of the situation in India suggests that there can be no escape from compulsion. There should be no hesitation on the part of the government to come out with legislative measures but there shall have to be no discrimination with regard to these being applied to various segments of the Indian society. This probably answers the next question pertaining to the critical targets. However, with a view to making the family planning movement more effective in rural areas a combination of traditional and modern methods may have to be evolved to arouse greater response from the rural people. The traditional methods like longer periods of lactation, and building up a network of information

transmission among the ladies of the house-hold may be considered in this regard. All these may help in bringing their concept of rationality quite close to the planner's concept of rationality. The moment it is achieved, the family planning movement shall become a self generating process and therein lies the success of any population policy.

Summing Up

India has emerged as the leading con-tributor to the world's teeming billions. An unusually long time-span between the country's mortality decline and fertility decline has been responsible for this distin-ction. While mortaliity in India started declining as early as 1921-31, the first signs of fertility decline appeared only after 1971.

India is a large-sized country with wide horizontal as well as vertical inequalities in the levels of its social and/or economic development which are reflected in its demographic scene as well. Kerala, on the one hand, and Uttar Pradesh, Bihar, Madhya Pradesh and Rajasthan, on the other, symbolise the kind of contrasts in tho demographic situation associated with the differences in their social and/or econo-mic development. Since the contributions of Uttar Pradesh, Bihar, Madhya Pradesh, Rajasthan, in the fertility revolution of India are going to be crucial for the coun-try in the years to come, their continued high fertility rates have serious policy implications.

India has the distinction of being the first developing country to adopt a positive population policy as back as 1951-52. However, its population policy failed to make the family planning programme a voluntary people's programme until the Seventh Five Year Plan. It is only through the Seventh Plan that the country has sought to generate an environment for fertility decline through relevant socio-economic interventions. Consequently, a wider range of targets had been set for achievement which included enhancement in age at mrrriage, higher protection rate, universal immunisa-tion, promoting female education and employment, and importing population to education younger age groups of 11-15 years.

In fine, no population policy can make a headway as long as it remains a bureau-cratic measure imposed from above. People shall accept a policy if it fits into their con-cept of rationality. Once it happens so, it shall develop into a self generating process. The success of a population policy lies in how far is it able to make the popu-lation programme a self generating process. The greatest attainment of the forthcoming Eighth Plan could be, to achieve this threshold point in the country's fertility revolution.

REFERENCES

Chandna, R. C. (1989) "Fertility : The most critical issue in Indian dmography", *Panjab University Research Bulletin* (Science), Chandigarh, Vol. 40, Parts I & II

Chandna, R. C. (1979) "India's population policy", *Asian Profile*, Hongkong, Vol. 7, No. 4 p. 338.

Gosal, G. S. (1989) "Spatial patterns of fertility trends in India 1971-87 : an interpretative study", a paper presented at Kiel (West Germany) at symposium sponsored by I.G.U. Population Commission.

Government of India (1960) *The Second Five Year Plan, Progress Report 1959-60* Planning Commission, New Delhi.

Government of India, *Draft Sixth Five Year Plan 1980-85,* Planning Commission, New Delhi.

Government of India (1985) *Seventh Five Year Plan 1985-90,* Planning Commission, New Delhi.

United Nations (1982) *Population of India,* Country Monograph, Series No. 10, New York.

World Bank (1980) *India-Staff Appraisal of a Second Population Project,* United Nations, New York.

CONTRIBUTIONS OF THE IGU AND ICA COMMISSIONS IN POPULATION STUDIES

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This paper sums up the contributions of International Geographical Union (IGU) and International Cartographic Association (ICA) to population studies. It traces the activities of these bodies since early sixties in terms of focal themes and thrust areas in various symposia sponsored by IGU and ICA. Over the years greater attention has been focussed on issues crucial for the developing countries. The promotion of population cartography emerges as an important activity of ICA.

International Geographical Union (IGU) is affiliated to the International Council for Scientific Unions (I.C.S.U.) and International Social Science Council (I.S.S.C.). Under the umbrella of I.G.U. there are several commissions, working groups and study groups having interest in population studies. In the history of this international body there has been commissions related to population for four years term, almost in succession. In the term of reference of the IGU commissions on population, migration and population cartography have been a focal theme of academic and research interests however with varying degrees of emphasis. Under the aegis of these IGU commissions population related issues have been studied as a part of larger study on population redistribution, depopulation, return migration, migration and cities, role of woman in migration, labour migration, population cartography and the like. Regional population issues have also been studied, such as, pattern of migration in Pacific islands, effects of development projects in Africa, labour migration and population redistribution in South Asia.

Parallel to IGU is the International Cartographic Association (ICA), which had a full commission on Census Cartography and later on Population Cartography. However, the activities of the ICA commissions on population revolved around Census related activities. IGU and ICA commissions have been contributing to population studies at the international level during past several years.

Early Attempts For Studying Population by the IGU Commissions.

For this study the activities of the IGU commission from 1964 onwards have been scanned. Migration was not included as a specific field of study during the period 1964-68, however, a major project of the IGU Commission on Population Geography in form of symposium was on Population Pressure on Physical and Social Resources in the Developing Countries (September

1967). Several papers were presented where migration was studied in relation to population pressure, overcrowding in metropolises demographic dynamism and the like. A volume entitled *Geography and Crowding World* was produced out of this symposium.

In 1968, the 21st International Geographical Congress was held in New Delhi, where this IGU commission was extended for another term. Again, there was no particular item related to migration studies in the terms of reference. In the commission meeting in the following year in London concurrently with a conference sponsored by the IUSSP, it was decided to hold an international symposium on international migration. This symposium was held in Edmonton, Canada in 1972 and resulted in a major publication entitled *People on Move : Studies in Internal Migration.*

In 1972 International Geographical Congress in Montreal IGU Commission on Population Geography was renewed. Similar to earlier terms, there was no particular mention of migration studies in the terms of reference, but such studies were included in other larger projects of this commission. For example, in commission's symposium on Population at Microscale which was held in Palmerston North, New Zealand in December 1974, one of the principal themes was the behavioural approach to the study of populations, which included decisions on migrations.

Following this, another symposium was held in Minsk, U.S.S.R. July 1976 on Perspectives on Macro-Populations. Among the varieties of topics discussed there, following topics were related to migration studies.

(a) Use of behavioural approach in the study of reproductive attitudes and of migration.

(b) Urbanization trends and metropolitan expansion.

(c) Migration processes.

During this period the Commission maintained close contacts with a number of organisations, particularly with the committees on Urbanisation and Population Redistribution of the I.U.S.S.P.

Studies on Population Redistribution and Education

When this commission was renewed again in Moscow in 1976, the terms of reference were modified and studies on population redistribution were included for the first time. However, similar studies have been included in the activities of the commission earlier. The formal inclusion of of this aspect of population encouraged migration studies all over. The first activity in this series was a symposium on Population Redistribution in Africa which was held in Nigeria in July 1978. The sessions focussed on following four themes.

a) General problems of population redistribution and related policies.

b) Migration in Africa.

c) Redistribution of population in Africa.

d) Redistribution of population in other parts of the world.

During this symposium a special session was devoted to a debate on the desirability and feasibility of a major long term research project on population redistribution in Africa. A small task force was established for this purpose.

Another symposium in this series was related to policy oriented researches on population migration and redistribution. This international gathering however focussed on developed countries and was held in Oulu, Finland in August 1978, immediately before the I.U.S.S.P. regional conference in Helsinki. The meeting was held simultaneously with the seminar of the I.U.S.S.P. Committee on Urbanization and Population Redistribution. Twenty two papers presented there can be divided into two categories (a) theoretical constructs, policies and policy instruments; and (b) population redistribution policies and their implementations—case studies. Papers presented were on policy-related research on internal migration, policies of population redistribution in different developed countries and migration decision making processes.

The third in this series of international gatherings was a symposium on Population Redistribution and Development in South Asia. It was held in Karachi in January 1980. The major issues for discussions were as follows :

    (a) National, regional and local policies of population redistributions.

    (b) Population redistribution aspects of national development plans.

    (c) Development projects and population redistribution.

    (d) Settlement of refugees.

Since, South Asia experienced several political turmoils, such as partition of India in 1947, liberation of Bangladesh 1971 and later Afgan problem, a sizable population has become refugees. Hence, in this symposium migration in relation to refugee problem became the focal theme. Migration was also studied in different context as well, such as development process and tribal migration in Central India; flood induced migration in Ghahgra zone; cultural—ecological appraisal of refugee resettlement in Independent India, population growth and redistribution in Sri Lanka; population mobility in North West Frontier Province of Pakistan and refugee problems in Bangladesh.

Another activity during this term was related to population education. The IGU Commissions on Population and Geographical Education appointed a working group which met in Edmonton, Canada in November 1977. The purpose of the meeting was to consider the feasibility of and plan projects on population education in geography. Two projects were identified :

    a) Population education units for social studies.

    b) Population education posters.

The last activity of this term of the commission was a symposium on Migration and Population Redistribution in Asia and the Pacific. It was held in Nagoya, Japan in August, 1980. The major issues for discussion were as follows :

    a) Changing patterns and urban concentration of population.

b) Migration and circulation.

c) Population redistribution aspects of national plans and development projects.

In this symposium, papers on some very interesting themes were presented, such as remittance and migration, the commerce of movement; conflicts between explicit and implicit population distribution policies; governments perceptions and policies of population distribution; population concentration, density, measure and correlates; evidence of population decentralization; internal migration and development transitions; mapping of demographic variables and the like. Some of the above papers forced a special volume of the *Population Geography* Journal which is published from Chandigarh. Further, migration in relation to region specific problems were also presented. These paper were on Trans-Tasman migration; internal migration and population redistribution in Pakistan; internal migration; the population distribution policy in Japan; metropolitan area based migration in South Korea, U. S. India and West Asia. The effect of development plan and programmes were studied for Zambia. Another interesting paper was on decision makers in migration-in Papua, New Guinea.

Migration As a Thrust Area in IGU Activities

In the 24th International Geographical Congress in Tokyo, the IGU appointed several bodies, apart from the Commission on Population Geography, which were having some academic interest in population studies. These are :

1. Commission on National Settlement System.

2. Commission on Rural Development.

3. Commission on Geography of Tourism and Leisure.

4. Working Group on Transformation of the Rural Habitat in Developing Countries.

5. Working Group on Great World Metropolitan Cities.

6. Working Group on Urbanisation in Developing Countries.

7. Working Group on Geography and Health.

The IGU Commission on Population Geography continued its interest on migration and population redistribution. The first activity in this series as a symposium on the Impact of Development Projects upon Population Redistribution which was held in Khartoum in March 1982. Studies on different parts of Africa were presented such as, Sudan, Upper Zambezi flood plain, Gezira Scheme, Saudi ports on Red Sea, Kenana project, agricultural settlement scheme in Ethopia, dry lands of Uganda, New Half scheme, Tanzania and Gesh Delta. Some conceptual issues were also dealt which are related to Africa in particular, or impact of development on migration in general. Issues were discussed regarding demographic intermediation, demographic impact, mobility transition, urbanization, migrant labour, displaced population, environmental aspects, political economy of population movement and rural

water and redistribution.

Considering the international decade for women, special attempt was made to study the role of women in population redistribution. A symposium on this aspect was held in Cagliari, Sardinia (Italy) in September 1982. Papers were presented on the following themes :

(a) Sex differentials in migratioin : Theoretical and methodological approach.

(b) The influence of female migration on demographic trends.

(c) Female emigration in the Mediterranean : Problems concerning female labour and the woman in family.

(d) The changing role of the migrant women in the family and in society.

(e) Spatial analysis of female mobility: global analysis and overall patterns.

(f) Female mobility between tradition and modernisation : the case of Sardinia.

Four publications were brought out of this symposium.

Alongwith the XV Pacific Congress, this commission organised a symposium on Mobility, Identity and Policy in the Island Pacific in Dunedin, New Zealand in February 1983. The focus was on different aspects of mobility. The objectives of this gathering were :

(a) To take a more humanistic approach to issues of mobility, identity and policy in the Island Pecific as a means to reveal conceptual and empirical links.

(b) To achieve focus across both cultures and disciplines, and explore the levels of integration between population movement and island identifies in ways that admit the philosophical and the experimental, the academic and the applied.

(c) To suggest, for the practitioner, alternate approaches to and methods of examining questions about island mobility set within the context of rapid social changes.

(d) To promote an intensive dialogue between international scholars, island and expatriate academics, local planners and administrators and prepare a reflective statement based upon this experience.

Following this symposium there was another international gathering in Kathmandu, Nepal in April 1983 on Mountain Population Pressure. Among the other demographic aspects, such as fertility and mobility levels, or servicing mountain population, there were several papers on the effects of population pressure upon out-migration from mountion regions of the world. In this series there was another symposium related to population migration. The theme was on problems and Consequences of Refugees Migration in the Developing World. It was held in Manitoba, Canada in August/ September 1983. The symposium was divided into following sessions focussing on region—specific problems :

(a) Africa's refugee problems.

(b) Local solutions for Africa's rural refugees.

(c) Africa's urban refugees.

(d) Refugees in the Middle East.

(e) Pakistan's refugee burden.

(f) Refugees in India and Bangladesh.

(g) S. E. Asia's refugee dilema.

(h) Latin America's growing refugee problem.

(i) Resettlement to developed countries.

Some very interesting issues were discussed in this symposium : Large scale refugee movement, role of U.N.H.C.R., refugee assistance, role of N.G.O.S., national refugee policies, repatriation, resettlement, involuntary migration, and research in refugee problems.

The last symposium of this term was on Migration and Cities which was held in Rouen, France in August 1984. The themes were as follows :

(a) Migration to cities of developing countries.

(b) Intra-urban migration and counter-urbanization in more developed countries.

(c) Urban-oriented population redistribution policies.

(d) Migration models and theories.

Census Cartography

During this term two edited volumes were produced. The first one was on *Geography and Population* : *Approch and Application*, and the other was on *Census Mapping Sur-*

vey. Both the books deal with population, including some aspects of migration studies. In the earlier volume, there is a chapter on population geography at micro scale : residential mobility and public policy. There are two other chapters in this volume which are related to population cartography :

(a) Pre-Census mapping.

(b) Post-Census mapping.

Various aspects of census operations and possible role of geography and cartography has been discussed. There are several other chapters in this book which provide glimpse of the research frontiers now considered under the purview of population geography. The nine chapters on different countries give an idea how this sub-discipline has developed in different national settings (Clarke, 1984).

The other edited volume on Census Mapping Survey is a joint effort of the IGU Commission on population Cartography and ICA Commission on Census Cartography. There are 22 chapters consisting mainly of national reports of different countries. The national surveys cover following aspects :

(a) Nature of population grouping.

(b) Census district as a tool for mapmapping.

(c) Links between pre-census and post-census Cartography.

(d) Census cartography with special reference to last published census.

(e) Relationship between census cartography and population cartography.

(f) Scope for automation in census mapping.

(g) Census maps as an aid to study population geography.

Recent Activities

The IGU met again in Paris in 1984 and appointed following bodies which have some interest in population studies :

(a) Commission on Population Geography.

(b) Commission on Urban Systems in Transition.

(c) Commission on Changing Rural System.

(d) Commission on Geography of Tourism and Leisure.

(e) Working Group on Urbanization in Developing Countries.

The Commission on Population Geography remained as the main IGU body for studying migration. For its present term (1984-88) two main themes were identified :

(a) Internal migration, including population dislocation caused by disasters.

(b) International migration, including migrant workers and refugees.

Keeping the above broad themes in view, following programmes were proposed :

(a) Symposium on Temporary Migration in Latin America, Quito, Ecuador, November 1984.

(b) Symposium on Geography of Ageing, London, July 1986.

(c) Symposium on the problems of Depopulation in Rural areas, Zaragoza, Spain August 1986.

(d) Symposium on the Development and Redistribution of population and Labour force in Agrarian Regions of European Socialist and Capitalist countries, Greijswald, German D. R., August/September 1987.

(c) Symposium on Planning for Population Change, Sydney, August 1988.

Complementary Issuess

The symposium on Temporary Migration in Latin America had three major activities :

(a) Theoretical : and methodological aspects of temporary migration.

(b) National case studies.

(c) A workshop on recommendations for migration policies and future academic developments.

The symposium on the Geography of Ageing focussed on the contemporary population related issues in developed countries. Distribution, projection, migrations, health services of elderly population were discussed. The broad themes were as follows :

(a) Demographic ageing : trends, projection and distribution.

(b) Households and living arrangements.

(c) Metropolitan analysis and studies.

(d) Regional and rural analysis.

(e) Focus on special groups and services.

The Zaragoza symposium focussed on rural depopulation. Similar to the above

symposium, the focus was again on ageing along with other population issues, such as area specific depopulation process, desertization leading to depopulation, return migration, migration differentials, development policy implications, growth cycle, consequences of migration, aspects of measuring migration and the like.

The Greijswald symposium also concentrated on the population-related issues of the developed world, divided into socialist and capitalist countries. Here the redistribution of working population in agrarian region was considered. The sub-themes were as follows :

(a) Redistribution of population and workforce global an lyses and overall patterns : the case of socialist countries.

(b) Redistribution of population and workforce, global analyses and overall patterns : the case of capitalist countries.

(c) Redistribution of the agrarian labour force, urbanization and methodological approach.

(d) Development and patterns of population of settlement of different rank (size, production, infrastructure etc.)

e) Population policies, regional planning, demographic trends and redistribution of population in agrarian regions.

(f) Urban growth, rural-urban migration and settlement systems; causes and social impacts.

The Sydney symposium was the pre-congress activity of the 26th IGC. The issues related to planning for population change were divided into developed and developing countries. The issues in the former countries were similar to those discussed in London and Zuragoza, such as mortality trends at advanced age, changing fertility patterns, infertility, life-cycle, migration movements, public policy and mobility, return migration, and recovery process after disasters. Regarding the developing countries the themes were related to rural-urban migration arising from economic, social and developmental processes.

Apart from the above symposium touching different aspects of population redistribution issues, there was an International Conference on Population Mapping in Calcutta in December 1985. The IGU and ICA Commissions on Population participated in this gathering. This conference focussed attention on :

(a) Conceptual development in population mapping through ages.

(b) Census and extra census sources of data.

(c) Pre-census mapping and developments of data base.

(d) Cartographic representation of population characteristics.

(e) Population problems in developing countries-their anasysis and mapping.

(f) Computer application in population mapping.

(g) Population atlases.

(h) Cartographic representation of population projection.

There was a wide gap in population mapping process and in the themes of such maps among the developed and developing countries. The former countries are highly advanced in this mapping technology, starting from data collection to map reproduction. On the other hand in developing countries the imported technology is not always suitable and in number of countries the tradition of census data collection is yet to be matured.

In the Calcutta seminar, on international project on population and disaster was finalised. A multi-authored international volume without the backing of a seminar was mooted. Population was studied in relation to exceptional situations, natural, such as earthquakes and typhoons, man made, such as wars. This volume is to hit the stands soon (Clarke et. al. 1988).

Population Cartography

Population cartography has always been considered as essential part of the IGU commission's activity, though in some years other projects have surpassed cartographic activities. In 1980 the International Cartographic Association (ICA) appointed a commission on census cartography. This commission in collaboration with the IGU commission, conducted an international survey on census mapping which resulted into an edited volume as mentioned earlier (Nag, 1984).

In the fellowing term (1984-87) ICA appointed an ad-hoc commission on population cartography. Two major piojects were carried out :

(a) To compile an inventory of maps used in conducting the collection data on population in various countries, and to suggest an optimal methodology; and design for the production of these maps.

(b) To analyse existing population maps of metropolition regions, to suggest methods, design and content criteria for basic population maps (population density, change and fertility maps) and to prepare set of population maps using suggested criteria for a selected metropolitan area in a Third World country.

The first project concentrated on pre census maps and identified different ways to improve maps for population data collection after studying the global patterns. For the second project, Dhaka was selected as a case study. A population map of this city was prepared. Population map series of Australia on microfiche was also produced. Experiments to produce population data on CD-ROM was also done (ICA, 1987).

The second term of the ICA commission on population cartography (1987-91) is concentrating on tranfering of population mapping technology from developed to developing countries. However, census mapping has remained as the focus of the activities of this international scientific body.

Emerging Trends in Population Studies

Migration studies have been one of the focal theme in population geography which has been traditionally concerned with distance and movement. Further, geographers depend on their own fieldwork for migration studies. In any case the published or

official data provide a weak basis for migration studies. Geographers would like to have information on migration for each smallest spatial or statistical unit of the concerned area. The activities of the IGU commissions on population related issues reflect the increasing interest geographers are taking in migration studies. The term "redistribution of population" provides broad basis for studying migration. Study under its aegis-stretches from stages in decision-making process to post-migration consequences in the areas of in-migration and out-migration. As a result, the studies carried out under different programmes of this commission involve almost all types of migration : seasonal, daily, labour, return, marriage, student or permanent. Push and pull factors have been studied in relation to place of origin and destination of migration. Such migrations have been at different scales, ranging from changes in urban residential pattern to refugee problems extending across continents. It is not only hunger, poverty, disaster and catastrophe or mismatching of individuals with habitat or combination of these factors which results into migration. People in general are reluctant to move to a new environment. A lot of studies of this commission show why do people move. A cross cultural anasysis will indicate that a reasonable volume of migration takes place for better standard of living, economic targets, social obligations, and for better occupational and professional opportunities.

Alongwith the migration studies, another major thrust area of the IGU and ICA commissions has been population mapping including census related activities. But, unfortunately, both these specializations have been developing sepearately, perhaps owing to non-availability of mapable data on migration all over. Due to statistical and model building techniques and computer application, migration studies are likely to be more refined in the years to come. On the other hand, poulation mapping is also becoming more and more sophisticated with the introduction of digital mapping and availability of population data on CCTs, CD, ROM and disks. Census cartography will continue to remain centre of activity in the ICA commission. The IGU commission has been more dynamic. Apart from migration population has been studied in relation to development process and disasters. The feedback from one field of specialisation to another within population geography is yet to be matured.

REFERECES

X. Archixia Sardo, (1982) : Special Number on Emigrazione Elavoro Feminile.

Clarke. J. I. *ed.* (1984): *Geography and Population : Approaches and Applications*, Pergamon.

Clarke J. I. and L. A. Kosinski *eds*. (1982) : *Redistribntion of Population in Africa*, Heinemann, London.

Clarke, J. I., *et. al. eds.* (1985) : *Population Development Projects in Africa*, Cambridge University Press,

Clarke, J. I. *et. al. eds*. (1988) : *Population and Disaster*, Basi¹ Blackwell, London.

Espace—Populations—Societies, (1985-1), Special Number on Migrations and Urbanisation.

ICA (1987) : Report of the Ad-hoc Commission on Population Cartography.

Kosinski L.A. and K. M. Elahi *eds.* (1985) : *Population Resistrbution and Development in South Asia,* D. Redidel, Holland.

Kosinski, L. A. (1989) : "Population geography and the International Geographical Union" *Populatioh Geography,* Vol. 2, No 18, June-December.

Kosinski, L.A. and R. M. Prothero *eds.* (1970) : *Geography and Crowding World,* Oxford University Press, New York.

Nag, Prithvish, *ed.* (1984) : *Census Mapping Survey,* Concept, New Delhi.

Pacific Viewpoint, (1985) : Special Number on Mobility and Identity in the Island Pacific.

Population Geography, (1981) : Special Number on Population Redistribution in Asia and Pacific Region.

Population Geography, (1983) : Special Number on the Role of Women in Population Redistribution.

Revista Geografic (1983) : Special number on Ladonna nei fenomeni migrator.

Shrestha, C. B. and J. I. Clarke and A. Ahmed *eds.* (1981) : *Mountain Population Pressure* : *Proceedings of the Symposium in Kathmandu, Nepal,* Kathmandu.

Webb, J., W. A., Naukkarinen and L. A. Kosinski *eds* (1982) : *Policies of Population Redistribution,* Geographical Society of North Finland, Oulu.

BOOK REVIEW

Prabha Shastri Ranade : Population Dynamic in India
Ashish Publishing House, New Delhi, 1990, 221 pp.
Price Rs. 200/-

Reviewed by Swarnjit Mehta

Although titled as Population Dynamics in India this book focusses on the Vidarbha region of Maharashtra. The book is an extended and updated version of doctoral dissertation of the author. Besides the introductory chapter the book treats the themes of Physical set up of the region, spatial pattern of total population distribution, as also that of the scheduled castes and the scheduled tribes. The chapter on distribution are logically followed by those dealing with growth of total population, rural population, migration and urbanisation. The concluding chapter is devoted to identification of research themes and policy implications of certain trends relating to Vidarbha's population.

As stated by the author the study addresses itself to some simple but significant questions (p.5) viz., factors influencing pattern of population distribution; deviation of the present pattern from that obtained in the past; differentials in growth rates in general and those of rural and urban populations in particular; and migration as a component of population growth.

Physiographic details of the uplands, the river basins and the plains provide the backdrop against which the contemporary patterns are supposed to be visualised and understood. However, the details regarding terrain, soil, climate, forests, while important in themselves, are only inadequately integrated with later interpretations. Also it is intriguing to find urbanization (p.25) included as a 'factor' influencing population distribution as also redistribution (p.105).

In the discussion of population growth the role of natural increase as a function of birth and death rates finds only a passing reference. The author refers to a decline in fertility and attributes it to 'more rigorous family planning drive' without giving any statistical evidence for this relationship in support of her arguments.

Separate chapters on growth of population (chapter 5) spatial variations in rural growth (chapter 6) also warrant a justification especially when practically all the explanatory variables are identical. Obviously there is a lot of repetitive matter in these two chapters. Some explanations given by other scholars for other regions and for different time context (Gist's study published in 1955 for South India) have been used to interpret 1981 data for Vidarbha region (p. 159).

The book contains useful details on the spatial pattern of migration and the trends in spatial mobility. The incorporation of some flowline maps indicating various migration

streams would have further enhanced the quality of this interesting chapter. The chapter on urbanization is replete with generalities and among the specific factors arresting urban growth in the region lack of industrialisation and concentration of workers in agricultural activities have been rated as most important ! That is all. Urban sex ratios have been shown (Fig. 8.9) using the choropleth technique. The author could try shaded graduated circles in order to bring out the relationship between the size of urban centres and sex ratios.

Books by trained geographers such as the present one should not flaw on one major front : quality of maps. Maps in this book leave much scope for improvement.

Organized in the empirical-inductive tradition of inquiry this book, essentially a micro-level study in Population Geography, is a useful contribution to the meagre literature on small regions. A series of such studies for many other distinct regions would surely prove beneficial in understanding India as a whole.

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