Urbanization: Definition, Data and Measurement

1.1 Background

The word urbanization is a multifaceted term and requires a clear understanding by aresearcher. The basic struggle faced by the researcher is to make distinction between the statistical problems involved in the actual measurement of urbanization in its static and dynamic senses. Thus, the present module will try to understand the problems related to various definitionsof urban area, sources of urban data as well as the measurement of urbanization (including tempo, degree, and scale of urbanization). In short, if urbanization is to be studied quantitatively and comparatively, it will be necessary to develop both the metrics which allow observation, quantification, and assessment of the process across space and through time.

Hence, for instance, attempting to develop internationally applicable measures of the level of urbanization is difficult by the diverse criteria used in national definition of urban which are currently employed by different countries. As the definition of urban area varies from country to country, and with periodic reclassification, it can also vary within one country overtime, making direct comparisons difficult. An urban area can be defined by one or more criteria in different parts of the world.It may be based on administrative or political boundaries, a threshold population size, population density, economic function, or a presence of urban characteristics (e.g. paved streets, electric lightening, sewerage etc.).Therefore, to draw the line between urban and rural can be a complex task.

To highlight the variation, urban definition of few major countries has been discussed here. To begin with, the United States Census Bureau uses criteria including a) Total population threshold b) Density c) Land use, and d) Distance. Census blocks are the building blocks for urban areas. In Census 2000, the Census Bureau expanded the classification to include two types of urban areas:

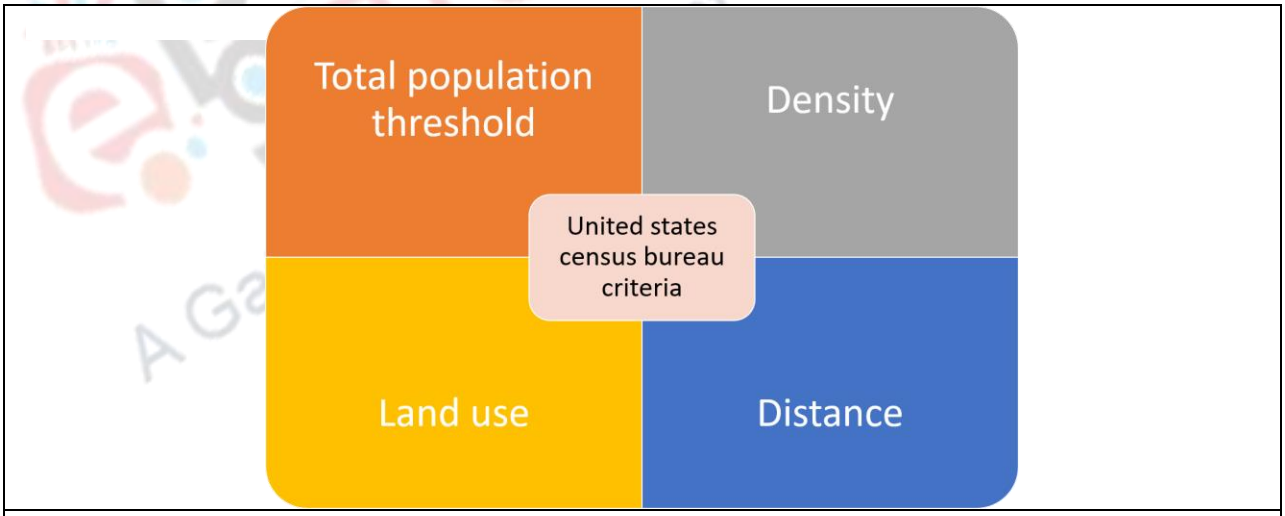

Figure 1: US Bureau criteria for urban areas

Source: Data above

a) Total population: Firstly, the Urbanized area (UA) of 50,000 or more people and secondly, the Urban Cluster (UC) of at least 2500 but less than 50,000 people. Rural encompasses all population, where housing territory is not included within the urban area.

b) Density: In order for a block to quantify as urban, it must have a density of 1000 people per square mile.

c) Land use: A block containing non-residential urban land uses can be included as urban area if it has a high amount of impervious surface, and is within a quarter mile of the urban area.

d) Distance: The Census Bureau recognizes that there are instances where urban development is not continuous, but perhaps should be included in a representation of an urban area. For example, a housing subdivision may be separated from another urban development by a large regional park, a shopping centre or other commercial development, or even a small farm. In order to accommodate these real-world instances in patterns of urban development, hop and jump criteria are applied. The hop criteria allows for areas up to half a mile along a road corridor (with multiple hops) to be included. The jump criteria allows for the inclusion of areas up to 2.5 miles, but only one jump along a road (www.census.gov0.

European countries define urbanized area on the basis of urban-type land use, where any gaps of typically more than 200 metres are not allowed. These areas also use satellite imagery instead of census blocks to determine the boundaries of the urban area.

In Australia, urban areas are referred to as urban centres and are defined as the population cluster of 10,000 or more people, with a density of at least 2000/km^2.

According to Statistic Canada, an urban area in Canada is an area with a population at least 1000 people where the density is not less than 400 persons per square kilometre. If two or more urban areas are within 2 km of each other by road, they are merged into a single urban area, provided they do not cross census metropolitan area or census agglomeration boundaries. Moreover, in the Canada 2011 Census, statistics Canada redesignated urban areas with the new term "*population centre*". The new term was chosen in order to better reflect the fact that urban vs rural is not a strict division, but rather a continuum within which several distinct settlement patterns may exist.

In the case of Census of India 2011, the definition of urban area adopts three main themes:

1) Statutory criteria: All places with a municipality, corporation, cantonment board or notified town area committee, etc.
2) Demographic criteria: All other places which satisfies the following are considered as urban:
   a) A minimum population of 5,000;
   b) At least 75% of the male main working population is engaged in non-agricultural pursuits; and
   c) A density of population of at least 400 persons per square kilometer

3) Discretionary criteria**:** Beside the major project colonies, areas of industrial development, railway colonies, and important tourist destinations are also treated as urban even though they might not fulfill the above criteria strictly.

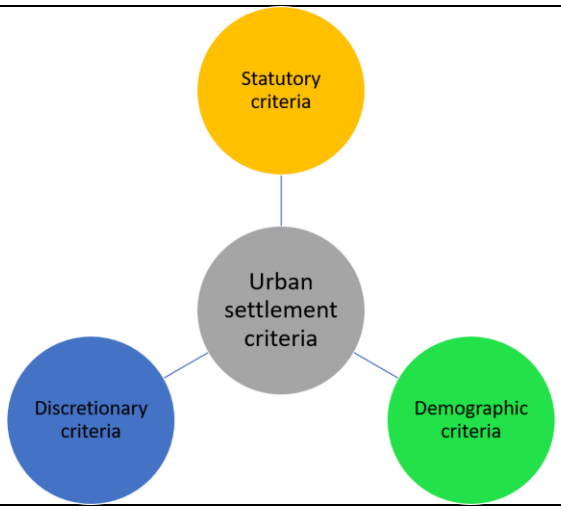

Figure 2: Main themes in India to adopt urban area

Source: Data above

In the following section, we will discuss the selected measures of demographic dimension of urbanization (the degree of urbanization, Tempo of urbanization and scale of urbanization).

1.2 Degree (or level) of Urbanization: The degree of urbanization usually refers to the absolute or relative number of people who live in urban places. Two kinds of indices have been developed for measuring the degree of urbanization: first, those based on proportion of people living in places defined as urban, and second, those relating to the absolute size of the cities of a country.

Percent of population in urban places: The percent of population in urban places has been the most commonly used index for measuring the degree of urbanization. Thus U and P represent the Urban and Total Population of a country, the percent of population in urban places is simply calculated as

$$\mathbf{PU} = {}^{\mathbf{U}}/_{\mathbf{P}} * \mathbf{100}$$

According to census 2011 of India
Total population (P) = 1210569573
Total Urban Population (U)= 377106125

$$PU = \frac{377106125}{1210569573} * 100$$

$$= 31.15$$

This index is popular because it is very easy to calculate and interpret, and also because of the relative availability of the needed data. It depicts that the higher the percentage of urban population to total population, the higher will bethe level of urbanization.

Ratio of Urban-Rural Population: The ratio of urban to rural population should be considered asit measures another aspect of urbanization process. This index is as simple as the percent of total population

urban and is closely related to it where, the proportion of population urban tells us the relative number of persons in a country. In symbols, the urban-rural population ratio may be expressed as

$$\cup \mathbf{R} = \frac{\mathbf{U}}{\mathbf{R}}$$

Where, UR is the Urban-rural ratio, and U and R are the urban and the rural populationrespectively. For example,

Urban population (2011) = 377106125

Rural Population (2011) = 833463448

$$\mathbf{UR} = \frac{377106125}{833463448}$$

$$= \mathbf{0.45}$$

This index has a lower limit of *zero* when the whole population is rural; it is *one*when 50 percent of the population is rural, thus indicating the existence of one urbanite for each rural person. This index is useful for estimating changes in urbanization process. The disadvantages of this index is that this index is also affected by changes and differences in the definition of urbanas seen in the case ofpercent urban.

Size of locality of residence of the median inhabitant: This index establishes the size of the locality where the median inhabitant lives. The concept is similar to that of median age except that this index employs the size of cities rather than age. That is, if the population of the country is ordered according to the size of the localities where people live from the largest to the smallest or vice-verse, and a rank is assigned to each inhabitant from number one to the total population number, the index would represent the size of the locality inhabited by the person occupying the middle rank.

$$\mathbf{MI} = \mathbf{Q_i} + (\mathbf{Q_{i+1}} - \mathbf{Q_i})\frac{\mathbf{50 - PPi}}{\mathbf{PP_{i+1} - PP_i}}$$

Where, PP_i is the cumulative percent of population for the locality size category just under 50 percent, $PP_{i+1}$is the cumulative percent of the next locality-size category, and Q_i and Q_{i+1} are the upper limits of the locality-size categories I and i+1, respectively. For illustrative computation of size of locality of residence of median inhabitant:

Localities size categories	**Population**	**Percent**	**Percent cumulative distribution**
Total	**37, 511, 420**	**100**	
<1000	11,347,314	30.25	30.25
1000-2499	6, 431, 444	17.15	47.40
2500-4999	3, 077, 131	8.20	55.60
5000-99,999	9, 341, 214	24.90	80.50
10,000 and over	7, 314, 317	19.50	100

MI= 2499+ (4299-2499) 50-47.40/55.60-47.40)

= 3292

While interpreting this index, it is assumed that the higher the size of median inhabitant, the higher will be the level of urbanization. Thus, index takes into account the actual size of the locality while determining the degree of urbanization. It is however, observed that the value of the index can vary over the time or between countries solely because of city size distribution. Besides, this index cannot be calculated in case of those units where the percent of population in rural areas is above 50 percent and no classification of rural localities exists (Arriaga, 1975).

Mean City Population Size: Another way to measure the degree of urbanization is to obtain an average of the size of cities where the population resides. The statistical concept of this index is the expected value of the size of the cities. According to the statistical concept of expected value, the mean city population size is expressed as

$$\mathbf{MC = E(C_i) = \varepsilon\, p_i v_i}$$

Where E (C_i) represents the expected value of the size of the cities, p_i is the probability that a randomly selected person lives in city C_i, and $v_i$is the size of the city. The probability pi is equal to the population living in the particular city Ci divided by the total population of the country p. Since the population living in a particular city is also the size of the city both the variable value and the city population are the same, and can be represented by the same symbol Ci. Therefore, since

$$\mathbf{vi = Ci \text{ and } Pi = Ci/p}$$

$$\mathbf{MC = \frac{\sum_{i=1}^{m} C_i^2}{p}}$$

Where Ci is the population of the city i, p is the total population of the country, and m is the total number of localities.

1.3 Tempo of urbanization:

The concept of tempo of urbanization refers to the change in the degree of urbanization during a period of time. If the degree of urbanization is measured by the percent of population living in urban places, the urban-rural ratio by the city size of the median inhabitant, or by the mean city size, the speed of urbanization would be the change registered in these indices over a period of time. When the degree of urbanization is measured in terms of percent urban, the tempo can be measured either as the absolute change in percentage points or as the rate of change in the percent of population urban between two dates.

Annual change of percentage points: To measure the tempo of urbanization as an absolute annual change in percentage points, we calculate

$$\mathbf{TA = 1/n\ (PU^{t+n} - PU^{t})}$$

Where TA is the tempo of urbanization, n is the number of years, and PU is the percent of population urban at the year's t and t+n.

For example:

Percent urban in India 2011=31.15
Percent Urban in India 2001=27.78

Tempo of urbanization = $\frac{1}{10}$ (31.15-27.78)

= 0.34 percent

Difference of urban and rural rates: This refers to the rate of change in the number of people living in urban localities in relation to the people living in rural areas. It can be presented under four different hypotheses concerning the changes in the ratio of urban to rural population, i.e. arithmetic or linear, geometric, exponential, and hyperbolic. But, linear and exponential are frequently used.

$$\text{Linear: } W=\frac{1}{n}\left(\frac{URt+n}{URt}-1\right)*100$$

$$\text{Exponential: } W=\frac{1}{n}*\ln\left(\frac{URt+n}{URt}-1\right)*100$$

Change in size of place of residence of the median inhabitant: If the degree of urbanization is measured by index of place of residence of the median inhabitant, the tempo of urbanization is considered the annual average rate of exponential change in that index. In symbols

$$\mathbf{TMI}=\frac{\mathbf{1}}{\mathbf{17n}}\cdot\mathbf{1n}\frac{\mathbf{MI}^{\mathbf{t+n}}}{\mathbf{MI}\mathbf{t}}$$

Change in the mean city population size: In this method, the change can be decomposed into two components: the percent of population taken as urban, and the size of the localities considered urban. Since the index of mean city population size is a result of these two products, and the products can be transformed into two addends by taking logarithm. Therefore, the contribution of each component can be easily analysed. It can be expressed in the same way as mean city population size discussed earlier in degree of urbanization.

$$\mathbf{TMC}=\frac{\mathbf{1}}{\mathbf{n}}\cdot\mathbf{ln}\frac{\mathbf{MC}^{\mathbf{t+n}}}{\mathbf{MC}^{\mathbf{t}}}$$

1.4 Scale of Urbanization:

A measure of scale of urbanization is another frequently used measurement of urbanization. It expresses two properties simultaneously: i) the distribution of the urban population among the various size classes of urban units and ii) the same distribution with the number in each size class considered as a proportion of the total population of the country. The formula for the measure of scale of urbanization is:

$$Su=\sum XY$$

Where, Su is the measure,
X is the proportion of the urban population in units above a certain size (e.g. above 4,999), and
Y is the proportion of the total population in the same units
As such, the two variables, X and Y, are mathematically independent within certain limits, e.g. if the value of X for a given size class is .99, Y could assume any value from less than .001 to .999.

The above measure of scale of urbanization has three merits. First, unlike the degree of urbanization, it considers the distribution of both the total and the urban population. Second, although the use of size classes introduces an arbitrary element (i.e. different cutting points could alter the value of measure), and makes it necessary to use the same classes for all countries, the measure can be applied to individual urban units arranged in a size hierarchy, and thereby escape any arbitrary distinction other than the minimum limit. Third, in any given case there is a fixed minimum and maximum value for the measure,

which facilities its interpretation. The minimum values approach .000 and the maximum is 1.000 (N), where N is the number of size classes.

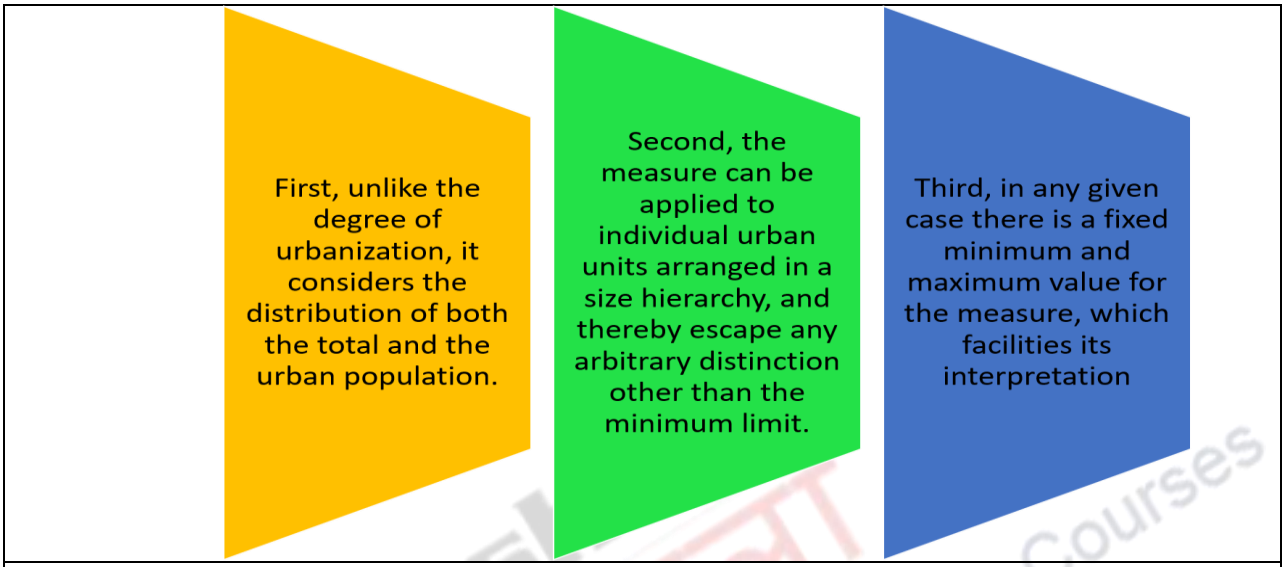

Figure 3: Merits of scale of urbanization

Source: Data above

1.5 Summing up

This module elaboarated the definition of urban as followed in several countries of the world. It may be noted that there is no uniform definition of urban, and it is left to the country to define urban. To define urban is important to count the urban population, and measure the process of urbanisation. This section presents various measurement of the process of urbanisation.

References:

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