7. URBAN FUNCTIONS

7.1. INTRODUCTION

Urban functions have long been a central theme in geographical research and an analysis of the urban scene of West Bengal would be incomplete without a study of the functions performed by the state's urban centres. Analysis of urban functions in this chapter has been done from three different aspects and includes a study of (i) functional classification of urban centres and (iii) functional zoning of urban centres.

Functional classifications of urban centres have been widely used in the analysis of urban functions since the earliest times. Initially such classification schemes established classes in descriptive terms only and towns were classified on a subjective basis (Aurousseau, 1921). Subsequently there was an introduction of objective, statistical methods in the scheme of classification (Harris, 1943). These classifications consistently made use of data on occupation or employment since there is a clear link between the occupational or employment categories and a town's functions. Finally, multivariate techniques have also been applied to the problem of functional classifications so as to analyse how towns are related to a series of variables (Moser and Scott, 1961).

To obtain a complete picture of the distribution of urban functions in the state, three different schemes of classification have been employed, (i) classification by ternary diagram (ii) functional classification after Nelson and (iii) principal component analysis. The first is based on a broad threefold division of urban functions into primary, secondary and tertiary categories while the second scheme gives a more detailed picture being based on the ten industrial categories of workers provided in the Census of India. The third scheme makes use of the same data on industrial categories but provides the most detailed view of the functional mix in the different urban centres of the state, for grouping of individual functional types has become possible through use of principal components.
Since it is generally accepted that there is an influence of certain functions on urban growth, a study of the relation between functions and population size of urban centres becomes relevant at this point. For a quantitative approach to this problem the functional mix of individual urban centres have been quantified by use of certain functional indices and related to population size by use of the technique of correlation analysis.

Finally, it is felt that a study of the functional zoning of an individual urban centre is necessary so as to provide a deeper insight into the spatial distribution of different functions within a town or city. Since it is not possible to make such a detailed study of the numerous towns and cities of the state, the analysis has been restricted to two case studies, namely, Asansol and Chandannagar. Both are Class I cities and the former is located in the western part of Barddhaman district, a zone which has been emerging as an important area of urban agglomeration in the recent decades, while the latter is situated within the Calcutta Urban Agglomeration within commuting distance of the city of Calcutta. These two cities have been selected because, it is felt, they will provide a clear picture of contrasts in urban landuse since the former is an important city of a typically industrial region while the latter is primarily a residential city very much under the influence of Calcutta.

Before going into further details of the work that has been done, it must be noted here that the data base for analysis has been provided by the 1971 census, because a detailed breakdown of working population into different industrial categories for all the urban centres has not been provided in the 1981 census.

7.2. METHODOLOGY

7.2.1. Functional classification of urban centres

7.2.1.1. Functional classification by ternary diagram

Functional classification by ternary diagram involves the recognition of three broad functional classes, namely primary, secondary and tertiary. The percentage of working population in each
category is calculated and the urban centres are then plotted on a facies triangle or ternary diagram, the three axes of which represent the three functional classes. One of the simplest uses of the facies triangle was developed by Pelto (1954) in which a classifying function was used to divide the triangle into seven sectors. In other words, the function divides a continuous three-component system into seven classes resulting in three sectors with one component end mixture, three sectors with an end mixture consisting of equal amounts of two components and one sector which has equal amounts of all three components (Figure 7.1). Thus on the basis of the different combination of functions that are seen to occur in the graph, a sevenfold classification of the urban centres have been made into (i) primary (ii) secondary (iii) tertiary (iv) primary-secondary (v) primary-tertiary (vi) secondary-tertiary and (vii) primary-secondary-tertiary. Figure 7.2 shows the spatial distribution of towns of different functional types over the state.

7.2.1.2. Functional classification (after Nelson)

H.J. Nelson (1955) in his 'A service classification of American cities' put forward a scheme of functional classification of urban centres in which the classes recognised are derived statistically from the available occupational data. In this method diagnostic functional groups are selected from census data. For each town the percentage of workers in different categories is calculated. The next step involves calculation of the mean and standard deviation for all towns for each functional group. Any town which then shows a percentage of workers of more than mean plus one standard deviation is said to be distinctive in that particular function. The degree of distinctiveness of a function may be expressed in the following way:

\[
\begin{align*}
\bar{X} + 1S & \quad \text{to} \quad \bar{X} + 2S & \quad 1 \\
\bar{X} + 2S & \quad \text{to} \quad \bar{X} + 3S & \quad 2 \\
\text{over} \ \bar{X} + 3S & \quad 3
\end{align*}
\]
As already stated the various functional classes identified in this classification have been selected on the basis of the different industrial categories provided in the 1971 census of India, where ten such categories have been recognised. However, the first three categories have been merged to give a single functional class, namely, agriculture and allied activities. The seven other categories have been retained as given in the census data; these are mining and quarrying; household industry (termed small scale industry in the following analysis) manufacturing, processing and repairing other than household industry; construction; trade and commerce; transport, storage and communication; and other services. A ninth class, namely, diversified towns has also been recognised where none of the functions mentioned above are distinctive.

A town has been placed in a particular functional class according to the function that is distinctive for that town. Sometimes, it so happens that two or more functions are distinctive for a town in which case that town is included in two or more of the functional categories.

7.2.1.3. Functional classification by principal component analysis

Principal component analysis has become extremely popular as a tool of geographical research in recent years. Its major value is in the identification of groups of related variables including overlapping groups which occur when variables have high loadings on more than one component. The technique may be said to be based on the general principles "that each variable can be subdivided into several independent parts in terms of its association with other variables, and that each correlation coefficient similarly is made of different segments" (Johnston, 1978). These segments may be entirely independent of each other so that it is possible to identify groups of variables within each of which there are high correlations but between which correlations are nearly zero.

A detailed explanation of the principles and mathematical procedure involved in the extraction of principal components is beyond the
scope of this study. However a general idea of the technique is given below for a better understanding of the results obtained from such analysis.

Principal component analysis rewrites a data matrix, comprising \( n \) variables and \( N \) observations, into another \( nxn \) form in which the new variables are (1) weighted representations of the original set; and (2) uncorrelated with one another.

The first step in principal component analysis is the calculation of a correlation coefficient matrix which shows the degree of inter-correlations between all the variables, elements along the diagonal indicating the total variations in data. Extraction of the first principal component involves summing correlations for each variable in the correlation matrix and expressing this sum as a ratio of the square root of the total sum of correlations. The maximum value of the total sum of the correlations can be \( n^2 \) which will be the case if every correlation is 1.0. By taking square root of this value it is made equivalent to the maximum sum of correlations possible for each variable. The square root of the total sum is the maximum value possible for any one variable and is the new average variable or principal component. The ratio of the sum of the correlations for each variable to square root of total sum is thus the correlation of each variable with the component and are known as component loadings which are interpreted in the same way as correlation coefficients so that the squares of their values indicate the proportion of the variance in the individual variable which can be associated with the component. Each squared component loading indicates the degree to which the new variable which is the average of all the original variables, replaces an original variable (that is, what portion of the original variable is correlated with the component). The sum of these squared loadings therefore indicates the total variance accounted for by the component. This value is known as the eigenvalue, and is calculated as

\[
\lambda_1 = \frac{1}{n} \sum_{j=1}^{n} L_{1j}^2
\]
where $L_{ij}$ is the loading for variable $j$ on component $i$

$\lambda_1$ is the eigenvalue for component $i$

The importance of the eigenvalue may be understood if it is related to the total variance in the correlation matrix which is equal to the number of variables, $n$. Therefore, if the eigenvalue is expressed as a percentage of $n$, it gives the percentage of the variance in the set of variables which is correlated with that particular component.

After extraction of the first component, it becomes necessary to extract a second component which will describe the largest common dimension of variation remaining in the matrix. This involves the construction from the loadings on the first principal component, a correlation coefficient matrix that would have existed had the first component completely exhausted all the variation in the original data matrix. This can be obtained by multiplying a vector of loadings by its transpose. Next step is to subtract this matrix from the original correlation coefficient matrix which gives the first residual coefficient matrix. Then, a second component is extracted from this residual matrix and component loadings and eigenvalue are computed for this component.

The maximum number of components that can be obtained from a correlation matrix is the number of variables, $n$, the limiting case being when all $n$ variables are uncorrelated and thus orthogonal to each other. Thus a full principal component analysis should extract all $n$ components. However, if the reason for analysis is to identify groups of related variables, then only the largest components (in terms of their eigenvalues) will be of interest. At this point, the question that often arises is that how many components should be interpreted to identify groups of related variables to obtain a general pattern. Different proposals have been put forward suggesting cutoff points in principal component analysis, of which the most frequently used one interprets only those components for which the eigen value exceeds 1.0. The argument for this is that 1.0 represents the variance of the original variables, so that a component with an eigenvalue of less than 1.0 accounts for less of total variance than did any one of the original variables.
So far this discussion of principal component analysis has dealt with the extraction of components from the correlation matrix. But the matrix is based on the original data for a set of observations about which nothing has been discovered. For this, component scores have to be derived. The components are identified in terms of the original variables; the larger the loading the more important the variable in the interpretation of the component. Thus if an observation has high values for the variables with large loadings on the component then it should have a high value on the component. The component score for observation 1 on component k satisfies this requirement and is obtained from the formula

\[ S_{1k} = \sum_{j=1}^{n} D_{ij} L_{jk} \]

where \( D_{ij} \) is the standardised value for observation 1 on variable \( j \);
\( L_{jk} \) is the loading of variable \( j \) on component \( k \),
\( S_{1k} \) is the score of observation 1 on component \( k \);
and summation is over all \( n \) variables.

Therefore, "component scores are values for the observations on the new variables, reflecting their values on the original variables and the contribution each component makes to the variance of these" (Johnston, 1978).

One fact must be noted here that while the input data, the z-scores have the same means and standard deviations, the standard deviations of the component score columns vary for the data has been weighted by components of different magnitude. For ease of comparison it is often considered desirable that each of the component score columns should have the same mean and standard deviations. To achieve this result the component scores are standardised. This may be done by dividing each loading by the eigen value for that component which expresses the loading as a proportion of the total 'explanation' and so brings all components down to a common base.
In the present study the technique of principal component analysis has been employed to identify different functional classes of urban centres in the state. The variables chosen for analysis are the ten industrial categories of working population identified by the Census of India, 1971. The analysis has been performed by computer and the output data consists of component loadings, eigenvalues, eigenvectors and standardised principal component scores.

7.2.2. Size-function relationship of urban centres

To relate the population size of urban centres with their functions, a functional index is required for each urban unit which gives the degree of functional diversification in that unit. Two different procedures have been used in this study to arrive at functional indices for the urban centres, namely, the entropy function and the crude and refined diversification indices; the former providing a broad view of the primary-secondary-tertiary mix of urban functions while the latter has been derived on the basis of the detailed breakup of occupational data.

7.2.2.1. Entropy function

Pelto (1954) also used the facies triangle to establish quantitative facies boundaries through the concept of an 'entropy function'. He used the term 'entropy' to refer to the degree of mixing of the components, the high entropy values occurring near the centres of the facies triangle and low values near the ends. In other words, high entropy values indicate a more or less equal mixture of the end members, whereas low entropy values indicate the end member components. He defined relative entropy as the ratio of the actual entropy to the maximum entropy which could be obtained with the same set of components and is expressed as

$$100 \frac{-100 \sum_{i=1}^{n} P_i \log_e P_i}{H_m}$$

The entropy of a set of probabilities $P_1, P_2, \ldots, P_n$ is defined as
\[ H = \sum_{i=1}^{n} P_i \log_e P_i \]

where \( P_i \) is the probability of occurrence of any component.

and \( H_m \) is the maximum entropy and it occurs when the system is a mixture of equal amounts of each component. The maximum entropy in a three component system is 1.0986.

\( H_r \) values have been computed for the urban centres on the basis of the broad threefold classification of working population into primary, secondary and tertiary activities, showing the degree of mixing of these components in them.

In order to find out whether there is a statistically significant size-function relationship in the urban centres, correlation coefficients have been calculated between the following pairs of variables.

1) Relative entropy and population size of urban centres
2) Relative entropy and population size of the six size classes of urban centres.

7.2.2.2. Crude and refined diversification index

Another way of determining the index of diversification of urban functions involves the computation of the crude diversification index. The method employed here is a modified form of that developed by R.C. Tress in 1938. The formula for computing the crude diversification index (CDI) may be expressed as

\[ \text{Crude Diversification Index} = n.x_1 + (n-1)x_2 + (n-2)x_3 + \ldots + 2x_{n-1} + 1.x_n \]

where \( x_1, x_2, \ldots, x_n \) are the percentages of different groups of working population ranked in descending order of magnitude and \( n \) is the number of groups of workers considered.

If ten occupational categories are used, the crude index for least diversity where a single category of workers absorbs the entire working population is 1000, whereas the most diversified having equal percentage of workers should have a crude index of 550. Thus, lower value of the index means greater diversification and higher values indicate less diversification.
Figure 71  Functional classification of urban centres in West Bengal by triangular graph, 1971
To remove this inverse relation between the nature of diversification and the magnitude of the index a refined diversification index has been calculated where greater value of the index indicates greater diversity and vice versa.

Refined diversification index is obtained by the formula

\[
\text{Refined Diversification Index} = \frac{\text{Maximum} - \text{CDI}}{\text{Maximum} - \text{Minimum}} \times 100
\]

where maximum and minimum refers to the maximum and minimum possible values of the crude diversification index.

Once the functional indices were obtained, correlation coefficients have been calculated between

(i) Refined diversification index and population size of urban centres
(ii) Refined diversification index and population size of the six size classes of urban centres.

7.2.3. Functional zoning: Case studies on Asansol and Chandannagar

Morphology of urban centres varies widely from place to place and this has been one of the prime concerns of town planners and urban geographers. Study of urban morphology may be done from two viewpoint; the arrangement of road and buildings or analysis of town plan; or the distribution of functional zones within the town. This analysis is concerned with the latter aspect of urban morphology. As already mentioned, the two cities selected are Asansol in Barddhaman district and Chandannagar in Hugli district. On the basis of detailed landuse surveys of these two cities, maps have been prepared identifying the following functional areas; (i) residential (ii) commercial (iii) industrial (iv) administrative (v) educational (vi) other public uses (vii) parks and playgrounds (viii) transport and (ix) agricultural and unutilised.
7.3. ANALYSIS

7.3.1. Functional classification of urban centres

7.3.1.1. Functional classification of urban centres (tricomponent method)

A glance at Table 7.1 shows that tertiary functions dominate in 95 out of a total of 223 urban centres in the state. It is interesting to note that in the districts of North Bengal almost all the urban centres show dominance of tertiary functions. Similarly another zone where tertiary function dominance is noticeable is in the eastern part of Twentyfour Parganas. Within the Calcutta Urban Agglomeration tertiary function dominant towns are mostly located in the immediate neighbourhood of Calcutta, more particularly in the southern part. Over remaining parts of the State such towns appear to be more or less evenly distributed.

Table 7.1. Number of towns in each functional class (tricomponent method)

<table>
<thead>
<tr>
<th>Functional classes</th>
<th>Number of towns</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary</td>
<td>7</td>
</tr>
<tr>
<td>Secondary</td>
<td>42</td>
</tr>
<tr>
<td>Tertiary</td>
<td>95</td>
</tr>
<tr>
<td>Primary-Secondary</td>
<td>1</td>
</tr>
<tr>
<td>Primary-tertiary</td>
<td>20</td>
</tr>
<tr>
<td>Secondary-tertiary</td>
<td>39</td>
</tr>
<tr>
<td>Primary-secondary-tertiary</td>
<td>18</td>
</tr>
</tbody>
</table>

Secondary function dominant towns are confined mostly to the Hugli Industrial Belt and the Durgapur-Asansol region.

Dominance of primary functions is particularly noticeable in the northeastern part of Medinipur district in the small towns of Amlagora, Ramjibanpur, Chandrakona, Khipai and Kharar, so that this region accounts for 5 out of a total of 7 urban centres falling in this class. The two remaining primary function dominant towns of the state are
WEST BENGA L
FUNCTIONAL CLASSIFICATION OF URBAN CENTRES
(AFTER NELSON)
1971
AGRICULTURAL TOWNS

Scale of distinctiveness
X<15 1
X=15 TO X<35 2
ABOVE X=35 3

Figure 73
Patrasaer in Bankura district and Baduria in Twentyfour Parganas both of which have a high proportion of their working population in agriculture and allied activities.

There is only one town (Panchla in Haora district) which shows a dominance of primary-secondary functions. Secondary-tertiary functions' dominance is seen to occur mainly within the Hugli Industrial Belt while towns where primary-tertiary functions are dominant, are located in the economically backward districts with a low level of urbanisation like Bankura, Medinipur and Murshidabad. The northern districts of Jalpaiguri and West Dinajpur also contain two and one such urban centres respectively.

A more or less equal mix of primary-secondary-tertiary functions may be seen in 18 towns and all of these are located in the southern half of the state. Again it may be seen that a number of such towns are located in the Haora district either within the Hugli Industrial Belt or in its outskirts.

### 7.3.1.2. Functional classification of urban centres (after Nelson)

Classification of urban centres of the state by employing this scheme reveals the following trends:

1) **Agricultural towns**

Most of the agricultural towns appear to be located in the southern part of West Bengal especially in the district of Medinipur which contains nearly one third of the total number of such towns in the state (Figure 7.3). The agriculturally prosperous districts of Hugli and Barddhaman also contain some agricultural towns. It is interesting to note that districts like Haora and Twentyfour Parganas with their comparatively high proportion of urban and industrial population also contain agricultural towns, as for example, Canning (a centre of fishing, paddy cultivation and so on) Baduria (a centre of jute cultivation, gur making) and others in Twentyfour Parganas. Three towns of Haora district have been classified as agricultural, namely, Podara, Panchla and Banitala, mainly because of a preponderance of agricultural labourers in their workforce.
WEST BENGAL
FUNCTIONAL CLASSIFICATION OF URBAN CENTRES
(AFTER NELSON)
1971
MINING TOWNS

Scale of distinctiveness

\[ x + 15 \text{ to } x + 25 \]
1

\[ x + 25 \text{ to } x + 35 \]
2

ABOVE \( x + 35 \)
3

Figure 74
Murshidabad district contains three agricultural towns - Lalgola, Murshidabad and Kandi which are centres for cultivation and distribution of various agricultural products such as mango, paddy, jute and so on. Islampur in West Dinajpur is another centre of jute and rice cultivation and gur making.

In the Northern part of the state, two such towns are found - Domohoni and Dhupgun in Jalpaigurí district which are centres of jute, tobacco cultivation and allied activities.

ii) Mining towns

There are very few mining towns in the state and most of them are coal mining towns located in the western part of Barddhaman district in the portion of the well known Raniganj coalfields falling within West Bengal (Figure 7.4).

iii) Small scale industrial towns

A study of Figure 7.5 reveals that there are three pockets where small scale industrial towns are found. The first of these occurs in Murshidabad district where three such towns are found, namely, Dhulian, Aurangabad and Jangipur all of which specialise in the manufacture of small scale goods like handloom textiles, earthenware, tobacco products and so on.

The second area of concentration is found in the district of Nadia where the towns of Nabaddip, Santipur, Phulla and Birnagar are found to be situated in close proximity to each other. These towns have long been well known centres of cottage industries producing handloom textiles, brass utensils, clay models and so on. The third pocket is found within the Hugli Industrial Belt where some towns have specialised in small scale manufacture of cotton textiles, foodstuffs, tobacco products, leather products and others.

In addition to these, there are also other small scale industrial towns scattered over the state. Guriahati in Koch Bihar district has specialised in manufacture of handloom cloth, tobacco products and rope making; Hili in West Dinajpur in small scale manufacture of foodstuffs;
FUNCTIONAL CLASSIFICATION OF URBAN CENTRES
(AFTER NELSON)
1971
INDUSTRIAL TOWNS

KEY TO INSET A
1 Dhalliya
2 Jhorhat
3 Sankrail
4 Sarenga
5 Manikpur
6 Bankhali
7 Fort Gloster
8 Chengali
9 Bauria
10 Ichhapur Defence Estate
11 Halisahar
12 Krishnagar

Scale of distinctiveness

Figure 76
FUNCTIONAL CLASSIFICATION OF URBAN CENTRES (AFTER NELSON) 1971
CONSTRUCTION TOWNS

Scale of distinctiveness

- \( \bar{x} + 15 \) to \( \bar{x} + 25 \)  1
- \( \bar{x} + 25 \) to \( \bar{x} + 35 \)  2
- ABOVE \( \bar{x} + 35 \)  3

Km

20  40  60

Figure 77
Jhalda in Puruliya in the making of shellac and tobacco products such as bidi; Sonamukhi and Bishnupur in Bankura district are well known for their clay models and silk textiles.

iv) **Industrial towns**

There are two distinct zones of concentration the first of which is the Hugli Industrial Belt comprising the districts of Haora, Hugli and Twentyfour Parganas containing 31 out of a total of 39 industrial towns in the state (Figure 7.6). This area has a wide range of industries with a predominance of light, medium and consumer goods industries, the most important being jute and cotton textiles, paper, chemicals, engineering electrical industries and others.

The other area of concentration is found in the western part of Barddhaman district and, in sharp contrast to the Hugli Industrial Belt, this zone is noted for heavy industries like iron and steel, aluminium works, locomotive plants and so on.

v) **Construction towns**

Only three such towns have been identified in the state (Figure 7.7), two of which are located in Murshidabad district namely, Farakka Barrage town and Jangipur. The third town is Haldia in Medinipur district which is the site for the construction of a large petrochemical complex as well as feeder port to Calcutta.

vi) **Commercial towns**

Most of the commercial towns are located in the northern part of the state and also in the southern part on either side of the river Hugli (Figure 7.8). It may be noted that the northern districts of the state especially Koch Bihar, Jalpaiguri and West Dinajpur contain a large number of commercial towns. Mathabhanga, Haldibari, Dinhata and Tufunganj in Koch Bihar are all important market centres for agricultural produce of neighbouring areas as well as products of cottage industry such as hand woven jute carpets, pottery, silver ornaments, bamboo baskets, tobacco products and so on. Similarly Mal, Dhupguri,
WEST BENGAL
FUNCTIONAL CLASSIFICATION OF URBAN CENTRES
(AFTER NELSON)
1971
SERVICE TOWNS

Figure 79
Falakata and Alipur Duar in Jalpaiguri, Raniganj, Kaliaganj, Ganga-rampur in West Dinajpur are also market centres for the agricultural produce of the neighbourhood.

A comparatively large number of commercial towns are also found in the districts of Murshidabad, Nadia and eastern part of Barddhaman district, the commercial activities of most of these towns being associated with the distribution of agricultural products of their neighbouring areas as well as small scale manufacture within the town itself.

Some commercial towns are also found to be located within the Hugli Industrial Belt, and Calcutta, the State capital, has also been classified as a commercial city.

vii) Service towns

There are two areas where a comparatively large number of service towns may be noticed (Figure 7.9). The first of these occurs in the northern part especially in the districts of Darjiling and Koch Bihar. Most of these towns are either centres of tourism especially those of Darjiling district, or centres of administration and cantonments like those of Koch Bihar district.

The other area where service towns are found lies in the southern part of the state in and around the Hugli Industrial Belt. It may be noted that Twentyfour Parganas has the highest number of service towns, a total of 20 out of which 16 are again found within the Hugli Industrial Belt.

It is interesting to note that with the exception of Murshidabad, Puruliya and Bankura most of the districts have at least one service town and in most cases it happens to be the district headquarters.

viii) Transport towns

In the northern part of the state there are three towns where transport and related activities are distinctive (Figure 7.10). The growth of such transport centres in this part of West Bengal may be attributed partly to the strategic importance of this region and partly to the bottleneck caused by partition of the country in 1947 which
WEST BENGAL

FUNCTIONAL CLASSIFICATION OF URBAN CENTRES
(AFTER NELSON)
1971

DIVERSIFIED TOWNS

KEY TO INSET A
1 Katapagg and Gokulpur Government Colony
2 Gayespur
3 Madrail Fingapara
4 Narayangar
5 Khardaha
6 Madhyagram
7 North Dum Dum
8 Bisarpara
9 Sultanpur
10 Arjunpur
11 Jyangra
12 Krishnapur
13 South Dum Dum
14 Bonpur
15 Jagaddhikpur
16 Chakspara

Figure 711
disrupted the communication system between the northern and southern parts of the state. Among these towns, Siliguri, particularly has been growing as a very important focus of communications between North Eastern India and other parts of the country.

Another zone where transport towns are found occurs in the western part of the state in the districts of Baroddhaman and Puruliya. Among these towns Asansol is one of the most important railway centres of West Bengal. Ondal, too, is an important junction of the Eastern Railways.

Transport functions are important also in Kharagpur and Kolaghat in Medinipur district. Kharagpur is an important junction of the South Eastern Railways and is also the headquarters of the Locomotive, Carriage and Wagon Departments of this section of the South Eastern Railways.

Dum Dum Aerodrome Area is situated in the suburbs of Calcutta and, as the name implies, contains an international airport.

1x) Diversified towns

This category contains the largest number of towns in the state. A glance at Figure 7.11 shows that with the exception of Mainaguri in Jalpaiguri district, the northern part of the state is practically devoid of such towns. Most of the diversified towns are found to be located in the south-east especially in the districts of Twentyfour Parganas, Haora, Hugli and Nadia. The Hugli Industrial Belt alone contains more than 60% of the total number of diversified towns in West Bengal. The western and central parts of the state show a fairly even distribution of diversified towns with the highest number occurring in Birbhum district. Except for Tamluk diversified towns appear to be conspicuously absent in the south western part of the state.

7.3.1.3. Functional classification of urban centres (principal component analysis)

A glance at table 7.2 which gives the component loadings, eigenvalues and percentage of trace obtained from principal component
<table>
<thead>
<tr>
<th>Variables*</th>
<th>Component Loadings</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>Component 1</td>
</tr>
<tr>
<td>X1</td>
<td>0.62754</td>
</tr>
<tr>
<td>X2</td>
<td>0.57291</td>
</tr>
<tr>
<td>X3</td>
<td>0.34996</td>
</tr>
<tr>
<td>X4</td>
<td>-0.03583</td>
</tr>
<tr>
<td>X5</td>
<td>0.14862</td>
</tr>
<tr>
<td>X6</td>
<td>-0.92265</td>
</tr>
<tr>
<td>X7</td>
<td>-0.07709</td>
</tr>
<tr>
<td>X8</td>
<td>0.57652</td>
</tr>
<tr>
<td>X9</td>
<td>0.02517</td>
</tr>
<tr>
<td>X10</td>
<td>0.45810</td>
</tr>
</tbody>
</table>

| Eigenvalue  | 2.26798     | 1.97327     | 1.13140    | 1.01233     | 0.97484    | 0.95797     | 0.89761    | 0.46491     | 0.31970     | 0            |

*Percentage of workforce employed in the following categories.
X1 - Cultivators, X2 - agricultural labourers, X3 - livestock, forestry, fishing, hunting, plantations, orchards and allied activities,
X4 - mining and quarrying; X5 - household industry; X6 - manufacturing other household industry; X7 - construction; X8 - trade and commerce, X9 - transport, stores and communications and X10 - services.
WEST BENGAL
FUNCTIONAL CLASSIFICATION OF URBAN CENTRES BY PRINCIPAL COMPONENT ANALYSIS
1971
COMPONENT I

Figure 7.12
analysis shows that the first four eigenvalues are greater than unity being 2.26798, 1.97327, 1.13140 and 1.01233 respectively. These first four components thus together account for 63.85% of the total variations in the data matrix.

The first principal component appears to be bipolar in nature showing positive correlation with the variables \( x_1 \) (percentage of cultivators in the working population) and \( x_7 \) (percentage of agricultural labourers in the working population) and negative relation with percentage of workforce in industries other than small scale \( (x_6) \). Therefore this component may be termed 'agricultural function dominant with a low level of industrial development'.

The second component shows high positive correlation with percentage of workers in services \( (x_{10}) \), trade and commerce \( (x_8) \) and transport \( (x_9) \) and may be named 'tertiary function dominant'.

The third principal component shows high positive relation with percentage of workers in mining and quarrying \( (x_4) \), construction \( (x_7) \) and transport \( (x_9) \) and is named 'mining function dominant with some tertiary functions'.

The fourth principal component shows positive correlation with the percentage of workforce in household industry \( (x_5) \) and has been named 'small scale industry function dominant'.

The standardised component scores on these four principal components have been mapped to show the spatial distribution of the variations in the weightage of each component on each observation unit, that is, each urban centre.

The map of component scores for the first principal component shows that high scores on this component are especially noticeable in Medinipur, Murshidabad and Bankura districts. Since a high score on this component indicates a high agricultural component with a low level of industrial development, the results of principal component analysis may be said to correspond closely to those obtained in the earlier classification in this respect. However there are some departures, as for example in the classification after Nelson only three towns of North Bengal (Domohoni and Dhupguri in Jalpaiguri district and Islampur in
WEST BENGAL
FUNCTIONAL CLASSIFICATION OF URBAN CENTRES BY PRINCIPAL COMPONENT ANALYSIS
1971
COMPONENT II

STANDARDISED COMPONENT SCORES

above +1
0 to +1
-1 to 0
less than -1

Figure 7.13
West Dinajpur district) have been classified as agricultural whereas a large agricultural dimension has been brought to light in three additional urban centres in this part of the state by principal component analysis, namely Haldibari and Mekliganj in Koch Bihar district and Gangarampur in West Dinajpur district. The first two towns are located in an area known for jute and tobacco cultivation while the latter is found to be an important market centre for the agricultural products of its neighbourhood like rice, jute and vegetables. Similarly Jiaganj-Azimganj and Beldanga in Murshidabad district, Jagadanandapur and Bagula in Nadia district also show high scores on this component. In the earlier classification Bagula was included in the diversified class and the remaining three in the commercial category. Again it may be noted here that these towns are also primarily market centres for agricultural products like jute, sugarcane, pulses, vegetables and molasses of surrounding rural areas. A third point that may be noticed here is that according to the earlier classification three towns in Haora district were included in the agricultural category, but these towns do not show very high scores on the this component. This might be an effect of the industrial dimension included in the component since the level of industrial employment is usually quite high in the urban centres of this industrial district (as is obvious from low scores on the this component in most of the urban centres in this district) and in each of these towns nearly a third of the workforce is engaged in industrial work.

Low and very low scores on the first component is visible in the urban centres of the Hugli Industrial Belt and the Asansol-Durgapur region indicating a large industrial dimension in them. Once again it may be seen that lowest scores are seen in those towns which have already been classified as industrial according to Nelson's classification. There are however two exceptions, Farakka Barrage township, classified earlier as a construction function distinctive town, shows very low scores on this component indicating a large industrial dimension in large and medium scale industry as well.
WEST BENGAL
FUNCTIONAL CLASSIFICATION OF URBAN CENTRES BY PRINCIPAL COMPONENT ANALYSIS
1971
COMPONENT III

[Map of West Bengal with detailed city names and component III analysis]

KEY TO INSET A
1. Namerpur 10. Paschim Digri
2. Uluberia 11. Burdett
8. Antill 17. Balurghat
9. Anandpur 18. Fori Gholer
20. Duttapulin
21. Goyespur
22. Hotilasahar
23. Bhalparo (1)
24. Bisorparo
25. Gorulia
26. North Borrockpur
27. Borrockpur Commerce U
28. Tilarpur
29. Xhardaho
30. Kirultala
31. Porohall (8)
32. Kamorholl
33. Boronogor
34. South Bum Bum
35. North Bum Bum
36. Madhyamgram
37. Gour
38. Dam Dam
39. Duttapulin
40. New Bum Bum
41. Shabganga
42. Duttapulin
43. Borockpur
44. Parsa Pallor
45. Bunder
46. Chicletta
47. South Suburban
48. Garden Reach
49. Panchur
50. Jugsandeshpur
51. Kirtishwarpur

Figure 7.14
High scores on the second component are particularly noticeable in the northern districts (Figure 7.13) indicating the existence of an important tertiary dimension in these urban centres. Similarly high scores may also be noticed in Calcutta and some urban centres located close to it. Over the remaining parts of the state, there are some urban centres which show high scores on this component. Most of these are district headquarters serving as centres of administration and are also market centres for surrounding rural areas like Puruliya, Suri and Medinipur or are towns like Adra and Ondal where transport functions are important. One interesting feature that emerges from this map is that urban centres located in the northern part of Medinipur district, adjoining parts of Bankura and Hugli district which showed very high scores on the first component are characterised by low to very low scores on the second component indicating a very low development of the tertiary sector in these urban centres. This trend shows some deviation from that of the earliest classification where some of these towns especially Garhbeta, Ghatal and Arambag were classified as primary-tertiary function dominant.

Most of the urban centres of the state show low scores on the third component. Exceptions to this are seen in scattered urban centres in the western part of Barddhaman district, in Chapari, Adra and Arra in Puruliya district, in Kharagpur and Haldia in Medinipur district where very high scores on this component are noticeable. If a comparison is made with the results obtained from Nelson's classification, it will be seen that all the towns showing high scores on the third component have been classified as transport, mining or construction towns in the former.

The map of component scores on the fourth principal component shows that this dimension has a very localised distribution in the state. Very high scores are found in the urban centres of Murshidabad, Nadia and Bankura districts, all of which are known for their small scale traditional cottage industries including cotton and silk handloom textiles, earthenware and clay models, tobacco products and so on.
WEST BENGAL
FUNCTIONAL CLASSIFICATION OF URBAN CENTRES BY PRINCIPAL COMPONENT ANALYSIS
1971
COMPONENT IV

KEY TO INSET A

1. Konnagar 10. Fort Barak
6. Bally 15. Dokmoka
8. Mahiori 17. Barpeta
19. Barolpur
20. Digha
21. Daltonganj
22. Gauhati
23. Nalbari
24. Bongaigaon
25. Dhubri
26. North Barpeta
27. Barpeta
28. Hailakandi
29. Tinsukia
30. Goalpara
31. Ukhiya
32. Sylhet
33. Kaziranga
34. Dhubri
35. South Dhubri
36. Goalpara
37. Silchar
38. Barpeta
39. Jorhat
40. Dibrugarh
41. Tezpur
42. Dibrugarh
43. Tinsukia
44. Guwahati
45. Gauhati
46. Jorhat
47. Tezpur
48. Hailakandi
49. Tinsukia
50. Gauhati
51. Silchar

Figure 715
7.3.2. Size-function relationship of urban centres

A glance at Table 7.3 shows that so far as correlation between population size and relative entropy values is concerned there is an overall negative and statistically significant relationship between them indicating an inverse size-function relationship in the urban centres of West Bengal. In other words, the larger the population size of an urban unit, the lower the level of mix of different functions. In this context it must be remembered that the index used here to indicate the functional mix in an urban centre gives a very generalised picture having been derived on the basis of a broad three-fold classification of occupational data into primary secondary and tertiary categories. Since urban areas by definition are regions where more than 75% of the workforce is engaged in nonagricultural activities, it is not surprising that a mix of urban functions which contain a primary category including agricultural activities should show more or less equal mix of the three components when the urban centres have small population size. As an urban centre continues to grow, its tertiary and or secondary functions assume prominence at the expense of the primary section so that a large urban centre should show a lower entropy value indicating a dominance of one of the components.

### Table 7.3. Correlation: Population size and different functional indices of urban centres

<table>
<thead>
<tr>
<th>Population size of urban centres (y)</th>
<th>Relative Entropy ($x_1$)</th>
<th>Diversification Index ($x_2$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>100,000 and over</td>
<td>-0.28 (t=1.05)</td>
<td>-0.09 (t=0.33)</td>
</tr>
<tr>
<td>50,000 to 99,999</td>
<td>-0.19 (t=1.04)</td>
<td>-0.08 (t=0.43)</td>
</tr>
<tr>
<td>20,000 to 49,999</td>
<td>-0.34 (t=2.48)*</td>
<td>-0.36 (t=2.68)*</td>
</tr>
<tr>
<td>10,000 to 19,999</td>
<td>-0.29 (t=2.31)*</td>
<td>-0.18 (t=1.39)</td>
</tr>
<tr>
<td>5,000 to 9,999</td>
<td>-0.13 (t=0.99)</td>
<td>0.03 (t=0.23)</td>
</tr>
<tr>
<td>less than 5,000</td>
<td>-0.31 (t=0.86)</td>
<td>-0.10 (t=0.27)</td>
</tr>
<tr>
<td>All classes</td>
<td>-0.26 (t=4.07)*</td>
<td>-0.06 (t=0.89)</td>
</tr>
</tbody>
</table>

*denotes significance at .05 level
INDEX
- Residential area
- Commercial area
- Industrial area
- Administrative area
- Educational area
- Area occupied by other public utilities
- Parks and playgrounds
- Agricultural area
- Unutilised area
- Ponds
- Railways
- Roads

Figure 7.16
For a clearer insight into the nature of the relationship between the variables, correlation coefficients for different size categories of towns may be studied. Again it is seen that the relationship is negative for all the size categories indicating that the inverse trend is maintained in all of them. However, statistically significant relations have been obtained only for medium sized towns (Classes III and IV).

A study of the correlation coefficients obtained with respect to the other functional index, that is the refined diversification index which has been derived on the basis of the detailed breakup of occupational data into ten categories, shows that an overall negative relation between variables is still maintained but the value of the coefficient is negligible so that it is no longer statistically significant. Thus there is no significant size-function relationship in the urban centres of West Bengal so far as this functional index is concerned. Coefficients for different size classes show a similar picture, only exception being provided by Class III urban centres where the correlation coefficient (significant at 0.05 level) shows statistically significant negative relationship between the variables.

7.3.3. Functional zoning: Asansol and Chandannagar

7.3.3.1. Asansol

Asansol, located in the western part of Barddhaman district at the centre of the Raniganj coalfield, originally started as a railway centre. It become a municipal town in 1896 and soon displaced Raniganj as a centre of coal industry. It is still one of the most important railway centres of West Bengal and is a junction point of the Eastern and the South Eastern Railways and its growth has been primarily the result of the railway lines, the Grand Trunk Road which runs through the town as well as coal mines of surrounding areas. In recent years the municipal limits of the town have been extended to include the mouzas of Gopalpur, Ganru, Gobindapur, Kumarpur, Shitla, Dakshin Dhadka and Asansol and also parts of the mouzas of Narasamuda, Narsinghband, Santa, Ismail, Mohishila and Kalipahari. Extension of municipal area is particularly noticeable in the northern part where
the city limits have extended to include most of the area between the railway line and the National Highway No. 2 byepass. At present the city constitutes an area of 25.20 sq.km. and according to the 1981 census has a population of 187039, ranking eleventh among the Class I cities of the state.

A study of functional zoning in Asansol city brings to light some distinctive characteristics, the most important of which is the clear association between the transport function and morphological structure of the city. Asansol developed along the railway lines and the Grand Trunk Road (National Highway No.2) and as a result shows some linearity of form. Though there has been considerable extension of municipal area in a north-south direction the original linear shape is still visible. The Grand Trunk Road divides the city into two halves which show definite contrasts in the nature of landuse. The northern half especially the area lying between the Grand Trunk Road and the railway line consists mostly of well planned residential units with rectangular street patterns. The southern half is like a typically unplanned, Indian city with winding roads and haphazard arrangement of residential areas.

A detailed study of urban landuse (Figure 7.16) in Asansol city reveals the following characteristics of the different functional areas:

**Residential areas:** A large part of the city area is given over to this type of landuse. Residential areas lying between the G.T. Road and the railway line mostly houses railway personnel and as already mentioned, is noted for its planned aspects. Within this zone Apcar Garden, west of the Loco Tank is particularly noticeable as an upper class residential area. North of the railway line low class residential areas are mostly located and contain two of the noted slum areas of Asansol, namely Jhingri Mahalla and Kasai Mahalla in the central part. Scattered residential areas interspersed with large areas of open space occur in the outlaying areas of the municipality falling between the NH2 byepass and the Grand Trunk Road which have been recently included within the municipal limits. South of the G.T. Road residential areas are interrupted by commercial, administrative, educational and other func-
tions especially near the main roads. The residential areas in this part have not developed in a planned manner as in the north. There are however some exceptions; as for example a planned residential section may be noticed in the south eastern part of the city.

Commercial areas: Commercial zone is noticeable mainly along the G.T. Road and the southern part of the city. In fact the main bazar area is located in the southern half adjacent to the G.T. Road, roughly in the centre of the city. Other commercial units are seen mainly along the eastern and southern fringes of G.T. Road. Another pocket where commercial functions are particularly developed is along the Dhadka road in the northern part of the city north of the railway line. It may be noted here that commercial units of Asansol deal with a wide range of consumer articles catering to the needs and tastes of the cosmopolitan population of the city.

Transport areas: Earlier analysis has already shown that Asansol has been classified as a transport function distinctive city (Section 7.3.1.2.). That the transport function dominates the city is obvious from the shape of the city which has been influenced by the east-west trend of the main transport lines that is the G.T. Road and the railway lines, which are vital to its economic life. The part of the city lying between the G.T. Road and railway line is a dominantly transport area consisting of the railway station, yards, workshops and so on. Road transport is also important to the city which contain a large bus stand in the central part adjacent to the G.T. Road on the northern side. Arrangement of roads show a planned rectangular pattern in the northern half especially in the section between the railway line and the G.T. Road. Similar planned arrangement of roads is rare in the southern half which is generally characterised by winding roads which do not form any regular pattern. There are however some exceptions as for example a planned road system may be seen in Upper Chelidanga in the west and also in south eastern areas.

Industrial areas: Even though Asansol is located in one of the most important industrial areas of West Bengal, areas occupied by industrial units are rare within the city proper. Industrial areas are found
mainly in the outskirts especially in the southwestern part including areas occupied by Indian Oxygen, Carew Company etc. west of the Burnpur road. Other industrial units include a stone quarry in the northeastern part beside the Nunia river. There are also small industrial pockets mainly consisting of small scale motor engineering works.

Administrative area: An interesting feature of Asansol is the peculiar location of administrative functions. Instead of the usual central location, administrative units comprising of courts, PWD building and so on are found confined to the southwestern parts of the city, east of the Burnpur road. Location of administrative areas thus indicates the secondary importance of such functions to the city. However a few administrative units are centrally located as for example the municipality is located on the Station Road near its intersection with the G.T. Road at the centre of the city.

Educational areas: Large parts of Asansol are occupied by educational institutions. Southwestern parts of the city which contain schools like the Loreto Convent, St. Patricks', St. Vincent's as well as the Asansol Girls' College are particularly noted for this type of landuse. Similarly the eastern part also shows considerable areas occupied by educational institutions which include Ushagram Girls' School, Arya Kanya School and others. North of the railway line two educational areas especially noticeable, one to the northwest comprising of the Kanyapur Polytechnic and the other to the northeast comprising of the Dhadka Polytechnic. In addition there are also scattered pockets characterised by this type of function.

Area occupied by other public utilities: Other public utilities such as hospital and medical centres, recreational and cultural amenities such as cinema halls and so on are found scattered throughout the city especially along the main transport lines near the commercial zone in the centre. Among these, areas occupied by medical functions are especially conspicuous. Hospitals in the city include the E.S.I. hospital in the north by the Kanyanagar Link Road, the Railway Hospital in the centre south of the G.T. Road and the Leprosy Hospital.
Parks and playgrounds There appears to be comparatively few parks and playground in this city and these are mostly found scattered within residential areas. Large playgrounds are particularly conspicuous within the railway area in the central part which houses the railway stadium. Upper class residential areas like Apcar Garden generally contain parks and playgrounds.

Agricultural and unutilised areas: outer fringes of Asansol have extensive areas which are still under agriculture or are unutilised. The northern fringes, north of Nunia Khal, especially areas newly included in Asansol municipality are particularly noticeable for this type of landuse. Similarly agricultural or unoccupied land may be seen in the south-eastern parts of the city especially south of the S.B. Gorai Road. However these areas are slowly being transformed into built up areas as for example a large part of what was formerly Shitala mouza in the northwestern part of the city has been acquired by the Housing Directorate of the Government of West Bengal for building a residential complex.

7.3.3.2. Chandannagar

Chandannagar, located on the right bank of the River Hugli in Hugli district is an important constituent of the Calcutta Urban Agglomeration. The main line of the Eastern Railways touches it at a station of the same name and the G.T. Road passes through it. The city which has a municipal corporation constituted in 1955 covers a total area of 9.71 square km. According to the 1981 census it has a population of 101,925 which gives it the last rank among the Class I cities of the state.

Formerly a French settlement, Chandannagar was one of the most important trade centres on the River Hugli under the colonial powers. French occupation of Chandannagar took place in 1696 on the basis of a farman granted by Aurangzeb permitting them to build a factory there. In 1701, Chandannagar was placed under the authority of Pondicherry. In the initial years trade did not prosper here. It was only after
Dupleix became the Intendent of Chandannagar in 1731 that the town began to flourish. During the ten years of Dupleix's administration it soon became one of the most important and flourishing European settlements of Bengal. After his departure in 1741 various factors such as the unstable political conditions, scarcity of funds and lack of enterprise resulted in a general decline of French trade in Bengal and its effect was felt in the settlement of Chandannagar. In 1757 Chandannagar was captured by the British. It was restored to the French in 1765 by the Treaty of Paris. However the settlement changed hands between the French and the British several times until it was finally made over to the French in 1816. Since that date the town remained under French rule until 1954 when it was formally merged with West Bengal.

Urban landuse within the city shows considerable evidence of the long French rule. This is especially true of the central parts which still show street names like Rue de Orleans Fort and where several Christian Mission schools and the Institute de Chandannagar are located. Analysis of urban landuse in Chandannagr (Figure 7.17) reveals the following characteristics of the different functional zones:

Residential areas: A study of the historical background of Chandannagar shows that it originally began as a trade centre. But, at present, the city which is located within commuting distance of Calcutta has become primarily residential. Thus maximum area is given over to this type of landuse. Except for some areas in the central and eastern parts which are occupied by other uses, most of the city shows residential areas interspersed with agriculture and unutilised space.

The distinction between upper and lower class residential areas is generally not very clear in Chandannagar though Gondalpara area in the south eastern extremity containing the jute mill, is characterised by lower class residential areas especially in the parts adjoining the jute mill. Comparatively lower class residential areas are also found in the western fringes of the city near the railway station and also in some of the central sections. One interesting feature that may be noted here is that most of the major roads of the city like G.T. Road,
Station Road and others are usually lined with different types of shops mostly occupying ground floors of residential buildings resulting in a mixture of residential and commercial functions in these areas.

Commercial areas: Commercial functions are particularly noticeable along the G.T. Road. Especially heavy concentration of shops may be seen at the crossing of G.T. Road with other main roads as for example Bagbazar-G.T. Road crossing. Most of these commercial areas consist of retail shops selling consumer products like sweets and condiments, clothing, stationeries and so on. Important zones of commercial functions may be seen in the east central part of the city where old bazar areas like Lakshmiganj bazar and also newer market complexes like Hospital Math Market and Ashirbad Supermarket are located. A similar zone of concentration of commercial functions is found in the southern part of the city around Swapna Market.

Some specialisation of commercial functions have also been noticed in particular areas; as for example, there is a concentration of shops selling earthenware and clay articles in the south along the G.T. Road, building materials at Lakshmiganj Bazar and furniture and other wooden articles in the Urdibazaar area in the northeast.

Industrial areas: Industrial functions are mainly confined to the Gondalpara locality in the south east where the jute mill is located. Over remaining parts of the town industrial areas are also seen in the northeast especially in areas adjoining the river Hugli. Except for the Gondalpara jute mill most of the industries are small scale manufacturing units and the most important item of manufacture is wooden furniture. A concentration of saw mills and timber merchants may be seen in the northeastern parts especially in the Urdibazar locality. There are also engineering workshops and vehicle repairing activities connected with road transport, usually located along the main roads. Another important item of small scale manufacture is bread and allied products in the Barabazar road area.

Administrative areas: Administrative functions have a particular importance in this city since it forms a subdivisional headquarter and after it was merged with West Bengal, many government offices, courts
and so on were established here. Thus administrative functions have a 
more or less central location in the city. The civil court, criminal 
court, SDO's office and other administrative units are located close to 
each other in the east central parts of the city around Urdibazar area 
and facing the strand. The Chandannagr Corporation is also located 
close by.

Educational areas: Educational functions seem to be particularly well 
developed here and educational institutions draw their students not only 
from the city itself but also from surrounding towns and rural areas. 
Extensive areas given over to this landuse is particularly noticeable in 
the central part close to the river. This area contains a number of 
educational institutions including the Chandannagar College. The city is 
noted for a number of missionary schools including St. Joseph's 
Convent for girls and Ecole de Jeunes Fils. This is once again a result 
of the historical background of the city since during the French 
regime, Christian missionaries established several schools here for the 
spread of Bengali and French education. There are also a number of 
other primary and secondary schools scattered throughout the city.

Area occupied by other public utilities: This function occupies 
considerable areas in the central part where a large hospital, cinema 
halls, libraries, Institute de Chandannagar and the newly constructed 
Rabindra Bhavan are located.

Parks and playgrounds: Land given over to this type of use is 
comparatively rare and most of the parks and playgrounds are again 
found to be located in the eastern and central parts of the city. It 
may be noted here that one of the most conspicuous and attractive 
areas of Chandannagar is the strand bordering the river Hugli and 
facing the important cultural, educational and administrative units of 
the city.

Transport: Though the road system of the city has not developed in a 
planned way, a roughly rectangular pattern may be noticed particularly 
with respect to the main transport lines. The G.T. Road which crosses 
the city in a north-south direction forms the main artery and is inter- 
sected perpendicularly by other important roads like the Chandannagar
Station Road, Mankundu Station Road and others which run east-west. However, most of the minor roads have developed in an unplanned manner. It may also be noted here that except for the road system, there are no other areas devoted to the transport function in this city.

Agricultural and unutilised areas: Even at present there is a considerable amount of land that is unutilised or is given over to agriculture. This is especially true of the western half of the city. However, many of these areas are slowly being converted into built up areas.

7.4. CONCLUSION

From the above analysis the following conclusions may be drawn:

On the basis of a comparative study of the three systems of classification of urban functions employed here the following facts become clear:

a) The tricomponent method of classification which provides the most generalised view of urban functions, shows that tertiary functions are most frequently dominant, either singly or in association with secondary functions. Secondary function dominance is localised in two regions namely, the Hugli Industrial Belt which is the most urbanised zone of West Bengal and the recently emerging Asansol-Durgapur region. There are also a number of primary function dominant towns in the state and these are again localised in the northern part of Medinipur district.

b) The more detailed picture provided by Nelson's classification shows that a large number of towns and cities fall within the diversified category and most of them are found within the Hugli Industrial Belt. Industrial and service categories contain the next highest numbers. Of these, the first category of urban centres generally coincide with the secondary function dominant towns of the earlier classification. The tertiary function in the earlier classification however has been broken down into several functional classes such as service, commercial and transport. An
interesting feature of location of such towns is that the first two functional types are found mostly in northern and eastern parts of the state and are practically absent in the southwest. At the same time transport towns generally show a very localised distribution in the western part of Barddhaman district and northern Puruliya district. Another area of concentration of transport towns is seen in North Bengal. A similarly localised distribution is also noticeable in the case of mining towns all of which are concentrated in western Barddhaman.

c) Principal component analysis provides a more detailed picture than the classification based on the ternary diagram and at the same time provides a clearer picture of association between different functions which is lacking in Nelson's classification; as for example, the first principal component reveals that a high level of agricultural function is linked with a low level of industrial development and vice versa. It also identifies overlapping groups of functions; as for example, the second principal component groups together service, commercial and transport functions while the third component shows that the transport function is also linked with mining and construction functions.

d) On the basis of these classifications and the spatial distribution different functional types it is thus possible to conclude that there is a clear distinction between the nature of urban functions in the two most urbanised zones of West Bengal, namely, the Hugli Industrial Belt and the Asansol-Durgapur region. While industrial functions are important in both, in the former, other dominant urban functions consist of service and commerce and in the latter mining and transport are the other important functions. The former also contains a large number of diversified towns while the latter contains only one such town. Thus, urban functions in these two regions may be said to reflect the nature of urbanising processes in them since urbanisation in the former is associated with trade and commerce and establishment of light industries while in the latter urbanisation is associated with coal mining and heavy industries. Dominance of commercial and service
functions over large parts of the State indicates that outside the two major zones of urban concentration mentioned above, majority of the urban centres of West Bengal have grown up as either trade centres for surrounding rural areas or as centres of administration.

e) **Agricultural function dominance in towns** is a characteristic of economically backward areas such as parts of Medinipur and Murshidabad district. However dominance of this function is also noticeable in agriculturally prosperous but predominantly rural areas like eastern part of Barddhaman district.

f) Many of the older towns of the state show dominance of small scale industrial functions; as for example, towns of Bankura, Murshidabad and Nadia districts, thus indicating continuing importance of the traditional handicrafts with which many of these towns have been associated for a long time.

Statistical analysis shows that there is an inverse size-function relationship in the urban centres of West Bengal with respect to the broad threefold classification of urban functions. At the same time however results obtained in respect of the diversification index based on a more detailed break up of occupational categories leads us to conclude that there is no statistically significant relation between population size and functions in the urban centres of the state. Only exception to this are the medium sized towns where once again a negative size-function relationship may be seen.

A comparison of urban landuse in the cities of Asansol and Chandannagar show that while there are certain similarities as for example residential functions occupy largest proportion of area in both, there are some interesting differences as well which may be said to reflect the influence of their different historical backgrounds as well as the urbanising processes responsible for their development. The most striking of these differences is the dominance of the transport function in Asansol
where extensive area is occupied by this function. In contrast, Chandannagar which also has the G.T. Road passing through it and is connected by a railway (which however falls just outside the Corporation limits) shows no such characteristic. It is true that originally this city flourished as a trade centre but it was on the river Hugli that the settlement was entirely dependent so that the river was the most important artery of transport at that time. At present, however, road and railway systems have become important since the present residential nature of the city necessitates good transport links with Calcutta and other areas. The second point of difference that is noticeable is the location of administrative functions in the two cities. In Asansol where administrative functions are secondary to its other functions have been pushed away to the southwestern sector of the city while in Chandannagar, an important centre of administrative activities, such functions have a central location.

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