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"DEMARCATION OF SPHERE OF URBAN INFLUENCE OF SOLAPUR CITY USING QUANITATIVE METHODS A GEOGRAPHICAL ANALYSIS"

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Abstract

Sphere of urban influence is a region of commanding influence of the city and hence its delimitation becomes a very difficult task that what criteria should be taken to delimit the zone of commanding influence. The city is influenced by its surrounding area and in turn it affects the surrounding area. The size of the city is dependent on the nature and function of the area surrounding it while the economy of the city, in turn determines the activities of the surrounding areas. Sphere of urban influence demarcated through various methods. It includes qualitative and quantitative methods. The present paper deals with the quantitative methods application on solapur city.

Keywords: *Sphere of influence, Gravity Model, Law of Retail Gravitation, Breaking point theory.*

Introduction:

A city is not an isolated feature on the urban landscape. It has intricate relationship with its surrounding area to operate as a unified functional region. A city influences its surrounding area and simultaneously it is affected by its surrounding region. Economy of the city influences the activities of the surrounding region to great extent while many of the needs of cities are fulfilled by the countryside's. Thus cities and their surroundings are interdependent and complementary to each other. However, the distance decay rule operates with regard to cities influence over the surrounding region. i.e. the influence diminishes outward from the city. After a point, the city does not exercise a dominant influence on the region. Thus the Areal extent over which a city has a dominant influence is termed as "*sphere of influence of city*". It has been alternatively called Umland (Andre Elix 1914), City Region (Harris and Dickinson1947), Urban field (Smailes1947), Hinterland, etc.

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Conceptual framework of sphere of urban influence:

The term sphere of influence describes the extent of an urban areas influence over its surrounding area. As countryside interacts depends upon the city for various physical social and economic reasons, there is a fusion of metropolitan regions, extending outward from the city.

An area over which an urban centre distributes services, (the delivery areas of shops) recruits labor, (the commuter belt) Customers (the catchments areas of schools) as well as providing that area with a sense of focus through the exercise of various forms of leadership (Publishing a weekly newspapers, possessing a local radio station, functioning as a seat of local government) one of the most important quality of sphere of urban influence is that they display a distance –decay characteristics. Urban sphere of influence is also known as ***Umland, Hinterland, Zone of influence, Catchment area, tributary area.***

Hypothesis:

Hypotheses are facts and realities that exist in the region. Hypotheses are the presupposition on which entire research work is based. The following are certain hypotheses which have been formulated for present study.

1) If goods and services increase then sphere of urban influence increases.
2) The Growth of city increases sphere of urban influence.
3) The growth of population increases, sphere of urban influence.

Objectives:

The present study has certain specific objectives, which are given below.

1) To study conceptual framework of sphere of urban influence.
2) To apply Quantitative methods for demarcation of sphere of urban influence of Solapur city.

Study Area:

The Solapur city is the district headquarters of Administrative Departments. It is located on the south east edge of the state and lies entirely in the Bhima and Sina basins. Solapur city is located on 17° 40′ North Latitude and 75°46′ East Longitude. Its maximum temperature up to

44°C and minimum temperature is 15.9 C. Annual rainfall 620.57mm. The total area of Solapur city is 178.57.Sq.km. according to Solapur Muncipal Corporation present population is 948000.

Data collection and research methodology: -

The present study covering an entire city as the study area. The analysis is purely based on quantitative data collected from Solapur Municipal Corporation. The secondary data collected from census of India, published by the directorate of economics and statistics, Government of Maharashtra.

Demarcation of sphere of urban influence: -

Sphere of urban influence is a region of commanding influence of the city and hence its delimitation becomes a very difficult task that what criteria should be taken to delimit the zone of commanding influence. It becomes more difficult in the context of constantly changing nature of interaction between city and its region. However, attempts have been made by many scholars in this regard to apply Quantitative methods for sphere of influence.

Quantitative Methods

The theoretical extent of the urban field is calculated by using quantitative methods. These are as follows.

1) **Gravity Model (1949):** - The gravity model was proposed by **Zipf** to denote spatial interaction i.e. the movement of people, goods and ideas between places within a transport system for a given period of time. This is an inductive method based on the ideas of Newton's universal law of gravitation.

Main Aim: Zipf's main aim was to predict the amount of movement between places in a given period of time.

Basic principal: it is based on the Newton's law of gravitation- that attraction of a region is proportional to the product of their mass (in this case population size) and inversely proportional to the square of the distance between them.

it can be mathematically expressed as--

$$Tij = \frac{G\_PiPj}{(dij)2}$$

Where i and j are two cities

Tij = interaction (attraction) or flow between areas i and j

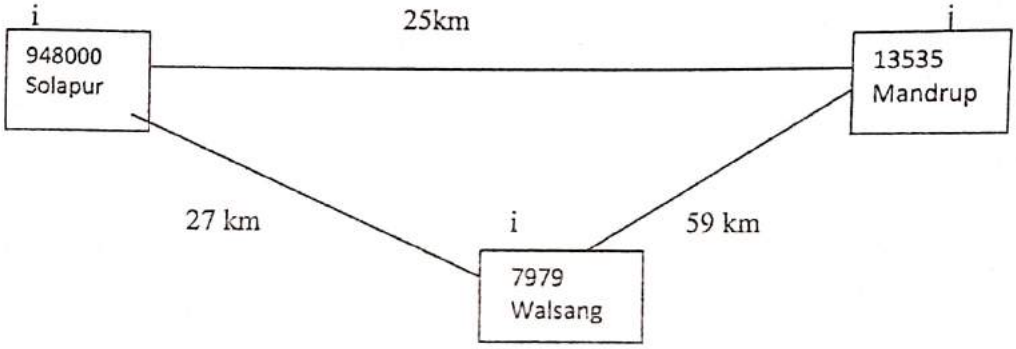
Pi & Pj = Population of the centres i and j

dij = distance between i and j centres

G = constant to be determined at calibration

b = distance exponent (measures of the frictional effect of distance and in the original gravity model value is taken 2)

Applying it to Solapur city taking with two towns' Solapur (i) and Mandrup (j) separated b 25 km.



$$Tij = \frac{948000 \times 13535}{25^2}$$

$$= \frac{12831180000}{625}$$

$$= 205298888$$

Applying to another situation, where two towns' Solapur and Walsang have a population of 948000 and 7979 separated by a distance of 27 km.

$$Tij = \frac{948000 \times 7979}{27^2}$$

$$= \frac{7564092000}{729}$$

$$= 10375983.53$$

Hence, the larger the population, the greater is the activity, and thus the greater is the attraction. Therefore, from the above formula it is proved that the centre and greater the disparity in size, the more will be the movement between them.

The model is simply portrays the volume of movement. Low level of development and unsophisticated transport development implies higher power than 2. When the exponent value is high it implies rapid decrease in movement with distance and vice versa. When it is zero there is no frictional effect of distance.

2) **The laws of retail gravitation (1931):** - This theory put forth by **W.J.Reilly**, an American economist as a modification over Zip's ideas, by this theory Reilly tried to explain the way of measuring the relative attractiveness of settlements as commercial centre's and mark the boundaries of their sphere of influence.

Reilly assumed a **breaking point** between two settlement, i.e., the point to which the shoppers prefer to travel from one settlement rather than the other.

Basic principal: - Reilly assumed that two centres attract trade from an intermediate place in direct proportion to the size (population size) of the centres and inversely proportion to the square of the instance both centres and an intermediate place. This statement can be expressed

$$\frac{Rak}{Rbk} = \frac{Pa}{Pb} \frac{dkb^2}{dka}$$

Mathematically expressed as, where a and b are two cities.

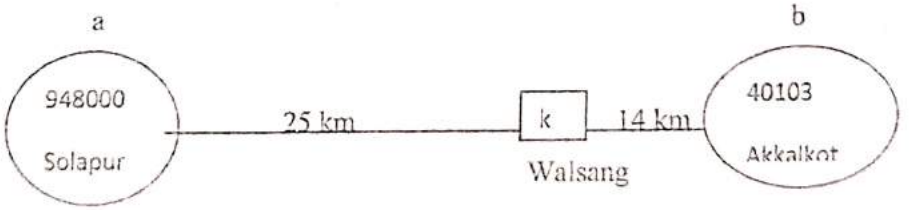
K = an intermediate place between a and b,

Rak an Rbk = volume of k trade ratio with respective cities a and b

dka and dkb = distance from k to cities a and b

Pa and Pb = Population of cities a and b

Applying it to Solapur city taking with two towns' Solapur (a) and Akkalkot (b) separated b 39 km.



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Putting the value of population of two cities **a** and **b**

$$\frac{Rak\ \ 948000}{Rbk\ \ 40103} \quad X \quad \frac{14}{25}$$

= **7.32**

On the basis it can be predicted that population of K village will patronize the services of town a is **7.32** as much as those of town b.

3) **Breaking point theory: (1949)** - In 1949, Reilly's law of Retail gravitation was modifies by **P.Converse** to predict the distance of the breaking point i.e. the intermediate point between two cities. He explained that between two towns/cities there is a point of limit up to which one city exercise the dominating retail trade influence and beyond which the other city dominates. If enough breaking points can be established around a city, its theoretical urban field can be delimited in that way. The interaction between the breaking point can be delimited by the help of following formula.

$$djk = \frac{dij}{1 + \sqrt{Pi}/\sqrt{Pj}}$$

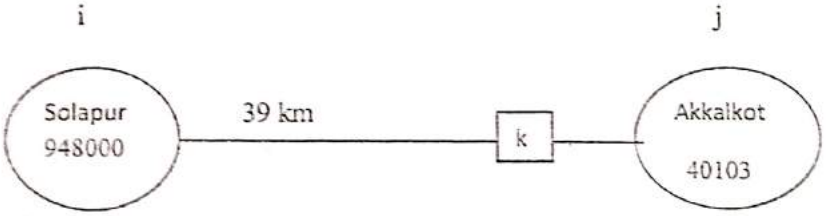
Where, i and j = two cities

K = breaking point between two cities

djk = distance from j from the breaking point k

dij = distance between i and j cities

Pi and Pj = population of i and j cities.



$$djk = \frac{39}{1 + \sqrt{\frac{948000}{40103}}}$$

= 6.65

Two towns with population of Solapur and Akkalkot respectively are located 39 km apart the breaking point will be at a distance of 6.65 km from the smaller city according to the formula. Thus the Solapur city with greater population would have a greater sphere of influence. Population can be substituted by other indicators such as the size of working population or the number of retail service outlets in each town.

Conclusion:

The present study is focused on application of quantitative methods on Solapur city for demarcation of sphere of urban influence. These models are very crude and when used for planning purpose it shows poor fit to the real ground. But these models suitable on some of the cities like Solapur. With the development of modern means of transportation, mobility between cities increases. Presently online shopping also reduces the importance of these models.

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