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THE HIERARCHICAL ORGANIZATION AND STRUCTURAL PATTERN OF URBAN CENTRES: A MULTIVARIATE APPROACH

A. RAJMOHAN, Madras

ABSTRACT : The urban centres reflect their growth histories and resource orientations. Distribution of towns of different sizes is uneven over space. Tamilnadu, the second most highly unbanised state, has 439 urban centres out of a total of 2641 in the whole of India. The organisation of the urban centres over space also is considered as providing an insight into the regional differences in the development precesses. Cluster analysis and factor aualysis have been used to establish the hierarchy of urban centres and to understand their structural pattern, on the basis of a set of rigorously scrutinised variables which are demographic, occupational and cultural in character. An understanding of the multiple number of measurements on these variables is made possible through a reduction of dimensions achieved by subjecting the data set to factorial analysis. Factor analysis enables thus, to discover the fundamental dimensions of urban places in Tamilnadu, while the multivariate taxonomic tool-cluster analysis is used to classify the urban centres into groups.

The cities and town in India have a hoary historical past. It is more so in the case of Tamil Nadu. The 'raison d''etre' of large towns and cities has always been that either they were the royal capitals or temple towns. Several of the larger towns in Tamil Nadu can be cited as examples: Madurai, Tiruchirapalli, coimbatore, Thanjavur, Kancheepuram, Kumbakonam, Tirunelveli, Nagarkoil and Tiruppur. Later several socio-economic and political factors stimulated further growth of urban centres: political infrastructure, development of transport networks like railways and roads, expansion of educational facilities, agricultural and industrial development. Such development processes in giving rise to heterogeneous types of urban places reflect their growth histories and resource orientations.

As elements of the central place system, towns are both spatial and functional. Functionally they are part of their hinterlands, although all towns do not necessarily develop hinterlands (Rao, 1971). Besides, the distribution of towns of different sizes is uneven over space like their hinterlands. It is in fact the resource base of a region which spontaneously helps in the origin and growth of urban centres reflect ing its (the region's) basic characteristics.

Tamil Nadu has achieved a higher level of organization of human space : it is the second most highly urbanised state of India with 30.36 per cent of its total population living in unban areas; next only to that of Maharashtra's 31.2 per cent. The state has consistently had a higher percentage share of urban population in the previous decades also (Table I).

Urbanisation is an indicator of economic growth. Most of the economically advanced countries have between 50 and 80 per cent of their population living in urban areas. The proportion of Tamil Nadu's urban populat-

Table I

Degree of Urbanism : Percentage of Urban Population to Total Population

Year	India	Tamil Nadu
1951	17.29	24.35
1961	17.97	26 69
1971	19.91	30.26

ion has increased from 14.2 per cent in 1901 to 30.26 in 1971. The growth of urban population in the state had always been higher than that of general population. The decade 1941-51 registered a growth of 41.8 per cent in urban population as against 14.7 per cent of the general population. During 1951-61 and 1961-71 the urban population went up to 22.6 per cent and 38.6 per cent whereas the general population increased to 11.9 per cent and 17.23 per cent respectivly.

There are 439 urban centres in Tamil-Nadu (Census of India 1971) out of a total of 2641 in the whole of India. An investigation of table II substantiates the differential growth pattern of the process of urbanisation within the state.

The proportion and the rate of growth of urban population, as well as the increase in the number of urban centres have not been even. The various regions in the state have had a distinctly differing urban growth. The Tambaraparani basin (Tirunelveli district), part of Vaigai basin (Ramanathapuram and Madurai districts), the Cauvery delta (Thanjavur district) and the Palar basin (North Arcot and Chingleput districts) have been undergoing the process of urbanisation over a very long stretch of time (Table III).

The contributing factors have been soil fertility, abundance of water and administrative infrastructure as they were pievotal

Table II

Growth of Urban Population

District/State	% of UP to tot. Popn.	% growth rate of U. P. 1961–71	No. of U. Centres.	Rank.
India	19.9	38.2	2641	
Tamilnadu	30.26	38.64	439	
Madras	100.00	42.81	1	1
Chingleput	34.76	121.80	74	4
North Arcot	20.85	24.06	32	10
South Arcot	14.18	30.76	14	13
Dharmapuri	8.58	54.37	7	14
Salem	26.58	51.76	43	7
Coimbatore	35.59	50.77	58	3
Nilgiris	49.24	35.23	17	2
Madurai	33.62	30.37	38	5
Tiruchiraplli	22.27	26.39	32	9
Thanjavur	20.52	19.13	32	11
Ramanathapuram	26.11	24.55	34	8
Tirunelveli	32.17	21.42	52	6
Kanyakumari	16.72	36.20	5	12

Table III

Progress in No. of Towns

District/State	1901	1911	1921	1931	1941	1951	1961	1971
Tamilnadu	133	162	189	222	257	297	339	439
Madras	1	1	1	1	1	1	1	1
Chingleput	15	16	17	18	20	22	34	74
North Arcot	11	18	21	22	22	22	30	32
South Arcot	9	11	14	16	18	18	20	14
Dharmapuri	3	4	4	3	5	6	6	7
Salem	6	6	6	6	12	13	19	43
Coimbatore	8	12	12	12	19	52	34	58
Nilgiris	2	3	3	4	4	4	13	17
Madurai	9	11	14	19	23	56	32	38
Tiruchirapalli	7	9	11	21	28	32	33	32
Tnanjavur	19	19	21	22	24	29	34	32
Ramanatnapuram	19	22	25	31	32	33	35	34
Tirunelveli	23	29	30	36	38	49	44	52
Kanyakumari	1	1	10	11	11	20	4	5

areas of power since the historical periods. The Coimbatore plateau has availed a squarely different impetus for its very recent growth process of unbanisation : power and capital. Therefore, an insight into the regional differences in the developmental processes may be gained through understanding the organisation of the urban centres over space.

Methodology

Cluster analysis and factor analysis, the two very widely applied statistical tools in geography have been used to discern the hierarchical organisation and to understand the structural pattern of the basic urban characterstics of the urban centres through a set of carefully selected 28 variables (Table IV).These variables are demographic, occupational and cultural in characteristics.

Table IV

List of Variables

1. Administrative status
2. Urban Population
3. Urban density
4. Growth rate of urban population (1961-71)
5. Growth rate of urban population-density (1961-71)
6. Sex ratio
7. Literates
8. Workers
9. Cultivators
10. Agricultural labour
11. Livestock etc.
12. Mining etc.
13. Household industry
14. Manufacturing
15. Construction
16. Trade and commerce
17. Transport and storage
18. Other services
19. Receipt of revenue
20. Banks
21. Agricultural credit societies
22. None-agricultural credit societies
23. Electricity (Number of points)
24. Health (Number of beds)
25. Colleges
26. Secondary schools
27. Middle and other schools
28. Technical institutes

Cluster analysis through ascertaining the strength of the association between the variables by a computational transformation has produced 439 operational taxonomic units (OTU'S) which when subjected to the cartographic solution of a dendrogram or linkage tree (Fig. 1) helped to identify five distinct levels of hierarchy (Appendix A). The linkage tree represents the stepwise clustering of the urban centres. The several groups, subgroups and isolates are all linked on the basis of their nearness to each other in terms of the Euclidean distance between every pair of points. Yet the linkage tree does not show any specific level of hierarchy as there are no acceptable standards or norms on the taxonomic distance scale which would be considered as indicating the cluster status. Therefore, this complex procedure of obtaining the clusters or hierarchical orders has been solved on the basis of two cut off points on the taxonomic distance scale. They have peen drawn at the dij values of mean and one standard deviation. Centres clustering below the mean distance have been assigned to the 5th level, while those clustering between one standard deviation and the above the mean distance to the fourth. The third and second order centres link between themselves to ultimately cluster with first (or the highest) level centre above the one standard deviation level.

This hierarchical ordering speaks definitely of the composite strength of the variables as manifesting in the different orders of towns, yet does not reveal the structural strength and pattern of urban centres. Factor analysis while accomliishing this, helps in the reduction of dimension of the multiple number of measurements made on the 28 variables into a manageable number of new variables called factors. Thus eight basic dimensions have been extracted as representing the basic structure of urban characterics of Tamil Nadu.

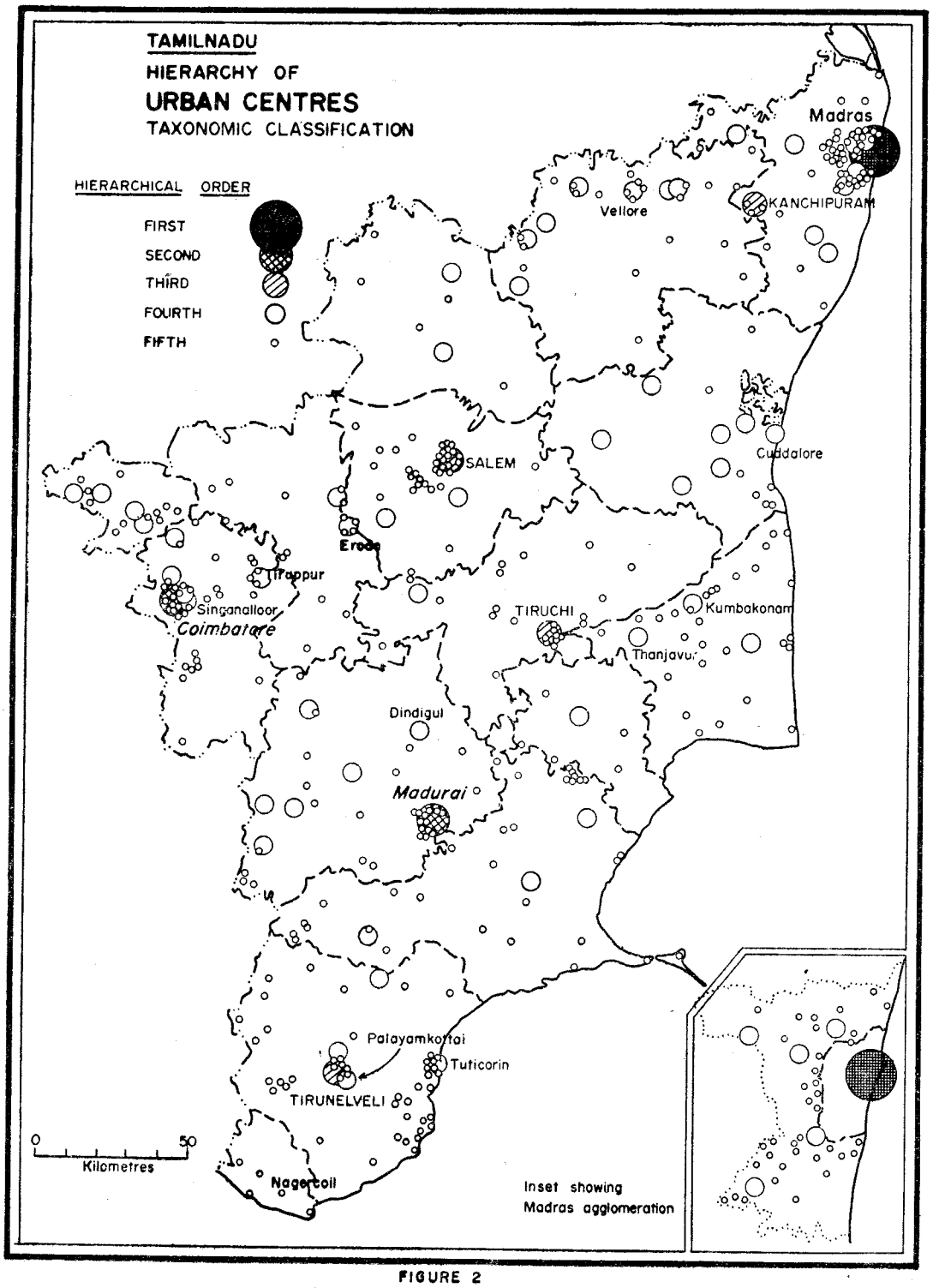
Hierarchical Ordering

Madras city (population 2469450), the fourth metropolis of India, occupies the highest level in the hierarchy (Fig. 2) Its supremacy in the hiearchical ordering is because of the historical advantage accruing by being the administrative capital of the state. It displays very high demographic and economic potentiais.

Madurai (549110) and Coimbatore (356370) comprise the second level of hierarchy, both of them far removed from the first order centre in location; Coimbatore located on the Kongunadu plateau is essentially industrial in character, thriving on the historical and locational advantages of proximity to the sources of energy and capital. Madurai situated in the middle of the dry southeastern part is a rival to Coimbatore as a leading textile centre.

Tiruchirapalli (307400), Salem (308720) Tirunelveli (108500) and Kancheepuram (110609) occupy the third level of hierarchy. Tiruchirapalli and Salem, possessing the necessary population potential, are centres of considerable industrial potential also (textiles, engineering, paper etc.) in addition to the claim of Tiruchirapalli as a centre of considerable tourist potential. Kancheepuram in spite of the handicap of having a smaller population (when compared to the above two larger towns) justifies its place in the third order on three grounds : i) its historical antecedent as a centre of pilgrimage. ii) the presence of a large specialised handloom industry and iii) as an imortant market for the agricultural produces of its hinterland (Spate and Learmonth, 1960). Tirunelveli owes its place within this order mainly because of its location in the Tambaraparani basin, a rich agricultural tract in the dry south eastern margin.

As many as 59 urban centres of varying sizes displaying a well distributed pattern belong to the fourth level. Centres of over 100,000 population such as Tuticorin (155310), Thanjavur (140550), Vellore (139080), Dindigul (128429), Tiruppur (113300), Kumbakonam (113130), Singanallur (1122110) Erode (105110) and


TAMILNADU
HIERARCHY OF
URBAN CENTRES
TAXONOMIC CLASSIFICATION
HIERARCHICAL ORDER
FIRST
SECOND
THIRD
FOURTH
FIFTH
Madras
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Cuddalore
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Erode
Tirappur
Singanallour
Coimbatore
TIRUCHI
Kumbakonam
Thanjavur
Dindigul
Madurai
Palayamkottai
Tuticorin
TIRUNELVELI
Nagercoil
0
50
Kilometres
Inset showing
Madras agglomeration

FIGURE 2

Cuddalore (101335) fall within this category.

Presence of urban functions in their lower dimension and the influence of primary variables like livestock, cultivators, aud agricultural labour expain the ordering of such large urban centres (population wise) within this level. Except for a few which are located in the vicinity of higher level centres (Ambattur, Avadi, Alandur and Tambaram near Madrus, Ganapa tinear Coimbatore and Palaymkottai near Tirunelveli) the rest of the fourth order centres exist as independent centres. The former set of centres owe their place in this hierarchy to the higher order urban centres whereas the latter group possesses distinct hinterlands of their own. This explains their dominant primary characteristic.

The fifth or the lowest level centres number 373 and are found distributed all over the state. A signifificant feature of their distribution pattern is their remarkable tendency to cluster around higher order centres. the lower order centres (mostly with a population of under 20,000) when found clustering around the higher order centres are their suburbs and do not possess hinterlends of their own whereas the rest of the fifth order centres found interspersed amidst the rural areas are the outcome of the compelling necessity to fulfil the needs and desires of the population, as market centres for the rural produce. Their distribution coincides with areas of medium and high population densities. Urban centres such as Nagarkoil (141290), Nagapatinam (68030), Virudunagar (61900), Karaikkudi (55450), Sriviliputtur, (56860), Chidambaram (48810), Rajapalayam (36950), Tiruchendur (18130) and Gudalur (15560), despite their population sizes are included wlthin this level mainly because of their significant participation in non-urban activities.

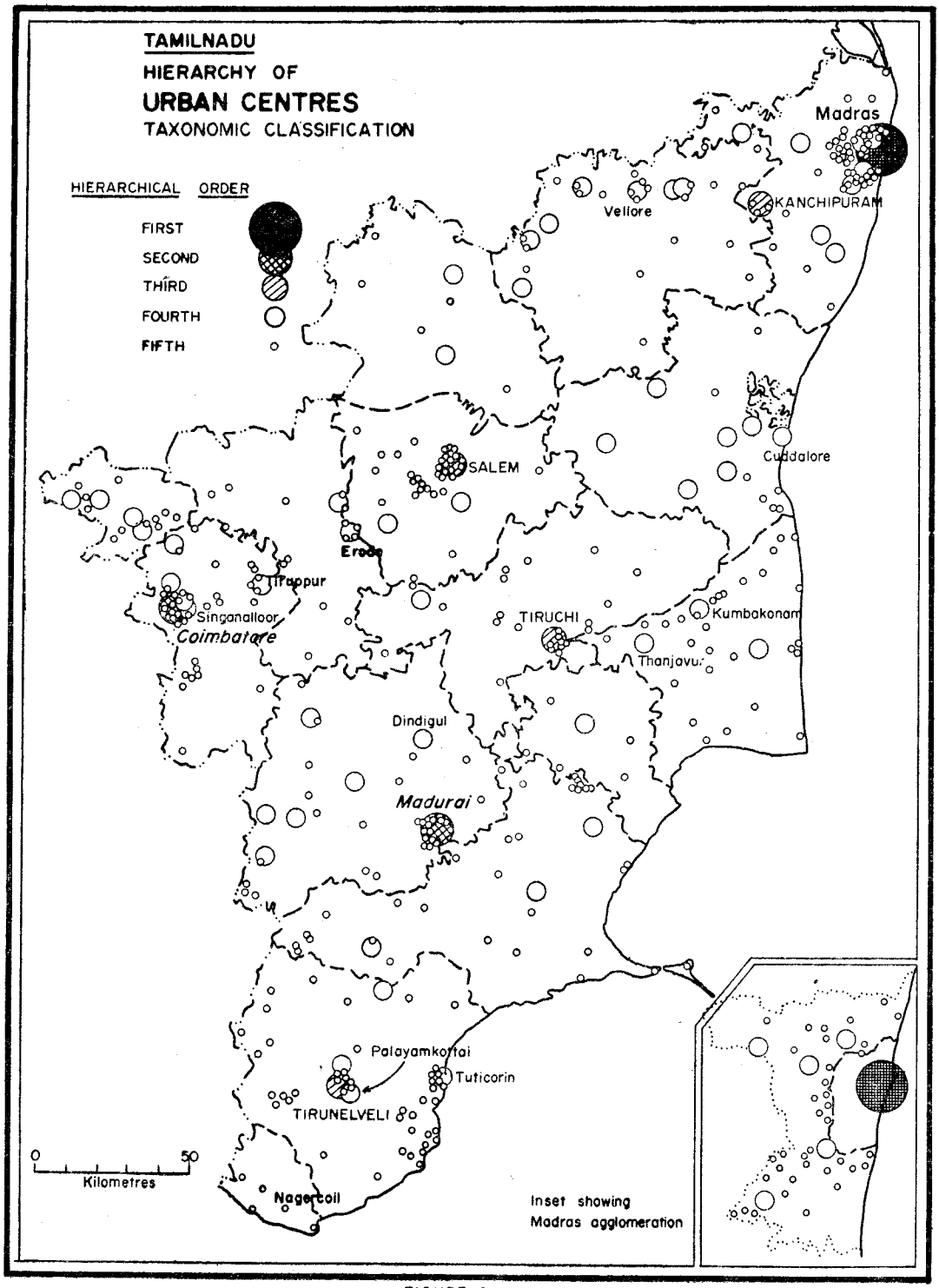
Urban Characteristics : Significance of Relationships Among Vaiables

Discering the structure and hierarchical organisation of urban centres could be more meaningfully achieved only when the vari ables subjected to analysis reflect more comprehensively the essential aspect of urban elements possessed by them. The matrix of Pearsonian Product Moment Correlation (28 x 28) contains 406 coefficents 225 positive and 181 negative (Tabl V). Further perusal revels that variables like administrative status, (Urban) population, (urban population) density, receipt of revenue, banks, non agricultural credit societies, electricity, health and educational facilties display significant positive correlations. Yet a considerably large number of variables have negative relationships. They are rates of growth of population and popula rion density, sex ratio, workers, trade and commerce, agrictural labour, livestock all mining, cultivators and agricultural credit societies. The positive relationships bear eloquent testimony to the potential economic and social characteristics of all the urban centres and more particularly of the higher order centres. The negative relationships reveal the dominance of such variables in the lower order urban centres. Hence the following inference seem to be in order the urban centres in general bear a strong imprint of their rural base; while only the trace of primary base is found in the higher order centres, the lower centres have their roots strongly embedded into it.

Structure of Urban Characteristics

The selected set of 28 variables as contained in the urban centres of Tamil Nadu (grouped into a five level hierarchy) have been reduced to 8 basic dimensions. The rotated factor matrix (Normal Varimax 28 x 8) shows the elements relevant to the factors of each variable (Table VI). The signs of the elements imply the directions of the association. The size of each value indicates the degree of association of each variable with the appropriate factor.

The 8 new independent variates explain away more than 75 per cent of the covariance of the original variable. Of this the first 4 factors, among themselves contribute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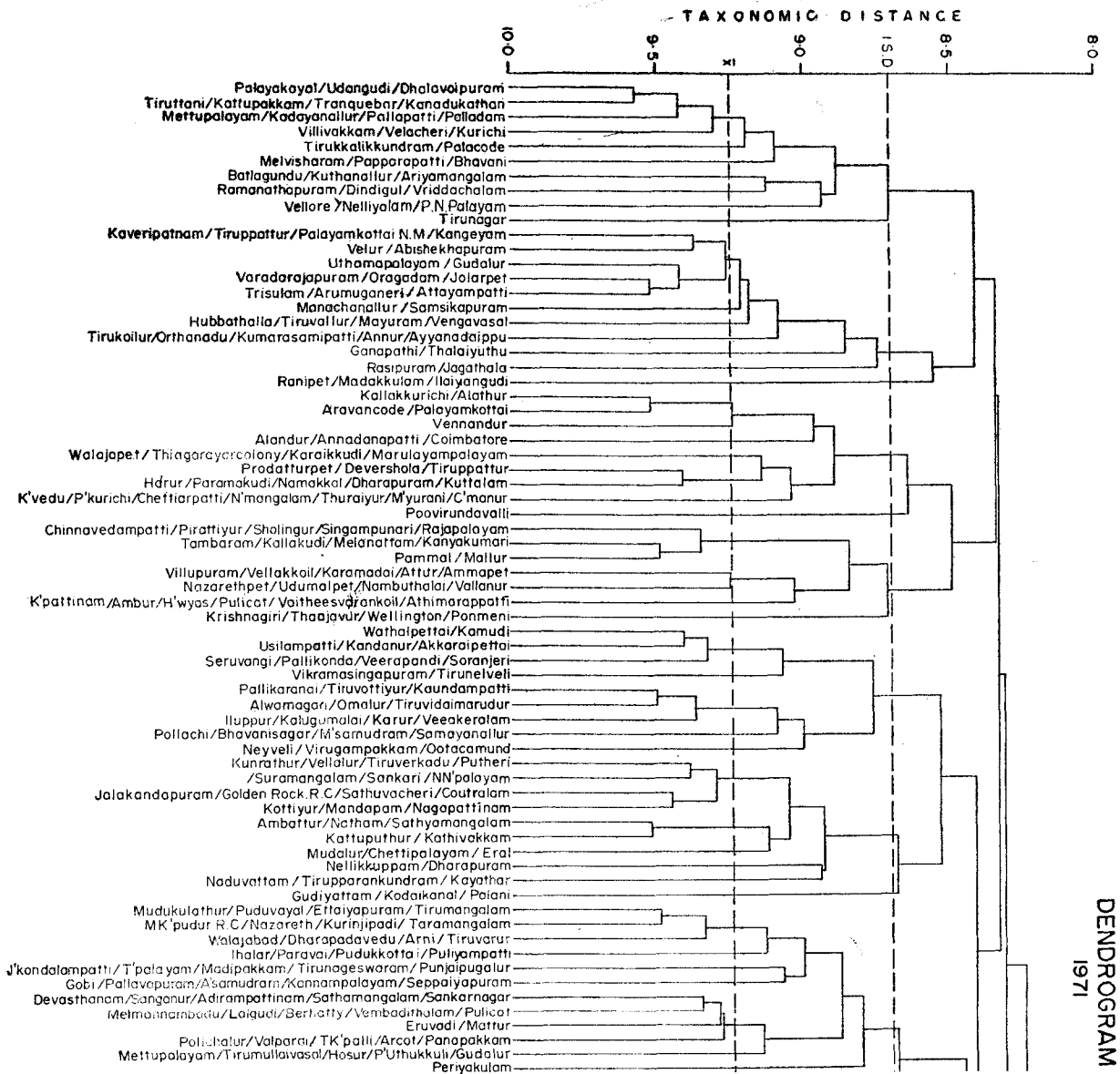
VARIABLES	1	2	3	4	5	6	7	8	9	10	11
1	1										
2	.36	1									
3	.47	.46	1								
4	−.31	−.12	−.25	1							
5	−.28	−.10	−.16	.89	1						
6	.07	−.04	−.03	−.19	−.14	1					
7	.17	.14	.37	−.29	−.29	−.01	1				
8	−.10	−.06	−.20	.21	.22	−.04	−.45	1			
9	−.13	−.14	−.35	.02	−.02	.17	−.38	.13	1		
10	−.12	−.14	−.31	.19	.15	.08	−.40	.24	.51	1	
11	−.16	−.02	−.13	00	.02	−.02	−.16	.21	−.19	−.17	1
12	−.08	0	−.04	.09	.08	−.02	0	−.04	−.02	−.02	−.03
13	.04	−.03	.0	−.06	−.02	.06	−.26	.42	.03	−.09	−.14
14	−.03	.04	.18	.25	.26	−.10	.11	−,02	−.35	−.26	−.22
15	−.01	.04	0	.08	.07	−.07	.10	−.16	−.22	−.26	−.05
16	.40	.14	.31	−.46	−.42	.17	.38	−.47	−.21	−.37	−.16
17	.07	.11	.19	.06	.05	−.24	.21	−.28	−.28	−.29	−.16
18	.09	.08	.14	−.22	−.24	−.05	59	−.45	−.20	−.30	−.09
19	.34	.98	.47	−.10	−.08	−.03	.13	−.07	−.14	−.13	−.02
20	.44	.58	.60	−.27	−.23	−.03	.28	−.13	−.17	−.16	−.07
21	.22	0	.05	−.24	−.25	.05	.06	−.01	.07	.06	−.06
22	.35	.99	.45	−.11	−.10	−.03	.15	−.08	−.13	−.13	−.03
23	.39	.98	.50	−.13	−.12	−03	.17	−.08	−.16	−.16	−.04
24	.33	.97	.42	−.10	−.08	−04	.14	−.07	−.13	−.13	−.02
25	.01	.03	0	.06	.05	−06	−.07	−.05	−.11	.08	−.02
26	.35	.98	.41	−.13	−.11	−04	.16	−.08	−.13	−.13	−.03
27	.39	.98	.48	−.16	−.13	−03	.17	−.07	−.16	−.15	−.01
28	.32	.98	.38	−.10	−.09	−04	.13	−.07	−.11	−.11	−.03

Table V
Inter-Correlation Matrix

11	12	13	14	15	16	17	18	19	20	21	22	23
1												
−.03	1											
−.14	−.04	1										
−.22	.04	−.19	1									
−.05	−.03	−.17	.07	1								
−.16	−.09	−.15	−.17	.13	1							
−.16	.01	−.23	.13	.14	.07	1						
−.09	−.03	−.31	−.22	.16	.34	.07	1					
−.02	.01	−.04	.03	.03	.14	.10	.09	1				
−.07	−.02	−.05	−.02	0	.32	.10	.16	.62	1			
−.06	−.07	.01	−.11	−.04	.15	−.09	.04	−.01	.01	1		
−.03	−.01	−.04	.02	.04	.15	.11	.09	.97	.59	.01	1	
−.04	.02	−.02	.04	.04	.17	.12	.10	.97	.64	.01	.98	1
−.02	0	−.04	.03	.04	.12	.10	10	.96	.55	−.02	.98	.96
−.02	−.01	−.03	.01	−.05	−.06	−.03	−.04	.04	.01	−.04	.04	.03
−.03	−.01	−.03	−.01	.04	.15	.10	.11	.95	.56	0	.97	.96
−.01	−.01	−.04	.01	.03	.17	.10	.10	.96	.62	.02	.97	.98
−.03	0	−.04	.02	.04	.12	.10	.09	.95	.50	−.01	.97	.96

20	21	22	23	24	25	26	27	28
1								
01	1							
.59	.01	1						
.64	.01	.98	1					
.55	−.02	.98	.96	1				
.01	−.04	.04	.03	.04	1			
.56	0	.97	.96	.97	.03	1		
.62	.02	.97	.98	.95	.04	.96	1	
.50	−.01	.97	.96	.97	.04	.98	.96	.1



TAMILNADU
URBAN CENTRES
DENDROGRAM
1971

LNADU
CENTRES
ROGRAM
971
Eruvadi/Mathur
Polichalur/Valparai/TKPalli/Arcot/Panapakkam
Mettupalayam/Tirumullaivasal/Hosur/PUthukkuli/Gudalur
Periyakulam
Truchirapalli/Deokkottai/Colachel
Alagapuram/TuticorinNM/Perungalathur
Muthupet/Tallakulam/NArasanikotti/Mullakadu/Reddipatti/Peraiyur
Virudunagar/Annamalainagar/Kulithalai
Kodambakkam/Cpakkam/Valangiman/Pallapalayam/Vnallur
VVpuram/Kotagiri/Puliangudi/PAmaravati/Kodungaiyur/Maduranthakam
Neikkapatti/Pallipalayam
ErodeNM/PCpalayam/Wandiwash/Virudampatti/Thatchanallur
Madras/Pattukottai/Portonovo/NAputam/Surmpatti/Thangal/Singanallur
Madavaram/Elampillai/Jaffarabad/Ariyalur/Coonoor/TMpoondi
Tiruvannamalai/Vennandur
Meenambakkam/Narasoijpatti
Chinnamoolayam/Koveripakkam/Erode/Thisayanvilai
Alagapuri/Mlavettam/Beebikulam/Mmadurai/Sirugamani
Bodinayakkanur/Coimbatore NM
Ayyampet/Padmanabapuram/Erode/AJakkampatti
Villupuram/Arantangi/Kavundamalayam/Sirkali/Arkonam
Denkanikotta/Arni
Mudichur/Anamalai/Tiruvaiyar/Nagarkoil/Srirangam/Senapalayam
Madurai/Thadampatti/Sirumugai
Poovalur/Srivilliputtur/Vedaranyam
Cumbum/Srivaikuntam/Meenattupalayam/Anakaputhur/Polai
Tirumazhisai/Tiruchendur/Pillanallur/Tambaram/Melapalayam
Andanapettai/Rameswaram
Avaniapuram/Sankarapuram/Mettur/Sadayankuppam
Sevilimedu/Seevur/Shencottah/Sivagripatti
Kurudampalayam/Musiri/Kavilpatti
/Perungadi/Panruti/Vetampalayam
Sivadapuram/Perur/Sembarambakkam/Masinagudi/Ponmalai
Nerkundram/EPuliyampatti/Melur/Adhurai/Sattankulam
Avadi/Thorapadi/Chinnalapatti/Sawyerpuram
Tiruvattipuram/Salem/Chidambaram/Aruppukkottai
Uttiramerur/Tiruthuraipoondi/Theni/Swaganga
Vilangudi/Alangudi/puthur
Sulur/Vilathikulam/Saligramam/Uthukuli/Papanasam
Komarapalayam/Pettai/Mulligoor
Katpadi Extn./Komarapalayam S
Pallapatti/Kallidaikurichi/Kondalampatti/Keeranur
Kariapatti/Tiruchengode/Kumarapalayam
Kuzhithurai/Kunnamuthur/Avanashi/Konavakarai
Tiruneermalai/Perambur/Andanapettai/Erukkancheri
Manimuthar/Polur/Manaparai/Makkinampatti/St Thomas Mount
Tirupuvanam/Ammapalayam/Sivakasi
Bhuvanagiri/Thattaneri
Cheyyur/BPAghraharam/Vanniambadi/Alaganeri/Muthiapuram
Nadukuthaghai
Harveypet/UAriyamangalam/Tiruppur/Kilakkarai
Dharmapuri/Cuddalore
Pernampet/Kumbakonam/Nilakkottai
Paliathur/Mannargudi/Srivaikundam/Sankarankoil
SPpudur/KSpatnam/Sennirkuppam/Madukkarai/Konavattam/Vilankurichi
OValley/Thenkasi/Tirumangalam/Kanchipuram
Edapadi/Urachikottai/Meyyanur/Thattayangarpet
Tiruvannamyur
Thandi
80
85
S.D
90
95
100
TAXONOMIC DISTANCE

Fig. 1

to the extent of 59 per cent to explaining the variability in the matrix of association.

Factor One

02 Urban Population	99
22 Non-Agricultural Credit Society	99
19 Revenue	98
23 Electricity	98
24 Health	98
26 Seconbary Schools	98
27 Middle and Other Schools	98
28 Technical Institutes	98
20 Banks	60
03 Urban Density	45

The first factor which is considered as the primary factor reveals the basic demographic and economic potentials of the urban centres. As many as 10 variables comprise this strong urban component which on its own explains 32 per cent of the total variance. The list of variables most highly correlated with this factor, clearly indicates that it is very closely associated with a range of demographic, economic and cultural variables. It is most highly positively associated with urban population, non-agricultural credit societies, receipt of revenue, electricity, health facilities and educational institutions. Interestingly enough it does not show high negative association with any of the variables. The associations of the first factor are clearly delineated, and show that it is positively associated with urban aspects.

Factor Two

08 Workers	78
13 Houshold Industry	72
18 Other Services	-71
07 Literates	-51
16 Trade and Commerce	-42

The second factor's contribution to explaining the total variance in the matrix of associations is significantly very low. It accounts for only 12.38 per cent. It shows high positive associations with total workers and household industry. It is highly associated with other services and literates. While retaining aspects of the secondary sector, it stands out as a tertiary component.

Factor Three

04 Growth rate of urban population	-87
05 Growth rate of urban population density	-55
16 Trade and Commerce	52
14 Manufacturing	-47
21 Agricultural credit societies	45
01 Administrative status	44

The third factor accounts for8 .98 per cent of the total variance. It is highly negatively associated with the rate of growth of urban population and significantly negatively with the rate of growth of urban population density and manufacturing. It is significantly positively related with trade and commerce and also with agricultural credit societies and administrative status. Therefore this factor clearly emphasises the growth characteristics of urban population and economic aspects as well.

Factors Four and Five

IV

09 Cultivators	81
10 Agricultural labour	79
14 Manufacturing	-52
03 Urban population density	-51

V

11 Livestock	-88

The fourth and fifth factors explain variances of 5.63 and 4.99 per cent respectivly. The fourth factor is highly positively associated with cultivators and agricultural labour. It possesses negative relationships with manufacturing and urban density. The fifth factor is highly negatively related to livestock. The associations of these factors clearly define them as rural components.

Factor Six

06 Sex Ratio	85
17 Tarnsport and storage	-51

The sixth factor has highly positive association with sex ratio. It has significant negative relationship with transport and storage. Thus it clearly identifies itself as a component of male population dominancy. The negative element of the vector in this factor explains its importance in the middle and lower order centres.

Table VI

Rotated Factor Matrix (Normal Varimax)

Variables	Factors								
	I	II	III	IV	V	VI	VII	VIII	h^2
1	35	06	44	18	38	-04	22	09	56
2	99	-02	03	-05	02	-01	00	00	99
3	43	-02	26	-51	-33	-06	04	20	67
4	-08	10	-87	08	04	-14	03	-02	80
5	-06	14	-55	01	05	-09	03	00	76
6	-03	00	13	08	11	85	-01	-06	77
7	09	-57	28	-43	13	-01	-06	-03	62
8	-03	78	-14	11	-21	-06	09	-05	70
9	-09	-09	-04	81	12	16	-03	10	73
10	-08	17	-14	79	14	02	03	18	73
11	-01	11	01	-15	-88	-04	06	08	82
12	01	-02	-06	01	05	-08	-83	-05	71
13	-03	72	19	-08	-06	13	-06	-05	61
14	00	06	-47	-52	37	02	01	16	66
15	05	-33	-23	-17	01	-07	35	-49	55
16	10	-42	52	-25	19	21	15	-09	63
17	08	-28	-09	-26	24	-51	-24	-11	55
18	06	-71	27	-20	-11	-05	02	-13	62
19	98	-03	02	-06	02	-01	-01	01	96
20	60	-06	32	-21	19	-08	-06	15	58
21	-02	09	45	19	20	-27	32	-09	47
22	99	-04	03	-04	02	-01	01	01	98
23	98	-03	06	-09	05	-01	-01	-01	98
24	98	04	00	-03	-01	-01	-01	-01	96
25	03	-11	-10	09	-04	-03	11	79	68
26	98	-05	-04	-03	00	-01	00	-02	97
27	98	-03	08	-07	-01	-02	02	01	97
28	98	04	00	00	-01	00	-01	-03	96
Eigenvalues	8.93	3.47	2.51	1.58	1.40	1.07	1.05	1.00	
Percentage Variation	31.90	12.38	8.98	5.63	4.99	3.81	3.76	3.58	

Decimals Have Been Omitted

Factor Seven and Eight

VII		
	12 Mining	-83
VIII	25 Colleges	79
	15 Construction	-.49

The seventh factor has high negative association with mining. It identifies its explicit importance in the lower order urban centres. The eighth factor has high positive relationship with colleges while showing negative association with construction. This minor factor lays stress on the importance of educational institutions in the urban centres.

Hierarchical Organisation and Structural Pattern

The urban centres of TamilNadu (as hierarchically organised) exhibit certain basic and overall characteristic features. The first order centre, Madras ranks first in terms of total population, banking, receipt of revenue, education and tertiary activities. It occupies second position in manufacturing and literacy (Table VII). It is also characterised by the lowest sex ratio. All these facts are strongly eorraborated by the factor structure (Table VI). Variables present in this centre show very high correlations with the primary factor. They include variables relating to basic demographic, economic and cultural characteristics. They also have significant loadings in the second (tertiary) sixth (sex ratio) and eighth (education) factors. This provides ample evidence on the high degree of urbanism of the first order centre.

The second order centres possess very high group means in such urban characteristics like industry, trade and commerce; second position in total population, agricultural credit socities and third in transport and storage. They are also characterised by highest population densities. These variables show significant associations with the sixth (sex ratio) second (literacy) and first (demographic and economic) factors.

The third order centres rank first in household industry and second in mining, transport and trade and commerce. They also occupy the third position in most of the other variables. As such they show significant loadings in the second (tertiary) and the first (demographic and economic) factors. The importance of household industry in this level is explained by the presence of Kancheepuram, Salem and Tirunelveli; Salem accounts for mining as well.

The fourth order centres rank first in mining and second in rate of growth of population and population density, total workers, agricultural labour and livestock. This indicates their importance in demographic aspects and in the primary sector. This is further fortified by the significant loadings of these variables in the third (demographic growth) sixth (sex ratio) fourth (rural) second (tertiary), fifth (rural) and seventh (mining) factors.

The fifth and the last order centres have the highest group means in growth rates of population and population density, total workers, cultivators, agricultural labour and livestock. They rank second in household industry, third in agricultural credit societies and construction. The importance of fifth order centres in terms of the demographic aspects is well substantiated by the significant loadings of the related variables in the third (demographic growth) and sixth (sex ratio) factors while their economic and primary characteristics are emphasised by their loadings is the second (tertiary) fourth (rural) fifth (rural) and seventh (mining) factors.

In the light of the above facts the following observations are in order. The higher-order centres display very strong and distinctive urban characteristics. As the hierarchical level decreases, there is a perceptible increase in the primary sector. The higher order centres despite their having larger population base and higher population densities, register lower rates of growth in respect of these variables. This phenomenon is explained by two factors; i) the physical expansion of these centres and ii) the process

of suburbanisation stemming out of the population moving towards the periphery from the congested urban core. The higher rate of growth of population occurring in the lower order centres could be attributed to natural growth as well as to the fact that as many as 100 villages have obtained urbanhood in 1971.

The foregoing synthetic account of inference from out of the results and of cluster factor analyses brings into focus as well as substantiate certain salient features of the

Table VII
Group Means

Variables	Hierarchical Order				
	I	II	III	IV	V
1	8.0	5.0	5.0	4.2	2.8
2	2469.45	452.74	208.82	48.92	14.47
3	1928.3	2070.95	1162.6	448.6	195.34
4	3.5	2.4	2.03	4.8	9.31
5	3.4	0.9	2.3	3.7	8.98
6	904.0	921.5	963.25	948.0	971.0
7	62.0	63.8	58.55	53.9	48.9
8	28.2	29.8	29.93	30.7	32.37
9	0.2	0.9	2.8	5.5	10.35
10	0.1	0.65	2.38	10.4	16.96
11	1.3	0.25	0.58	3.9	4 16
12	0.3	0.0	0.58	1.1	0.33
13	1.6	5.0	15.3	5.4	8.47
14	25.8	29.2	21.95	15.0	20.99
15	4.8	3.45	2.88	2.9	3.01
16	24.3	28 55	26.55	20.4	14.68
17	18.6	9.2	9.7	8.1	6.72
18	23.3	22.8	17.85	19.5	15.81
19	934.08	243.34	71.66	14.3	2.62
20	359.0	44.0	22.5	4.5	1.39
21	0.0	0.5	1.0	0.9	0.68
22	240.0	43.5	21.0	3.7	0.88
23	1915.57	368.41	286.80	44.7	11.97
24	9237.0	1634.0	398.0	144.0	24.07
25	27.0	12.5	3.0	0.7	2.08
26	178.0	30.5	10.5	3.7	1.51
27	604.0	117.5	70.75	16,7	6.18
28	209.0	24.0	9.0	2.7	0.75

urban centres. Madras City, the fist order centre is distinctly tertiary in character with a very strong economic base and also serve as a leading educational centre. The second and third level centres are basically tertiary in nature, yet have a strong industrial base as illustrated by Coimbatore and Madurai. The fourth and fifth order centres have their roots deep in their primary base while possessing such tertiary features necessary for their claim to the status as urban centres.

Distribution Pattern : Salient Features

The general distribution pattern of urban centres in Tamil Nadu has a tendency to clustering (Fig. 2) Four major clusters may easily be identified. They are the agglomerations of 1. Madras 2. Coimbatore 3. Salem and 4. Madurai. Eight minor clusters can also be discerned. They are: 1. Tirunelveli. 2. Tuticorin 3, Tiruchirapalli. 4. Karaikkudi 5. Tiruppur 6. Pollachi 7. Erode and 8. Vellore. This apart, two strings of urban centres, the first one straddling the Thanjavur-Mayuram road/ rail communication link (and also the Cauvery river) and the other the course of Palar are the characteristic features of the distribution pattern.

The first group of major clusters have developed around the higher order centres (Madras : first order, Coimbatore and Madurai Second order, Salem Third order) Their resource base is essentially industrial and tertiary. They are capable of commanding a larger hinterland.

The second group of clusters are mainly centred around fourth level centres except for Tiruchirapalli and Tirunelveli which belong to the third order. Tirunelveli Tuticorin (fourth) Tiruchendur (fifth) belt of urban centres has the advantage of location in the Tambaraparanc basin. Tiruchirapalli situated at the Cauvery river crossing liuking Madras to Madurai, Thanjavur to Salem and Coimbatore is at the head of the fertile Cauvery delta. Tiruppur and Pollachi are textile centres thriving on th eir location on the Kongunadu plateau, possessing the same advantages as does Coimbatore with respect to supply of power and raw materials. Erode-Bhavani clusters consist mainly of housebold industrial centres, depending on fresh water supply thus explaining their location on the Cauvery river. Lastly, the cluster around Karaikkudi does not possess any ' raison d'etre ' but for the complex of educational centres. The fact that the cluster consists entirely of a group of lower order centres is also evidence enough to the absence of any natural resource base.

Conclusion

Madras, the only centre in the first order is the primate city (of the state) and is located in the northeastern corner. There are very few centres in the next two levels, two in the second and four in the third. It brings into focus an anomalous situation where the numerous lower order centres in the fourth (59) and fifth (373) are left without the support of adequate number of higher order centres to sustain the system. Likewise, the well marked urbanism of the the higher centres stands out against the well entrenched primary characteristics of the lower order centres. Further, the distribution pattern too is not uniform wherein the urban centres are in groups and clusters. All these basic features sum up effectively the differences in the development of different regions of the state. This again definitely points at the uneven distribution of the resource endowment. The hierarchical ordering established thus should serve as an instrument in understanding the economy of the region as integrated over space.

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APPENDIX A
List Of Centres

First Order

1. Madras

Second Order

1. Coimbatore
2. Madurai

Third Order

1. Kancheepuram
2. Salem
3. Tiruchirapalli
4. Tirunelveli

Fourth Order

1. Tiruvallur
2. Tiruttani
3. Avadi
4. Tirumazhisai
5. Poovirunthavalli
6. Madavaram
7. Ambattur
8. Alandur
9. Tombaram
10. Chingleput
11. Tirukkalikundram
12. Ranipet
13. Melvisharam
14. Gudiyattam
15. Vaniyambadi
16. Ambur
17. Tiruppattur
18. Vellore
19. Tirukkeyilur
20. Kallakurichi
21. Vriddachalam
22. Cuddalore
23. Nellikkuppum
24. Panrutti
25. Neyveli
26. Krishnagiri
27. Dharmapuri
28. Tiruchengode
29. Rasipuram
30. Bhavani
31. Erode
32. Tiruppur
33. Mettupalayam
34. Periyanaickanpalayam
35. Ganapati
36. Singanallur
37. Pellachi
38. Nelliyalam
39. Naduvattam
40. Ootacamund
41. Wellington
42. Dindigul
43. Palni
44. Theni Allinagaram
45. Bedinaickanoor
46. Chinnamanoor
47. Bhatlagundu
48. Karur
49. Pudukkottai
50. Kumbakonam
51. Thanjavur
52. Tiruvarur
53. Devakkottai
54. Ilayankudi
55. Sivakasi
56. Kevilpatti
57. Tuticorin
58. Thalaiyuthu
59. Melapalayam.

Fifth Order

Due to constraint of space the listing of 373 centres of this level is omitted.

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Address of the author

A. Rajmohan, Department of Geography, University of Madras, Chepauk, Madras, 600005.