The Himalayan Review
Nepal Geographical Society

Vol. 14
1982

Changes In The Urban System In Nepal

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INTRODUCTION

The study of urban system has been investigated mainly within the conceptual framework of central place theory and the urban economic base[1]. Christaller's model is concerned with the size, hierarchy, number and distribution of central places[2]. The study of urban system covers conceptually a number of urban aspects. The fundamental basis of most of the studies in this direction is related to the concept of urban hierarchy. Second, the spacing of urban centres follows certain regularities that permit the recognition of systems of distribution which differ from one region to another according to the historical circumstances of the region[3]. Third, urban functions tend to segregate in ascending order in trait complexes of increasing size and variety of functions in such a way that the central functions are graded into a recognisible series from small centres to large cities.

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1 For pioneer studies along these lines see J. E. Brush, "The Hierarchy of Central Places in South Western Wisconsin," **Geographical Review** Vol. XLIII (1953) pp 380-402; also see H. E. Bracy, "Towns as Rural Service Centres," **Institute of British Geographers**, Publication, No. 19 (1954), pp 95-105.

2 W. Christaller, **Central Places in Southern Germany**, (Englewood Cliffs: Prentice Hall 1966),

3 R. E. Dickinson, **Citys and Region** (London: Routledge, 1964) pp. 72-73.

Closely related to this is the basis of spatial interaction, which is provided by varieties of urban complementarity[4]. The general objective of the present article is to analyse changes in urban system in Nepal along these lines. The study also indicates the importance of the hierarchical network of spatially dispersed market towns. Owing to lack of such network, opportunities of development are lost, and resources are devoted to less than optimal uses in numerous places.[5] If the tests of economic rationality are applied, the need of development of a hierarchical structure of dispersed market centres becomes apparent.[6]

The system of urban centres is not static. It undergoes fundamental changes with new developments and changing circumstances.[7] How the system of urban centres in Nepal has changed during the period from 1961 to 1981 has been analysed in the present work.

NATURE OF DATA

Generally, the study of urban systems measured in terms of hierarchy, locational arrangement and the pattern of inter-urban interaction is based on urban functional bases. The functional approach to the study of urban system in Nepal is not possible owing to lack of data as the employment structure of incorporated towns is given in only one census of 1971.

Even population figure is available only for incorporated towns. In view of this limitation, the present study covers only incorporated towns. Population is considered as a measure of the hierarchical structure of urban places. Several studies have revealed that the functional range is closely related to population size.[8] It is emphasised that the population of a central place is a function of the number and types of central commodities and services it provides.[9] Although several writers consider population size as crude

4 For information on interaction see R. Abler, J. S. Adams and P. Gould, **Spatial Organization: The Geographer's View Of The World** (Engle wood Cliffs: Prentice-Hall, 1971) pp. 193-223.

5 R. A. J. Johnson, **The Organization Of Space In The Developing countries** (London: Harward University Press, 1975), p. 137.

6 Ibid.

7 C B Shrestha, **"Spatial Integration in the Arniko Rajmarga Area"** unpublished report (in Nepali), N P C, 1973.

8 B. J. L. Berry and W. L Garrison, "Functional Bases of the Central Place Hierarchy", **Economic Geography**, Vol. 34, (1958), pp 145-54.

9 K. S. O. Beavon **Central Place Theory: A Reinterpretation** (Longman: London, 1977), p. 6.

measure of centrality, its rationality is reflected in several studies[10] . The use of population size as measure of centrality does reflect the functional hierarchy of large town in Nepal. In the study of functional interaction, retail sales or business turnover is preferable as an indic tor of mass in the gravity model[11] . However, in many gravity studies, mass has conventionally been equated with population size[12] . Owing to lack of other data, in the present study connectivity index has been used to reflect the trend of changes in the pattern of inter-urban interaction[13] .

CHANGE IN URBAN HIERARCHY

In 1961, there were only ten incorporated towns in the country. The number increased to sixteen in 1971. According to 1981 population census, there are twenty three **Nagar Panchayats** (incorporated towns)[14] . The relative importance of these towns has been measured in terms of population size. Christaller considered that there were regularities in the urban pyramid based on population size[15] . A primate settlement measured in term of population size is expressed symbolically as P Other urban centers in the country would be arranged in a hierarchy according to the rule of three- P/3, P/9, P/27, P/81 etc. The expected population sizes of different urban centres belonging to different class groups are computed according to this rule. The observed population sizes of different towns are groured according to size-classes and the towns are graded accordingly for three different years of 1961, 1971 and 1981 In each class group, average population of different centres is computed, it being considered as representative of different class divisions.

Tables 1, 2, and 3 show the class groups graded in this way for three different years. It is found that there has been no change in the tier system of the towns during the past twenty years. In all cases, the hierarchy consists of four tiers (Fig. 1) But a change in the pattern of K-values has taken place. In 1961 and 1971, only one town is associated with each of the first two grades (Fig 1A and 1B).

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10 E L. Ullman, "**A Theory of Location For Cities**"

11 C. D; Harries, "The Market As A Factor In The Localization of Industry In The United States", **Annals of the Association Of American Geographers**. Vol. 44, No. 4 (1954) pp. 315-348.

12 For detailed information see P. J. Taylor, **Quantitative Techniques In Geography** (London: Oxford University Press, 1974), pp 237-43

13 Recently, six more towns were incorporated.

14 W. Christaller, **cp. cit.**, Footnote 2.

However, in 1981 there has been addition of one more town in the second-order group (Fig. 1c). The K-values in three different years under consideration are relatively high in the context of the second and third-grade towns. Despite the presence of these comparable features, K-values are very irregular in all the years.

Generally, the differences between the expected and observed population size show the similar trend. In the first two class groups, the differences are minimal, and in the third and fourth grade towns the differences are relatively high. Therefore, the trend during the past two decades did not show any remarkable change in the hierarchical structure of the towns. It is to be noted that the deviations of observed population size from the expected one is positive in all the size class groups. It is also found that the growth of new towns in the lower strata does not present any regular pattern. But it is seen that the number of smaller towns has increased more than that of the larger towns. This is reflective of the fact that the pattern is tending towards the development of a hierarchical network of spatially dispersed towns.

Table 1: Urban Hierarchy, 1961

Size-class	Expected Population	Observed Population	Deviation	Number of town	Ratio
I	121,019	121,019		1	
					1.0
II	40,340	47,713	+	1	
					3.0
III	13,446	24,761	+	3	
					7.1
IV	4,482	7,101	+	5	

Source: Population Census, 1961.

Table 2: Urban Hierarchy, 1971

Size calss	Expected Population	Observed Population	Deviation	Number of towns	Ratio
I	150,402	150,402		1	
II	50,134	59,049	+	1	1.0
III	16,711	29,353	+	6	6.0
IV	5,570	10,665	+	8	1.3

Source: Population Census, 1971.

Table 3: Urban Hierarchy 1981

Size class	Expected Population	Observed Population	Deviation	Number of towns	Ratio
I	235,211	235,211		1	
II	78,403	87,399	+	2	2.0
III	26,134	38,715	+	10	5.0
IV	8,711	16,094	+	10	1.0

Source: Population Census (Provisional) 1981.

CHANGE IN LOCATIONAL ARRANGEMENT

The hypothetical distance between two settlements can be computed on the basis of a formula:

$$HD = 1.11\sqrt{\frac{A}{N}}$$

Where HD is the hypothetical distance, A is the area of the country and N is the number of towns[16]. The hypothetical mean distance for the towns of different classes is computed for three different years under conside-

16 H. K. Browing and J. P. Gipps, "Some Measures of Demographic and Spatial Relationships Among Cities" in J. P. Gipps and K. Davis (eds), **Urban Research Methods** (New York: Von Nostrand, 1961), p. 453

ration (Table 4). In 1961 and 1971, there was only one town in each of the first and second order groups. In these cases, the two towns were grouped together to compute actual mean distance. If the actual mean distance would equal the hypothetical distance, it would be an indication of dispersion. When the actual distance is expressed as a percent of the hypothetical distance, the value is a measure of the extent to which the towns are dispersed rather than concentrated[17].

Table 4: Hypothetical Mean Distance Between Towns

Grade	Hypothetical Mean Distance					
	1961		1971		1981	
	Number	Distance	Number	Distance	Number	Distance
I	1	73,550 Km	1	73,550 Km	1	
II	1		1		2	73,550 Km
III	3	36,777 Km	6	24,517 Km	10	14,710 Km.
IV	5	29,420 Km	8	14,710 Km	10	14,710 Km.

It is found that the relationship of actual mean distance with the hypothetical mean distance is not regular with reference to different classes in the considered years. However, it is found that actual mean distance is much less than the hypothetical mean distance in all class groups in the considered years. The percentage values associated with different classes are only fractions of the hypothetical distance. It shows that the towns in Nepal are highly concentrated rather than dispersed. But there has been gradual increase in percentage from 1961 to 1981, indicating the development of growing dispersion. In the first two class groups, the percentage during the decade of 1961-71 did not change. In 1981, the percentage in second grade towns increased to 0·33. The percentage associated with third order towns increased from 0.50 in 1961 to 3.7 in 1971. It was 8.2 in 1981. The fourth class groups showed a positive change from 3.4 in 1961 through 4.0 in 1971 to 6.7 in 1981 (Table 5). The regularity in positive trend is distorted in 1981 in the context of the third and fourth grade towns as the percentage in the fourth grade towns is lower than that of the third order group. However, the pattern of change in general reflects that the towns of the lower strata have

17. Ibid

tended towards dispersion, and the tendency of concentration has not changed so markedy in the upper class groups.

Table: 5 Ac ual Mean Distance Between Towns

(in Km.)

Class	Number of Towns			Actual Mean Distance			Hypothetical Mean Distance			Observed Mean Distance as percent of hypothetical		
	1961	71	81	61	71	81	61	71	81	61	71	81
I	1	1	1	3	3		73550	73550	–	0.004	00.004	
II	1	1	2		240				73550			0.33
III	3	6	10	183	900	1210	36777	24517	14710	50	3.7	8.2
IV	5	8	10	1000	730	980	294.0	18387	14710	3.4	04.0	6.7

Source: Derived from Table 4:

It is found that the pattern of interspacing of incorporated towns and changes that have taken place during the perod from 1961 to 1971 do not confirm to the hierarchical ranks. In fact, the frequency distribution of percentage values shows reverse order with higher percentages in the lower-order class groups and lower percentages in the higher-order classes. The actual mean distance between the two centres of the first and second grades in 1961 and 1971 and that of the two centres of second grade in 1981 is far less than those of the third and fourth-order classes. Similarly, the actual mean distance between the fourth-order towns in 1961 is higher than that of the third grade centres. In 1971 and 1981, although the mean distance between the fourth-order towns is less than that of the towns of third rank, the difference is very marginal (Table 5). These irregularities in the context of the expected pattern is partly attributable to the direction of urban growth along the line of distribution of accessible resources and partly the political decision regarding the creation of Nagar Panchayats (incorporated towns.)

The excessively high mean distance even between the fourth grade towns substantiates the low level of urbanisation as well as the tendency of concentration in few favourable localities. Notwithstanding the increase of the incorporated towns during the period from 1961 to 1981 distance apart is increasing with an exception in the forth-order towns during the decade of 1961-1971.

The relative importance of effect of transportation principle is well reflected in the locational arrangement of towns. The historical towns were located either along traditional highways (trails) or at focal points of the major trails. The repetition of the original areal pattern has occured in connection with the development of new towns along the new motorable highways. Most of the nodal points which have developed in new highways are break-of-bulk points. The situation is not favourable for the growth of the towns away from the roads. This situation will seemingly continue to exist till the development of adequate feeder-road networks.

In several cases, the locational arrangement of the towns could be explained with reference to historical factors only. It is difficult to explain the location of the upper grade towns within established conceptual frameworks as these centres are concentrated in close proximity. These locational arrangements can be examined in totality neither in terms of the distribution of population, resources, and purchasing power of the people nor in terms of the notion of 'range of a good' and 'threshold sales level.' One has to look to the national circumstances and historical factors to explain the pattern.

CHANGE IN INTER- URBAN INTERACTION

It is expected that an urban centre has some potential for interacting with each of the other towns in the country. In this regard, Reilly drew directly from Newtonian theory of gravity in suggesting that movement between two centres would be proportional the to product of their populations and inversely proportional to the square of the distance separating them[18]. In many gravity studies, mass has conventionally been equated with population size[19]. But population size can not be a true measure of interaction and there are several limitations of its use[20]. In measuring inter-urban inte-

18. W. J. Reilly 'Methods for the study of Retail Relationships', **University of Texas Bulletin**, 2944 (1929).
19. For detailed information see P. J. Taylor, op. cit., Footnote 12, pp. 286-325.
20. P. Hagget, **Locational Analysis in Human Geography** (London; Arnold, 1969)' pp. 37-38.

raction, retail sales could be the most relevant and effective measure[21] . However, data on trade and business activities are not avialable at invidual town level in Nepal. In view of these limitations, road connectivity has been use to trace the trend of changes in the pattern of inter-urban intraction[22] .

Road connectivity could be taken as a measure of interaction in view of the fact that it would show the degree to which the urban centres of a network would be directly connected to each other. Garrison[23] and Kansky[24] have devised a series of measures of network on the basis of graph theory. There are three indices of the road connectivity: 1) beta, 2) gamma, and 3) alpha[25] . These indices are derived from:

$$\text{Beta} = \frac{R}{T}$$

$$\text{Gamma} = \frac{R}{3\,(T-2)}$$

$$\text{Alpha} = \frac{R-T+1}{2T+5}$$

where R represents the number of road links among the towns and T refers to the number of towns.

It is found that there has been increase in road connectivity indices of three categories during the period from 1961 to 1981 with one exception

21. See C. D. Harris, **op. cit** , Footnote 11.

22. R. Hammond and P. S. McGullagh **Quantitative Techniques in Geography** (Oxford: Clarendon, 1974), pp. 50-51.

23. W. L. Garrison, 'Connectivity of the Inter- State Highway System,' **Regional Science Association: Paper and Proceedings**, No. 6, Pp 121-137.

24. K. L. Kansky, "Structure of Transport Networks: Relationship between network geometry and regional characteristics," **University of Chicago, Department of Geography**, Research Paper 84.

25. For further information see C. B. Shrestha 'Development of Road Connectivity in Nepal' **The Economic Journal of Nepal**, Vol. IV. 1981.

(Table 6). The most remarkable development has been in beta index. This index was only 0.63 in 1961, while it reached 1.08 in 1981 (Table 6). Similarly, gamma index also showed notable rise during the decade 1961-1971. However, there was a slight decline in this index during the period from 1971 to 1981. It reflects that the increase of road links lagged behind the growth of the number of new towns during this decade.

The value of alpha index was zero till 1971. It appeared only in 1981. The value is still negligible. It shows that there has not been any significant development of a circuit pattern in network geometry.

Table 6: Development of Road Connectivity

Year	Beta	Gamma	Alpha
1961	0.63	0.25	—
1971	1.06	0.40	—
1981	1.08	0.39	0.02

Seemingly, inter-urban interaction has steadily increased in the country. This is well reflected in the development of new road links and towns, which is clearly measured by different road connectivity indices.

CONCLUSION

The development of urban system is a recent phenomenon in Nepal. Even in 1961, the country did not have a well recognisible urban system. During the last twenty years, some notable developments in urban system have taken place. This is found even within the frameworks of incorporated towns. However, the changes in the hierarchical structure and locational arrangement of incorporated towns during the period from 1961 to 1981 are not significantly perceptible. Seemingly, the changes would appear more significant than what are reflected in the incorporated towns, if these could be analysed by incorporating all the urban centres developed during the considered period.

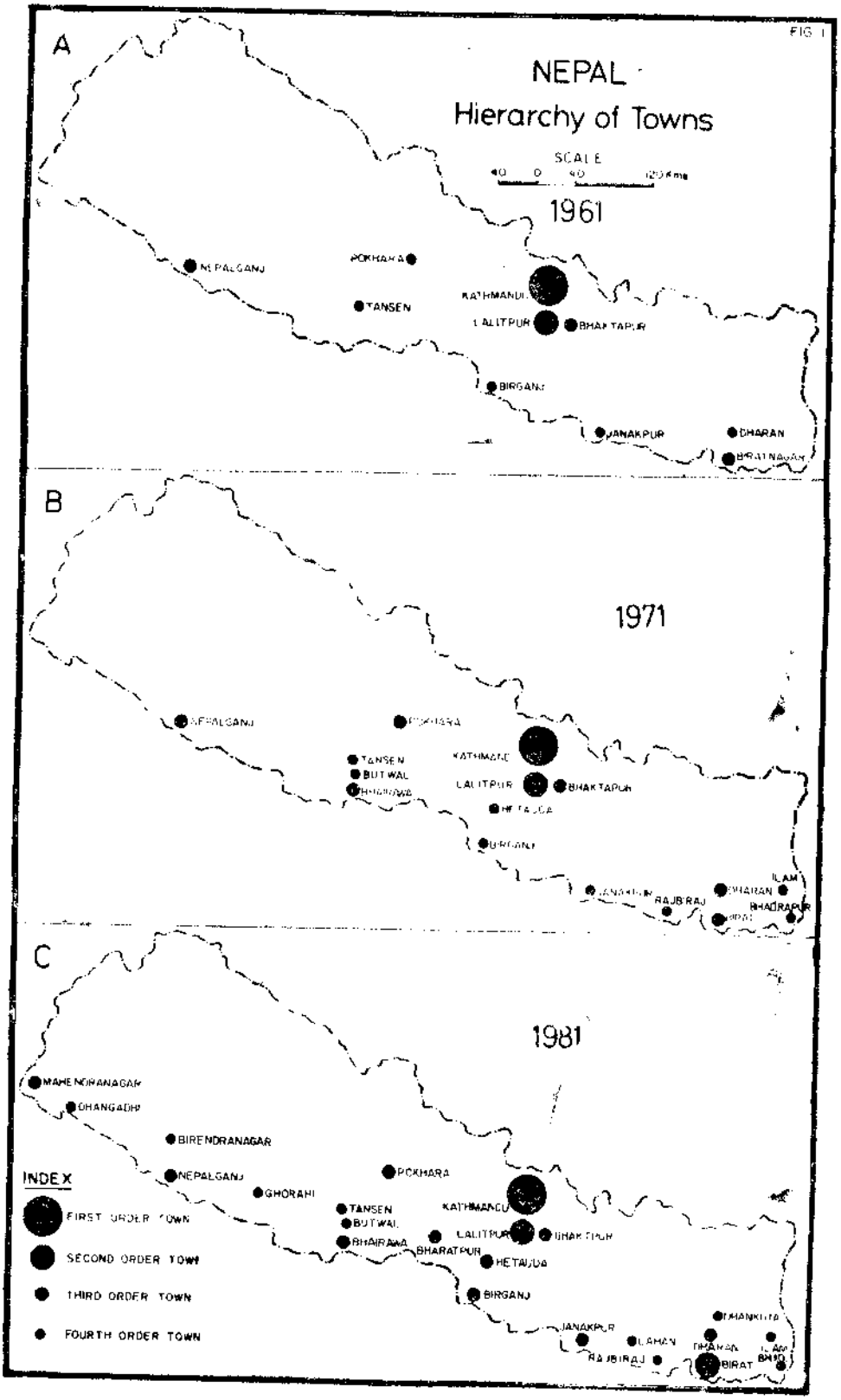
FIG. 1
A
NEPAL
Hierarchy of Towns
SCALE
40 0 40 80 120 Kms
1961
NEPALGANJ
POKHARA
TANSEN
KATHMANDU
LALITPUR
BHAKTAPUR
BIRGANJ
JANAKPUR
DHARAN
BIRATNAGAR
B
1971
NEPALGANJ
POKHARA
TANSEN
BUTWAL
KATHMANDU
LALITPUR
BHAKTAPUR
BIRGANJ
JANAKPUR
RAJBIRAJ
DHARAN
BHADRAPUR
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1981
MAHENDRANAGAR
DHANGADHI
BIRENDRANAGAR
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GHORAHI
POKHARA
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