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The Urban System and Emerging Structure:
An Application of GIBBS' Measure to the Case of India

Abhandlungen - Anthropogeographie
Institut für Geographische Wissenschaften, FU Berlin
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THE URBAN SYSTEM AND EMERGING STRUCTURE: AN APPLICATION OF GIBBS' MEASURE TO THE CASE OF INDIA

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An analysis of urbanization patterns of the fourteen states of India over the 1971-91 period based on GIBBS' measure of scale indicates that even with a relatively low degree urban, the scale has continued to outpace the degree. GIBBS' prediction of a low correlation between the degree urban and the smallest size class(es) is borne out. However, contrary to GIBBS' notion, the pyramidal base (at the lowest size classes) for India, a country with a very low degree of urbanization, appears to be contracting.

Key Words: Urban Scale, Degree, Urbanization Process, India, Developing Countries

Introduction

According to a 1989 United Nations' report, in the recent past the developing countries' share of the worldwide urban population has been rising rapidly, narrowing the wide gap in the levels of urbanization between the developed and the developing worlds (1989: 4). Three years ago the Department of International Economic and Social Affairs of the United Nations projected that by 2010 one-half of the population of developing countries will reside in urban areas (1991: 4). As such, third world urbanization has become an especially important arena for research for social scientists and urbanologists. It has become obvious that for urban strategies and policies to be effective it is essential that the changing trends and patterns of urbanization be clearly understood. It has long been felt that in order to understand and compare urbanization in international and regional contexts some simple and easily comparable measures need to be used. Such measures would ensure comparability and address a range of structural changes within the urban hierarchical system. Nearly thirty years ago Jack P. GIBBS (1966) proposed a simple measure as a supplement to the conventional measure of degree. The objective of the present paper is to apply GIBBS' measure in an intra-national context to provide an empirical analysis of the urbanization process of India as a case study among developing countries.

The Urban Framework in India

In India, according to the 1991 Census of India (NANDA 1991: 7-10) there exist "two distinct types of urban units." The first is defined as a place having some sort of urban local government, such as a "municipality, corporation, cantonment board or

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notified town area committee." The second category contains places which also qualify as census towns or non-municipal towns if they fulfill the following criteria:
1.   a population of at least 5,000;
2.   a minimum of seventy-five percent of the male work force engaged in non-agricultural occupations; and
3.   a minimum density of 400 persons per square kilometer.

Furthermore, places which do not meet the above criteria of population size, occupation and density, but depict certain urban characteristics and offer facilities such as "major project colonies, areas of intensive industrial development, railway colonies [and] important tourist centers" may be included in the second category.

Urban places with a population of 100,000 and over are known as cities, and those with smaller populations as towns. All cities and towns are grouped into size categories on the basis of population: Class I--those with 100,000 and above; II--50,000-99,000; III--20,000-49,999; IV--10,000-19,000; V--5,000-9,999; and VI--less than 5,000 population. Lastly, in 1961 the census introduced the term "town-group", which was subsequently redefined as "Urban agglomeration", consisting of "a town and its adjoining urban outgrowths". The Indian metropolitan area is generally defined as an urban agglomeration or a city with a population of a million and above[1].

Urban Scale and the Urban Process

As GIBBS pointed out, the measure of degree revealed only one dimension of urbanization, the proportion of total population residing in the urban areas. It is possible, then, that two areal units with the same degree of urbanization may have wide variations in their individual urban structure. He proposed a measure to supplement the degree, namely, a scale[2] of urbanization, that would take into account "the distribution of both the urban and the total population among size classes of urban units" (GIBBS 1966: 170-171).

Although he found the two measures to have an extremely high positive correlation, to the point of redundancy, GIBBS argued that "the logical possibilities of divergence [between degree and scale of urbanization] make the observed correlations all the more remarkable" (1966: 174). In other words, divergence is a possibility for countries with the same degree of urbanization but different structural patterns, reflecting a differential process at work.

GIBBS postulated that the process of urbanization would dictate the nature of the relationship between the two measures of urbanization, namely, degree and scale. He noted that "Countries do not achieve a high degree of urbanization by uniform and constant expansion of the population in each urban size class" (1966: 174). Drawing an analogy between the urban structure and a pyramidal structure, GIBBS noted that:

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". . . as the size of the pyramid (i.e., the degree of urbanization) expands, the base . . . [proportion of the total population in the smallest size class] does not expand proportionately, or at least it does not do so indefinitely. Eventually, the base either remains constant or contracts, and subsequently the degree of urbanization increases by expansion of the proportion of the total population in larger urban units. In other words, as the degree of urbanization increases, there is a corresponding increase in the scale of urbanization and population concentration." (1966: 174).

GIBBS hypothesized that the correlation between the degree of urbanization and the proportion of population in the urban hierarchical system would follow a curvilinear pattern, with very low correlation at the lowest class, increasing up to the middle classes and declining beyond that point. His rationale for the low correlation at the base was that in countries with a high degree of urbanization the base size would be stagnant or contracting, whereas in those with a low degree of urbanization it would still be at an expansion stage. The low correlation at the top was explained by the absence of urban units in "extreme upper size ranges, because the scale of urbanization has not yet reached that point" (1966: 174).

This hypothesis was borne out by an examination of the urbanization process of eighteen countries in GIBBS' study. He also found "additional supporting evidence" through an examination of intercensal changes in the proportion of total population in the lowest size class: seventy-five percent of countries with a relatively low degree [>.50] of urbanization, in contrast to only 37.5% of those with a high [<.50] degree, showed a proportional increase in the lowest size class, indicating that after the degree of urbanization reached a certain level, the base ceased to expand. GIBBS observed the contraction of the base of the pyramid to be extending beyond the smallest size class in the United States.

In addition to his theory about the uneven expansion of the urban structural system [the pyramid], and the possibility of a divergence between the two measures of degree and scale, GIBBS also agreed with Kingsley DAVIS and Hilda GOLDEN (DAVIS and GOLDEN 1954 as cited in GIBBS 1966: 177) that "increases in the degree of urbanization [would] eventually assume a logistic form, that is, the higher the degree, the less the subsequent increase." "In other words", according to GIBBS, "beyond a certain point, the crucial variable . . . [would be] the scale rather than the degree of urbanization" (GIBBS 1966: 177). Citing the example of a higher increase in scale than in the degree of urbanization in the United States in 1950-60, GIBBS concluded that "in at least some countries the degree of urbanization may eventually cease to reveal significant changes in the urban structure" (1966: 177).

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Degree and Scale - An Empirical Analysis[3]

The present study area consisted of fourteen states of India for which comparable data for the 1991 and 1971 census years were available. States lacking urban centers in one or more size classes[4] and the Union Territories were omitted.

At the outset, the high correlations between the degree and scale of urbanization among the fourteen states at .97 (1971) and among 15 states at .97 (1991) were consistent with expectation. This confirmed GIBBS' assertion that at least up to a point the two measures could be used interchangeably.

In order to examine GIBBS' findings of a curvilinear relationship between the degree of urbanization and the proportion of total population in the size classes, a series of coefficients of correlation were undertaken for each of the two census years. The results are presented in Table 1.

Table 1   Coefficient of Correlation Between Degree of Urbanization and the Proportion of State Total Population in Each Size Class 1971 and 1991

Proportion of State Total Population in Size Classes	Degree of Urbanization	
	1971	1991
Class I	.8813*	.9679*
Class II	.7582*	.4714*
Class III	.4322	.4888*
Class IV	.5623	-.0322
Class V	.2308	-.0357
Class VI	.4629*	.1147

*Significant at or above .05

At the upper end of the urban hierarchy the non-linear correlation pattern evidenced in GIBBS' study did not appear[5]. At the lower end, however, with the exception of class VI in 1971 (positive at .05 level of significance), the smaller size classes showed low correlation with the degree of urbanization. This finding is consistent with GIBBS' prediction and findings of relatively low correlation for the smaller size classes.

However, GIBBS had argued that this low correlation would come about in countries with low degree and scale of urbanization as the proportion [of population] in the size class would be in the process of expansion (1966: 174). This notion did not seem to

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Table 2   Inter-Censal Changes in Population (Proportion of State Total) in Size Classes: Selected States of India, 1971-1991

Proportion of State Total Population

States	'71	'91	VI '71	VI '91	V '71	V '91	IV '71	IV '91	III '71	III '91	II '71	II '91	I '71	I '91
Andhra Pr.	19.31	26.84	.0004	.0001	.0071	.0017	.0256	.0088	.0409	.0444	.0258	.0338	.0934	.1795
Assam	---	11.08	---	.0019	---	.0050	---	.0209	---	.0284	---	.0129	---	.0416
Bihar	10.0	13.17	.0005	.0002	.0052	.0024	.0147	.0093	.0228	.0274	.0100	.0231	.0468	.0693
Gujarat	28.08	34.40	.0006	.0007	.0187	.0083	.0359	.0265	.0442	.0362	.0433	.0438	.1379	.2285
Haryana	17.66	24.79	.0017	.0006	.0131	.0093	.0185	.0259	.0425	.0296	.0544	.0375	04.63	.1451
Karnataka	24.31	30.91	.0030	.0017	.0112	.0065	.0463	.0239	.0374	.0547	.0204	.0227	.1247	.1997
Kerala	16.24	26.44	.0002	---	.0031	.0015	.0148	.0179	.0448	.0504	.0187	.0191	.0807	.1754
Madhya Pr.	16.29	23.21	.0007	.0003	.0161	.0153	.0230	.0375	.0315	.0298	.0180	.0323	.0735	.1169
Maharashtra	31.17	38.73	.0009	.0004	.0087	.0039	.0255	.0160	.0343	.0402	.0216	.0251	.2206	.3015
Orissa	8.41	13.43	.0004	.0004	.0107	.0053	.0130	.0228	.0234	.0265	.0033	.0197	.0333	.0597
Punjab	23.73	29.72	.0030	.0014	.0162	.0060	.0316	.0311	.0527	.0383	.0376	.0588	.0962	.1616
Rajasthan	17.63	22.88	.0006	.0001	.0120	.0042	.0349	.0299	.0361	.0487	.0189	.0313	.0738	.1146
Tamil Nadu	30.27	34.20	.0010	.0005	.0082	.0047	.0299	.0209	.0457	.0383	.0430	.0519	.1747	.2256
Uttar Pr.	14.02	19.89	.0002	.0010	.0064	.0117	.0137	.0244	.0237	.0277	.0153	.0228	.0809	.1114
W. Bengal	24.75	27.39	.0002	.0003	.0044	.0037	.0102	.0071	.0223	.0209	.0257	.0180	.1847	.2238

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apply in the Indian context. When the intercensal changes in the proportion of total population in each state for each of the six size classes between 1971 and 1991 were compared, it became apparent that in ten of fourteen states in class VI, and in all fourteen states in class V, the proportion of state total population *decreased* instead of being in a state of expansion as GIBBS has postulated (Table 2). Furthermore, not only did the base of the pyramid contract, but, paradoxically - as GIBBS had concluded *in the context of the United States three decades ago* - "The contraction of the base of the urbanization pyramid . . . now extends beyond the smallest size class" (GIBBS 1966: 176).

A comparison of the findings presented in Table 1 above with those of a similar study conducted on the 1951 and 1961 urbanization patterns (MOOKHERJEE 1969) portrays an interesting trend in the development of urban structure in India over the past forty years. Whereas in the earlier study only class I cities showed positive correlation with the degree urban in 1951 and 1961 (1969: 311), current analysis revealed the same for classes I *and II in 1971 and classes I, II,* and *III in 1991.* Clearly, the conclusion of the earlier study that "the rise of urbanization in India is associated with increase of urban population in only these larger units" (1969: 311) is no longer tenable.

Finally, consistent with the trend observed in India (MOOKHERJEE 1969: 312; HARRIS, MOOKHERJEE and DENIS 1984: 51), the scale of urbanization in 1971-91 continued to outpace the degree of urbanization in all but two states (Table 3).

Table 3   Ratios of the Degree and Scale of Urbanization: Selected States of India
           1971-1991

States	Ratio of Degree 1971-1991	Ratio of Scale 1971-1991
Andhra Pradesh	1.39	1.63
Assam		
Bihar	1.32	1.46
Gujarat	1.23	1.42
Haryana	1.40	1.65
Karnataka	1.27	1.47
Kerala	*1.63*	*1.42*
Madhya Pradesh	1.42	1.52
Maharashtra	1.24	1.34
Orissa	1.60	1.83
Punjab	1.25	1.45
Rajasthan	1.30	1.46
Tamil Nadu	1.13	1.23
Uttar Pradesh	*1.42*	*1.37*
West Bengal	1.11	1.15

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GIBBS had theorized such an eventuality for the highly urbanized countries, which makes this finding a matter of interest for a third world country with only about a .26 degree of urbanization. The degree and scale of urbanization in the selected states of India for 1971 and 1991 are presented in Figure 1.

Figure 1   Degree and Scale of Urbanization by States

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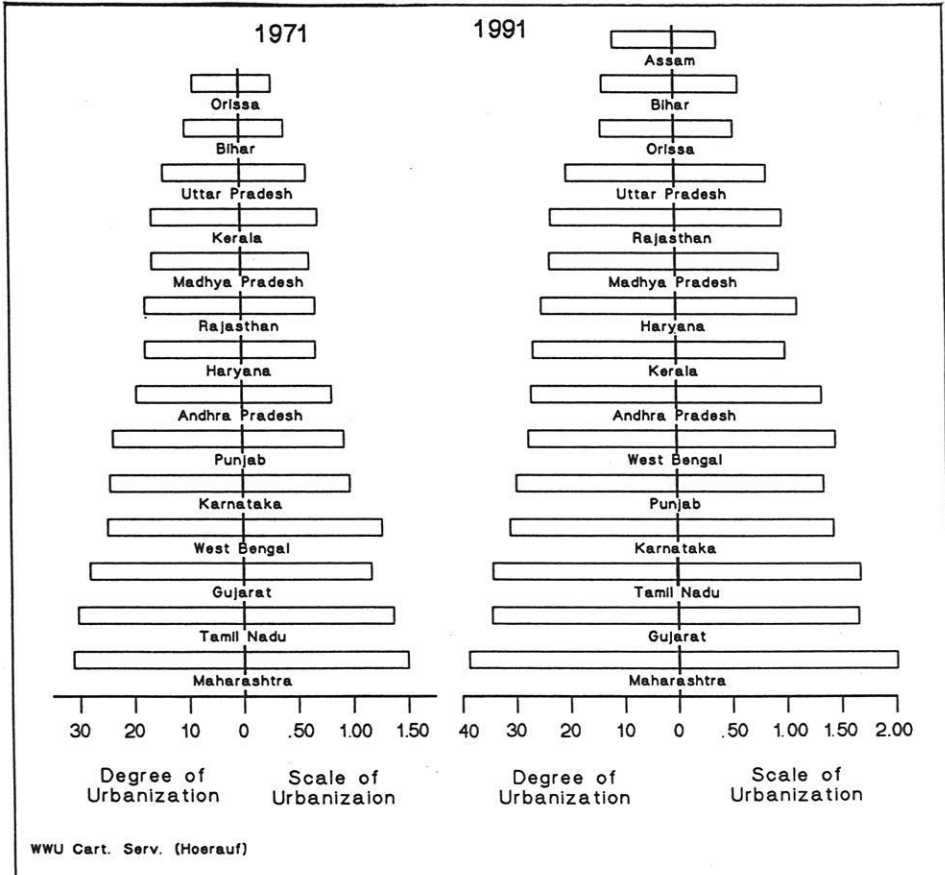
Concluding Remarks

As evident in our empirical study, the use of GIBBS' measure offers valuable insights into the process of urbanization; it is especially useful at sub-national or regional levels in depicting structural changes in the urban hierarchy. Our research findings, however, lend only partial support to GIBBS' theory. For example, the prediction of a low correlation between the degree urban and the lowest size class(es) was borne

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out, however, GIBBS' rationale for this result - involving intercensal increases in such class(es) - was not. The same anomaly was noted regarding his idea of scale outpacing degree. India has a low level of urbanization. Only a quarter of its population, according to census, resides in urban areas. However, with the exception of two states, the ratio of scales from 1971-1991 was higher than that of the degrees for the same period at the sub-national level. The degrees of urbanization in seven of the fourteen states under investigation are even lower than that at the national level. Lastly, for all but one of even these least urbanized states in India, the scale of urbanization has proved to outperform the degree.

These mixed patterns of inter-state spatial variations indicate that the variable of population concentration alone, as examined in this paper, offers only limited explanation of structural change. Other socioeconomic and institutional factors such as infrastructure resources and governmental policies must be explored in future research endeavors for a better understanding of the complexities of the urbanization processes, especially in the context of culturally diverse developing countries such as India.

Acknowledgements

NOTES

1. For details, see Census of India 1991, particularly chapters two and three (NANDA 1991).
2. GIBBS' measurement of scale is based on size classes and employs an arbitrary minimum size limit. For detailed discussions on the implication of the size limits, see GIBBS 1966. The formula for the measure of scale: "Su = ΣXY, where Su is the measure, X is the proportion of the urban population in units above a certain size . . . and Y is the proportion of the total population in the same units" (1966: 171).
3. Whereas GIBBS' measure of scale was based on a minimum size limit, the present study employed the Indian Census definition of urban that had no minimum cut off point.
4. The only exception was Kerala, which, in spite of absence of class VI towns in 1991, was included in the study because of its importance in the overall urban structural analysis.
5. It should be noted that the present analysis is based on six census size classes. If the population of the top size class I is further sub-grouped, for example, in 100,000-250,000, 250,000-500,000, 500,000-1,000,000, and 1,000,000 and above population size categories, a different pattern could have emerged. Population numbers for all urban centers for each class size are computed for each census year.

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