CHAPTER 1
THE PURPOSE AND THE NATURE OF THE STUDY

1.1. OBJECTIVE

The main objective of this study is to test as well as to formulate new hypotheses relating to the comparative study of the Indian and American urban systems. Firstly, the basic dimensions of the two urban systems are identified. Secondly, on the basis of previous studies, the following hypotheses have been formulated and tested over time and space.

Hypothesis 1: Some of the basic dimensions of the urban systems may remain stable in forms over time and through space.

Hypothesis 2: Due to the changes in the socio-economic and other characteristics of the population even if the urban dimensions may remain stable over time in forms, the scores of individual cities on them may vary considerably.

Hypothesis 3: The grouping of cities may vary according to the variations of their scores on the basic dimensions. This hypothesis may be regarded as corollary of the 2nd hypothesis described above.
Hypothesis 4: The loading of a variable (which may be described as the correlation between the variable and the dimension) in a particular dimension may vary over time and space, even though the dimensions itself may remain stable in form. This may be an indicator of differential economic, structural, and social conditions exist in the cities of different areas or at time periods.

Hypothesis 5: The major dimensions may present in cities of comparable sizes and ages even though they are geographically separated. This hypothesis may validate the functional characteristics of the cities of the different parts of the world.

Thirdly, as a corollary to the foregoing hypotheses, a few others may be put forwarded for further studies.

Hypothesis 6: As a reflection of the changing orientation of urban societies, the basic dimensions may show some changes over time, if a considerably longer time-span is considered. For example, pre-industrial cities and modern cities.

Hypothesis 7: The stability of the relative locations of cities in the urban dimensions space may reflect the strong regional contiguity among the member cities, showing a
tendency towards 'order' that has been well established in the central place studies.

In this study, to determine the basic dimensions of the two urban systems and to test and evaluate these hypotheses, a factor analytic model has been applied to data characterising the cities in 1951 and 1961 and on three separate regions viz. Middle Atlantic, West-North Central and Pacific of the U.S.A. In case of the cities of India, only 1961 data have been used as data for 1951 were not available, on the two regions viz. Northern and Southern cities. Altogether, eight separate analyses have been conducted for the cities of the U.S.A. and three separate analyses for that of Indian cities.

1.2. STATEMENT OF THE PROBLEM

In general, cities or the urban centres are the loci of the centralization of activities and culture. The division of labour makes urban society more specialized, high density of population makes social system more diversified and technological developments make the spatial pattern more complex. But, still from historical point of view, the process of urbanization is relatively very new in the whole of human history. The growth is so rapid that till today the whole phenomena is not fully understood or exhaustively researched.
Today there are mainly two groups of people who talk, criticize or praise cities from their own evaluation. One of the groups looks at the cities as the places of crime, sin, misery, filth, centres of congestion and root of the environmental pollution while the other group looks at them as the sources of civilization, progress of the society, centres of education, scientific innovations, bed of cultural diffusion and commerce. These two views are diametrically opposite and they are more moralistic or sentimental than scientific.

These two groups of people include intellectuals of the society, and mostly politicians who cry for the creation of the ideal type of cities, who invariably deplore the policies of the concerned authorities and try to remove the evils and crimes from the cities. These talks are more or less superficial, and they lack in the basic understanding of the root of the problems, how cities are growing, how they are now operating and their general trend and the main factors that are responsible for all these phenomena. Voluminous literatures on the cities are generally available having the above condemnation or appreciation of the cities but unfortunately relatively a very few literatures are available which deal with the systematic analysis of the cities scientifically.
From the beginning of this twentieth century, there seems to be a general tendency to study cities by different groups of scholars from different disciplines. Economists, sociologists, geographers, planners, engineers are all interested to know the structure, functions, human behaviors, socio-economic conditions and so on of the cities. They have studied the nature and problems of a same place (i.e. city) from their own perspectives. In other words, these different groups of scholars look at the same object from different angles to achieve some specific informations relating to their own interest. In doing so, in many cases, different ideas, views or concepts relating to the cities overlap giving rise to a new image, new concept or better understanding of the cities.

In recent years, three distinct aspects of urban studies are seen. Firstly, the inter-disciplinary research. As it has been discussed already that the researchers are gradually realising that investigation of a particular aspect of the city from a specific perspective is not complete. Cities are becoming the centres of the manifestations of various aspects of the human habitation. For example, to plan for a good residential area by the planners or architects will not be successful if the aspects of drainage system, racial segregation, highway develop-
ments and other community facilities are not taken into account. On the other hand, a planner may not have a good understanding about the social setup of the society. So, there is a great need to borrow ideas from other disciplines and the experts to work together for the advancement of the urban study. In America, some institutions like, International Population and Urban Research in the University of California at Berkeley, The Joint Centre for Urban Studies of the M.I.T. and Harvard and The Centre for Urban Studies at Chicago, are some of the few examples of the interdisciplinary works. Over and above, most of the Geography Departments of the American Universities specialise in some specific aspects of the urban systems. For example, Regional Science Studies at the University of Pennsylvania, Minority Problems at North Carolina University and at Detroit, Transportation at the North-Western University, the Urbanization of the Developing Countries at the University of Texas and the Housing Problems at the University of California, Los Angeles, are a few out of many that can be cited in this respect. This type of interdisciplinary works are prevalent in the United Kingdom also. The London Centre of Urban Studies and the Birmingham Centre of Urban Studies are the two important examples. These urban centres provide facilities to the researchers of different disciplines and link
the individual works together in a team basis and the results give a multiple perspective of the city system.

Most of the developing countries, where the impact of urbanization is far intense than that of their industrially developed counterparts, are lacking of such interdisciplinary works. Of course, Japan can be excluded from this remark where some of the fruitful studies have been completed in recent years. In India, though there are some patch-works on cities completed by some researchers, this country is lagging far behind in respect of the interdisciplinary works. Most of the studies are empirical and they are based on inductive approaches. These studies are in general devoid of sound theoretical or deductive analyses. Very recently, the idea of interdisciplinary works is seemed to be introduced at the University of Mysore. There seems to be quite a few problems of this type of study and are discussed at the later section of this chapter.

The second aspect of the urban studies that is making a headway for the better understanding of the problems and policies of the cities is the use of standard Statistical Technique. This is the most important amongst all the three aspects. A standard Statistical Technique can be termed as a common medium or language of communication among the scholars of different disciplines.
Most of the early studies on cities were facing serious problems of the Methodologies that had been used to study the functional characteristics. Studies based on the functions of the cities are quite old. Too often, it has been seen that the whole study ends itself in presenting the different methodologies and the classification of the cities. Duncan and his companions rightly remarked that:

"In examining representative studies in functional classification one is impressed by the apparent complexity of the detailed criteria by which cities are grouped into types or categories, the variation of these criteria from one study to another and the consequent variation in the results."

There are two approaches of classifying cities. One is qualitative and the another is quantitative. Qualitative studies are relatively few and Aurousseau's scheme is one of the best known examples.

He postulated six types of cities depending on the functions: administration, culture, defence production, communication and recreation. Also, he noted that some cities may have more than one function mentioned and in that case, the city will be classified according to the predominant ones. There are several subsequent researchers who worked in the same line of thought in this field. The main drawback of all these studies is to place a particular city in a single category from general observation.

The use of quantitative techniques in classifying cities and in studying the functional characteristics, is of relatively recent origin and far more numerous in numbers. The basic assumption in this type of study is that the occupational characteristics of the people of a city will reflect the city's activities. Naturally, the occupational data of the city's labour force have been manipulated in various ways to find out the functional characteristics of a city. The objective was achieved

through the explanation of "specialization index", which in a very general way means a proportion of the labour force in a given occupation which exceeds by a certain margin - some predetermined minimum level.

Different scholars have defined specialization index in different ways according to their own judgement. Harris used this index to classify American cities and determined the threshold value "On the basis of an analysis of cities of well recognised types".

He stated that 30 percent or more of the employed labour force in manufacturing was required to be identified a city as the manufacturing city. Unfortunately, Harris failed to identify the well recognised types and the use of the higher threshold percentages to some functions than to others makes his classification rather inconsistent and uncomparable. Still his "specialization index" was used by several other researchers with some modifications.

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6. Ibid., pp.87-89.
A second group of scholars have used some statistically defined quantities to classify cities according to the similarity of their functional characteristics. The uses of arithmetic mean, standard deviation, medians, quartiles or deciles are more appealing than those of Harris's and others. At the first sight, these quantities seem to be the representative of the 'average' or 'normal' city and their validities are hard to be disputed.

Nelson used mean and standard deviation as a measure of specialization index. With the use of average and standard deviation also, Nelson's question of how large a percentage of the labour force must be employed in a particular service to make the performance of the service to make the performance of the service far enough above normal, could not be answered properly. For example, the same American cities are falling in different groups now using Nelson's 43.11 per cent as the minimum proportion of the labour force indicating manufacturing specialization to that of Harris who had selected 30 per cent as the minimum level. Some of the other scholars, who have chosen quantitative methods as the criteria for classifying the cities, argued that simply average, or total or

above average figures could be regarded as an indicative of the functional specialization of cities. At this level another point should be made clear relating to the use of average as an indicator of specialization. From statistical point of view, the average or the arithmetic mean is not the representative of the values from which it is calculated because of the fact that it is heavily influenced by some marginal values. For example, out of the nine categories of industry percentages calculated by Nelson, the arithmetic mean is truly representative of only Retail Trade. Thus, the arithmetic mean or the average can be also looked at as an arbitrarily chosen specialization index.

The third group of researchers have used an arbitrary majority quantity, very often 50 per cent. This approach is characteristic of many urban studies of Europe and very often the whole of classification the cities are presented on triangular graphs, where three activities

10. See, Nelson, H.J. "A Service Classification", Fig. 1, page 192. Loc. Cit. Foot Note 8.
can be represented simultaneously in a single graph.\textsuperscript{11} The consideration of 90 percent or above as a standard is purely subjective and there is a great danger of comparing cities of the different parts of the world where the definitions of the cities are different. Moreover, all of these three approaches suffer from the fact that they consider the occupational groups of people rather than their value of output or the efficiency and they are unidimensional.

One of the main objectives of the city classification is to group the cities according to their similarities of the functional characteristics. Generally, similarity is maximised within groups and minimised between groups. If this is so, none of the above three quantitative methods are very useful. This point will be clear if reference is made to figures 1.1 and 1.2. Two main functions are represented along the two axes and their average values are marked. Each of the cities now can be placed in one of the four quadrants. However, this procedure ignores the functional similarities of the cities. As, it

FIG. 1-1

USE OF AVERAGES TO CLASSIFY TOWNS

![Diagram showing classification of towns according to average commerce and manufacturing.]

SOURCE: From Smith, R.H.T. Methods and purpose of Functional Town Classification; Annals of the AAG Vol. LV, No.3.(1965) pp. 589-48

Fig. 1-2.

CLASSIFICATION OF TOWNS ACCORDING TO FUNCTIONAL SIMILARITIES.

![Diagram showing classification of towns according to average commerce and manufacturing.]

SOURCE: See Caption for Fig. 1-1.
can be seen in figure 1.2, group D represents a cluster, whereas in figure 1.1 it is subdivided into 4 different groups.

These three widely used procedures have some major limitations from the simple fact that the occupational characteristics of the cities are reported in many categories than these two or three groups. These procedures fail to depict the realistic picture of the cities properly. They oversimplify the actual nature of the cities. Naturally, there is an increasing demand for some standard multivariate techniques that can utilise many more than two or three functions of the cities. In recent years the use of the technique of the multivariate analysis has permitted researchers to consider multiple perspectives of urban systems. Factor Analysis is one of such techniques which has applied by the researchers of different disciplines to study various aspects of a place on the surface of the earth considering the multiple characteristics. This technique is utilised in the present study.

also and the methodological derivation is discussed in Chapter 3.\(^{13}\)

The third aspect of the urban study is the use of ecological concept in the field. The general meaning of Ecology is "adaptation to environment". The Greek root *oikos* means habitat or home. The concept has been derived in Geography from the Darwinian thought where environment has been conceived as the total web of life wherein all plants and animal species interact with one another and with physical features in a particular unit of territory.\(^{14}\) According to Webster, the biological meaning of Ecology is "the mutual relations between organisms and their environment".\(^{15}\) Though the impact of this idea was felt in geographical research, it was Harlan Barrows who advocated and defined Geography as Human Ecology.\(^{16}\)

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the University of Chicago become the main platform of the ecological research since the beginning of the twenties, underwent a considerable evolution and embraced not only the physical environment but also the man-made structural, institutional and cultural environments, within the frame work of research.

Most of the studies completed at the University of Chicago were related to the cities. Park, Burgess and McKenzie were the pioneers in this field. The first formal presentation of the collected views was in "The City" published in 1925.\textsuperscript{17} Thus, a formal field of inquiry called "Urban Ecology" which means the application of the concepts and techniques of "Human Ecology" to a study of the city, has emerged. In this field of inquiry human ecology is defined in its broadest sense and the main concern primarily is "......the study of the spatial distribution of interrelated social variables" rather than "Systematic Ecological Theory" as derived from biological sciences.\textsuperscript{18} Then, the approach turned over to "Factorial" because it uses the technique Factor Analysis, a method designed to identify "Fundamental Dimensions of Variations" defined by the many variables characteristic-

cally measured for some specific areas. Thus, the most recent formal field of inquiry becomes "Factorial Urban Ecology" which is not even a century old. From the wealth of empirical data a number of statements concerning urban ecology have emerged.\textsuperscript{19}

Recently, Philip N. Rees says that,

"Factorial ecology seeks to understand interrelationships among human groups and between them and their socio-economic environments by first describing how and then trying to explain why areas differ in characteristics and human behaviour.............Customarily, the term factorial ecology has been applied only to studies that use the city as their study area, census tracts as their observational units and census variables as manifest input. However, there is no conceptual difference in kind between that type of study and one employing the world as study area and countries as observational units".\textsuperscript{20}

Thus, in many studies, countries, provinces, districts or cities have been used as the units of observations. The basic assumption made is that the only significant variance will occur between the observational units and the within group variance is either neglected or ignored. One basic question may be raised regarding the validity of


the analysis when the areal units used are internally heterogeneous. Rees, substantiated this criticism by stating that:

"If the unit used is a functional entity, a nation, state or city for example, then the problem is not serious. Nations and cities are deserving of study no matter what the internal variance."21

In Table 1-1, a selected list of references that used Nation, States, Counties or Cities as the units of observation, is presented. The Table is prepared according to the scale and relevant problem area rather than by methodology used. The Table is very selective and for specific discussions and bibliographies references can be made to some other studies.22 Quite a very large number of studies have been completed selecting individual cities as the universe and census tracts or the city blocks as the units of observations.23 They have been excluded from the present Table, as this study will be limited to the city level observational units.

23. For bibliographies and references, see for example, Mundie, R.A., "Factorial Ecology of Metropolitan Toronto", University of Chicago Department of Geography. Research Paper No.116 (1969), Table 3, pp.32-38.
TABLE 1-1
A SELECTED LIST OF REFERENCES OF THE ECOLOGICAL STUDY.

<table>
<thead>
<tr>
<th>Universe</th>
<th>Observational units</th>
<th>References to bibliography with year of publication</th>
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<tbody>
<tr>
<td>LESS-DEVELOPED WORLD</td>
<td>Nation-States</td>
<td>Adelman and Morris (1967).</td>
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<td>NATION-STATE</td>
<td>Micreregions</td>
<td>Berry &amp; Murdie (1966)</td>
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<td>Brazil</td>
<td>Counties</td>
<td>Berry (1966), Ray (1969)</td>
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<td>Canada</td>
<td>Communities</td>
<td>Berry (1969)</td>
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<td>Chile</td>
<td>States and Metropolises</td>
<td>Berry (1966), Berry (1966).</td>
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<td>India</td>
<td>Districts</td>
<td>Forde (1968).</td>
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<td>Ghana</td>
<td>Voivedships &amp; Metropolitan areas</td>
<td>Brown &amp; Trett (1968).</td>
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<td>Poland</td>
<td>Census divisions</td>
<td>Cole &amp; King (1966), Higgeod (1943).</td>
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<td>U.S.A.</td>
<td>States</td>
<td>Berry (in progress)</td>
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<td>Country</td>
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<td>Britain</td>
<td>County Boroughs</td>
<td>Mercier &amp; Scott (1961)</td>
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<td>Municipal</td>
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<td>Boroughs, Urban</td>
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<td>Districts</td>
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<td>Canada</td>
<td>Cities</td>
<td>King (1966), Ray &amp; Murdie (Forthcoming).</td>
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<tr>
<td>India</td>
<td>Cities</td>
<td>Ahmed (1968).</td>
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<td>Nigeria</td>
<td>Cities</td>
<td>Nabogunje (1965).</td>
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<td>U.S.A.</td>
<td>Cities</td>
<td>Berry (Forthcoming), Kaplan (1958), Perle (1964), Price (1942).</td>
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<td>ised areas,</td>
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<td></td>
<td>Metropolitan</td>
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<td>areas, Metropolitan</td>
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<td>A NATION-STATE</td>
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<td>Andhra Pradesh</td>
<td>Tehsils</td>
<td>Berry &amp; Rae (1968).</td>
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<td>Central Canada</td>
<td>Counties</td>
<td>Ray &amp; Berry (1967).</td>
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<td>Ontario</td>
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<td>Ohio</td>
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<td>Hodge (1968).</td>
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<td>Prince Edward Island</td>
<td>Cities</td>
<td>Hodge (1968).</td>
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1.3. REVIEW OF THE RELEVANT LITERATURES

The importance of the analysis of urban social structure through the use of multivariate statistical technique was felt at the beginning of this century. Still, the progress in the field was followed by a depression period due some reasons. The first geographical study in this field appeared in 1939. This idea of using multivariate statistical technique seems to be borrowed from the field of Psychology. A suggestion was made by Hagood in 1941 that the method could be applied to the urban sub-areas. Since then a number of studies have used Factor Analysis* in the field of urban geography.


* Here the term Factor Analysis is used in its general sense of referring to the whole array of the methods of matrix manipulation and transformation that have been developed. For a good discussion of the differences between Factor Analysis and Principal Component Analysis (two of the Factor Analytic methods) in the methodological perspective, see, for example, King, L.J. Statistical Analysis in Geography, (Prentice-Hall Inc: Englewood Cliffs, N.J. 1969) Chap. 7, pp. 165-191.
In the western world, particularly in the U.S.A., one of the first systematic works in the field of urban geography, through the use of multivariate statistical analysis was done by Price in 1942. He examined the co-variation of 15 variables for 93 American cities having 100,000 or more people according to 1930 census of the U.S.A. The method he used was Factor Analysis. The main objective of the technique of factor analysis as utilised by Price was to explore the possibility of some independent underlying dimensions on which urban areas could be characterised and differentiated. By rotating the axes, he extracted four factors relating to the maturity of the cities, the extent of service functions, level of living and the per capita trade volume. The study may be regarded as an illustrative example of the use of Factor Analysis to city data.

In 1958, Kaplan, in his doctoral thesis at the New York University applied the same methodology in a study of 370 American cities having populations of 25,000 or more using 1950 census data. He included variables

relating to size, age, sex, race, nativity, migration, income, occupation, housing conditions and so forth in an attempt to comprehensively describe urban system and their components. The whole study was explorative in nature and was not based on the testing or formulating hypotheses relating to cities. The major contribution of this study beyond Price's work was an examination of the effects of using raw data and adjusted (transformed) data. He found nearly identical results in both of these analyses.

One of the early studies completed outside the United States was by Moser and Scott (1961) whose aim was to classify "British Towns" into a few relatively homogeneous groups based on 1951 census data and to discuss the validity of such a classification. They had collected the data for 57 social and economic variables for 157 towns of over 50,000 population in England and Wales in 1951 and through the use of Principal component analysis, they were able to account 69 per cent of the total variation by the first six components. Of these six components, the first four alone were able to explain 60 percent of the variance. These four components were identified as:

(i) Social class
(ii) Growth pattern from 1931 to 1951
(iii) Growth pattern from 1951 to 1959
(iv) Over crowding.

By the use of component scores on these four dimensions (components) those are statistically independent of each others, they were able to classify the towns with the help of scatter diagrams. Then, by inspection 14 groups of towns were identified. Their attempt, of classification was modest and stated that the multidimensional classification "is meant to be an average classification, and it has the advantages and disadvantages of any average".31

In 1965, two studies were conducted. One at the University of Wisconsin by Hadden and Borgatta on American Cities32 and the other at the University of Chicago by Ahmad on the cities of India.33

Hadden and Borgatta incorporated 65 variables covering demographic, housing and economic characteristics of 644 cities of 25,000 or more population using 1960

33. Ahmad, Q., "Indian Cities: Characteristics and Correlates", Research Paper No.102 (Department of Geography, University of Chicago, 1965).
census data. The main departure of this study from Ahmad's on Indian cities was the consideration of different sizes of cities (on the basis of population total and metropolitan states). Consequently, parallel analyses were performed for eight groupings of cities. From the study they claimed that this type of analysis helps comparability between the cities of different sizes. Of the total 16 dimensions of the urban characteristics, six were common to all of those eight groups of cities. Where variation in structure occurred, they discussed these differences and presented some speculations as to the reasons for the variation. From the analyses, they concluded:

"Major factors here reported represent empirically stable underlying dimensions of the social characteristics of the cities."  

The first half of the study had been devoted to the repetitive and sometimes bitter criticism of urban classification as end in themselves. Unfortunately their study might also appear to fall in the same line, still they claimed that:

34. For a detail discussion, See, Hadden and Borgatta, op.cit. pp. 34-38.
The general inclusiveness of the study appears to warrant the conclusion that the relationships among variables for different units should be expected to occur in parallel. Differences in relationships should be viewed as errors in the use of sampling the urban phenomena rather than providing different 'Theories'.  

The next study, in which cities were considered as the observational units was by Ahmad. He considered 62 variables for 102 Indian cities and reproduced about 72 per cent of the variances in terms of nine well defined principal components.

Ahmad's study of Indian cities is a case of the single point in time. The whole study is seemed to be conceptualized in a system frame-work. Berry's influence of "cities as systems" is quite predominant throughout the whole discussion. Ahmad stated his objective as "to determine the critical properties of the Indian cities" or in other words, "to discover dimensions of variation along which Indian cities can be arrayed". He assumed that the discovery of these dimensions of variation would describe the state of the system of Indian cities. One of his dimensions is the size of population which explains only 5.3 per cent of the total variance. Though the contribution of this dimension is not very significant and it appears

36. Ibid. p. 193.
as the 9th component when the dimensions are arranged according to the descending order of magnitude, yet it plays a significant role in India's urban system. Through the help of this dimension, Ahmad concluded that larger cities play more central roles in the system. But this is not a new or basic finding for the recognition of the hierarchical order of cities. Already in many occasions, the hierarchical order of Indian cities or the existence of the rank-size regularities has been identified long back. Berry attributed the existence of the regularities to the "history of urbanization."  

Methodologically, the whole study can be said to be an informal application of principal component analysis. He used principal component analysis but then he rotated the components following varimax routine to a simple structure solution. This rotation is actually a question more properly associated with the factor analysis. In geographical study in many occasions, this type of thing is done uncritically.


The most important contribution of this paper is the identification of approximately the same number and types of underlying dimensions in the cities of different sizes. In all the 3 analyses he found the strong regional association of the cities. Though this result is coming as a byproduct of the main analysis, it has a tremendous significance in understanding the urban system of India and their basic structures at a single point in time.

The last point in this regard can be made relating to "the story of Indian urbanization". Though Ahmad tried to tell this story in terms 62 variables, it will not be that easy to tell the true story of urbanization in India. Urbanization is a process - a product of past and present. So, just by considering a single point in time will it be possible to explain this process? If not, there is a greater necessity to test the variation or the stability of them over time. If they remain stable we will be able to tell the story of urbanization in terms of them; otherwise the story tells by these dimensions today may be completely different to that of the past or future. It would be very interesting to see the pattern of regional differences of the Indian cities by testing the dimensions against different points in time particularly before and after independence.
Whenever we talk about the rank-size regularities as a state of a system, we should have to be explicit whether we are considering a close or an open system.  In the closed system, we will not allow new cities to enter into the system (in the lower categories) and we will see the behavior of the changes of those initial cities. In open system, we will allow both entrance and departure of the cities. This type of regularities, which are assumed to be the state of the system, can be examined by the use of Markov Chain Model. In Ahmad’s study, about 50% of the works was devoted in discussing the grouping of the cities. But, it is difficult to find out their significance in explaining the regularities of the distribution of cities by sizes.

Ahmad found the dimensions of variation and grouped the cities according to their major similarities and differences, which according to him, formed subsets of the whole system. But the main questions are still remaining unanswered.

40. Berry, B.J.L., op.cit., pp.147-150.
41. Ibid. p. 152.
They are:

(1) How will these dimensions behave over time?

(2) How long these subsystems would remain stable and as a result, the whole system?

(3) Will it be possible to get the same story after say 20 years that is told by the 62 variables today?

All these questions could be answered to a suitable extent by the consideration of the dynamic model of investigation. None-the-less, Ahmad's paper provides insights into some of the major characteristics of Indian cities. He compared his results with those of Lal and Moser and Scott and made some interesting generalizations, concerning the Indian urban system.

The studies of Moser and Scott, Ahmad and Hadden and Borgatta can be said to the extensions of price's 1942 study. They are all exploratory in the sense that they are not structured around any hypothesis or the testing of any theory of urban systems. The major difference between these studies and price's is the use of more advanced


43. Moser and Scott, op.cit. Foot note 7.

44. Ahmad, Q., op.cit. pp.113-123.

computer facilities, inclusions of more variables as well as more strategic ones, and as a consequence, the dimensions identified were more basic and general.

All the studies to this point were lacking in that they did not demonstrate the stability of urban systems over time and through space. In addition, they did not attempt to demonstrate the linkage between the existing theories of city systems and their empirical findings.

The study that tried to achieve these goals was King's (1966) examination of Canadian cities.46

In the study of the Canadian urban dimensions, King tried to examine the following four features of the urban dimensions model.

(1) The behavior of urban dimensions over time.

(2) Changes of the individual position of the cities showing some changes in socio-economic transformations even though there are some stability in the basic form of the dimensions.

(3) Changes in the grouping of the cities on the basic dimensions.

(4) Variation of the loadings of the variables on a particular dimension over time.

He tested these features of the Canadian cities over 2 time periods, 1951 and 1961, considering more than

50 variables for 106 cities with a population of 10,000 or more. In this study, King tried to explain some of the dynamic aspects of the urban dimensions model. He criticized the previous works from the point that they were the studies in a single point in time and they were exploratory in the sense that they were not based on any hypothesis.

Principal component analysis is generally used when it has been conceptualized that there is a general factor and some other bipolar factors or components. Keeping this in mind, if we look at the index of his first component (viz. youthfulness of the female population in the cities) for 1951, it does not seem to explain the general behavior of the city structure or development. Again, sometimes it so happens that one will have to consider the reverse signs of the factor loadings for easy interpretation of the results. If we look at the first component of 1951 and 1961 it will appear that most of the loadings have negative signs. For 1951, King identified this component as an index of youthfulness of female population in the cities and for 1961, he named it as urban manufacturing. But, unfortunately, both the indices did not represent the general characteristics of the cities. May be as a result of this, he had to conclude "that these
dimensions are not stable in form, and that over time they may reflect the changing orientations of urban society.47

Now, following the objectives of the principal component analysis, the name of this first component may be given as "the level of urbanization" which appeared to be more relevant from the component loadings for the 2 years. This index will be more pronounced if the signs are made reversed.

For 1951, King used 52 variables but for 1961, he used 54 variables. Though the difference in total number is small, he did not use the same variables for both the years and what he used was the "related" variables. In this situation, it will not be easy to look for the same component for both the years. The dimensions found in 1951 may not be the same in 1961.

Similarly, the subjectivity on the calculation and finding out the number of groups of cities is well known and need not be discussed separately here.

In this study, King suspected some of the problems relating to the regularities of the urban dimensions model. For example,

(1) He pointed out about the grossness of linearity assumption made in the principal component analysis.

(2) The problem of "flipping over", which he wanted to mention as a methametical consequence of the procedure used.

(3) From the city groups of 1951 and 1961, it has been seen that they are remaining fairly stable over the decade. Though by this, he was able to substantiate his proposition mentioned at the beginning of his paper, one question arises in this respect. The dimensions he identified for the 2 years were not similar. But the percentages of variances explained by approximately same number of dimensions were the same. The grouping of the cities had been performed just by considering the orthogonal dimensions. Same types of groupings may be expected due to the following: Though the position of the cities (loadings) will change on the respective dimensions, the overall effect on the total urban dimensional space will not be much due to the consideration of fairly same number of variables and due
to the short period of time (only 10 years). Another factor may be the size of the city. Variation may be expected due to some vigorous changes in political or economic conditions.

This study has merits over the previous studies in that here King considered 2 time periods through which he was able to show the growth and development of the urban system. It would be interesting to see the stability or the variations of the aspects mentioned at the beginning considering medium or small sized cities and over space. As it has been mentioned earlier that if we could identify the basic dimensions "level of urbanization" and "socio-economic diversification" as the general factors, it will be able to show their stability and variation over time and space.

No doubt that King's study is a further advancement of the previous studies. The same type of study can be done by considering the changes over time and space which will give the dimensions of urban structural change.48

There are some more studies that use multivariate analyses. These studies focus their attention to various aspects of city life. Hofstaetter, tried to

examine the goodness of a city through the use of factor analysis following the same principle as that of Thom-dyke. He included variables relating to diseases, public services and so forth and derived his factors as "enlightened affluence". Recently, another study that have selected the areas of underdeveloped world, is done by Berry and Spodek. They have selected six cities of India, data have been derived from different sources mainly for 1961 that are analysed through the use of factor analysis and have drawn some interesting conclusions. They found socio-economic status as the most predominant ones. They remarked that:

"If ecology is to be understood as process in time, much more historical study of urban ecology is needed in India where traditional patterns have great longevity and where social areas display great resistance to change".

Only three years back (1969) Berry and Horton reviewed the literatures on the basic dimensions of urban systems and suggested that:

"At least four major features of urban dimensions model warrant further study, especially from the point of view of their sensitivity to changes in the urban systems over time."

52: Ibid. p.284.
Equally important is the question of the appearance of some of the major dimensions in different geographical locations, which may support and clarify the existing generalizations regarding the multiple characteristics of the cities. The basic features of the urban dimensions model requiring further research are:

1. Temporal stability
2. City position
3. City grouping
4. Variable position
5. Geographic generality.

Some of these features have been tested by King to shed not only a new light on the Canadian Urban System but also contribute to the better understanding of the urban structure in general. Still his study was deficient in terms of the fifth aspect mentioned above.

Robson, pointed out that:

"The conclusion must be that any attempt to test for the stability of factors or components can only be achieved, either by comparison of a given area at two points in time or in two different regions at one point of time, so long as the same set of variables is used in the analysis. Unless the technique is used as a classificatory device which has some further end product in mind, the classification of units can only be regarded as stable on the basis of further testing in different areas or at different time periods." 54

Lastly, as it has been seen from the previous discussion that still much remains to be studied and it is from this point that the present comparative study of the temporal and spatial stabilities of Indian and American Urban Systems has been built.