



## Market Concentration Analysis Through Clustering and Quadrant Method: a Case Study of Paschim Medinipur District, West Bengal

### KEYWORDS

Centrographic technique; market clustering; economic agglomeration; transformation; economic process.

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**ABSTRACT** Market clustering is one of the useful techniques for identifying economic zones of any part of the world. Gradual expansion and agglomeration of markets developed economic hubs which function as nodal centres particularly in rural areas. Every market in market clustering is interdependent upon to increase volume of trade and linkage of rural markets to urban development. Paschim Medinipur district of West Bengal, the study area consist of twenty nine CD blocks within which 76 markets have been identified for the present study where the rural markets maintain a meaningful system of economic process. Different statistical methods have been used for market clustering analysis of Paschim Medinipur such as Centrographic technique, Quadrant Analysis and Standard Distance Analysis. Study reveals six market clusters within seven blocks and distribution of market does not show normal pattern completely due to regional paradox of Paschim Medinipur.

**1. Introduction:** The existence of 'pattern' in the spatial arrangement of phenomena on the earth's surface provides a fundamental stimulus to the research mind of a geographer. Pattern implies some sort of spatial regularity, which confirms the operation of a regular causative geographical process. Point pattern analysis deals with the simplest type of spatial data, a point pattern. A spatial point pattern is simple because the data comprise only the coordinates of events at least at the most basic level (Bailey and Gatrell, 1995). Generally point pattern analysis techniques allow understanding when and where, events of a distribution are organized in the space either randomly or regularly or in cluster of different size corresponding to certain locations. Centrographic technique efficiently explains point pattern distribution which is two dimensional correlates to the basic statistical moments (Bachi, 1957; Levine, 1999). The word centroid means the geometric centre or the physical centre of mass or the centre of gravity. The centroid of an area is similar to the centre of mass of a body and related with the geometrical shape of the area. In the present study of market pattern in general, it is very much important and necessary to identify the mean market centre of the study area. The mean market centre is the locational point around which theoretically and also practically other markets cluster. The mean centre is constructed from average  $x$  and  $y$  value stored in the feature centroid.

**2. The Study Area:** Paschim Medinipur located in the southern part of West Bengal, has been carved from the erstwhile Medinipur district, the then largest district of India and came into existence in the present form from the 1<sup>st</sup> January 2002. Paschim Medinipur district is the southernmost district of the Burdwan Division, is situated between 21°36'35" and 22°57'10" North latitudes and between 86°33' 50" and 88° 12' 40" East longitudes. Its boundary lies in Bankura and Purulia districts in the north, Mayurbhanj and Balasore districts of Odisha in the south, Hugli and Purba Medinipur districts in the east and Singbhum district of Jharkhand and part of Odisha in the west. The total geographical area of Paschim Medinipur district is 9345.00 sq. km. Paschim Medinipur comprises of four sub-division and twenty nine blocks. The study includes 76 markets of Paschim Medinipur district which have been distrib-

uted in twenty nine (29) blocks with varying level of concentration (Fig No-1).

### 3. Objectives of the Study:

The major objectives of the study are the following:

- i) To study the spatial distribution pattern of markets of the district.
- ii) To identify the clusters of market centres of the study region.
- iii) To find out the correlation between the markets of various size of the cluster.
- v) To analyze the present pattern and future tendencies of the markets of the clusters.

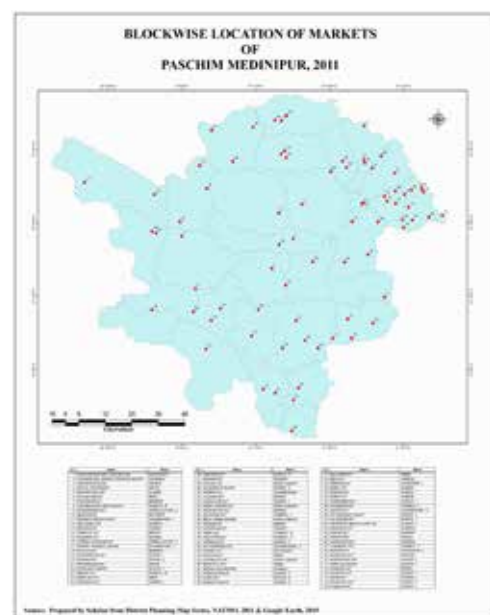


Fig No-1: Location of Markets

**4. Data and Research Methodology:** Spatial locations of the markets are identified from District planning Map series of Paschim Medinipur prepared by National Atlas and Thematic Mapping Organisation (NATMO), 2011 and Google Earth image, 2015. The major data sources are Agricultural Market Directory, Paschim Medinipur, 2011. As per Theakstone and Harrison (1971) and Das (2015) it is the centre of gravity of distribution and is analogous to the arithmetic mean of descriptive statistics and the co-ordinates of the mean centre (Xc, Yc) may be calculated. Statistically the centroid may be expressed as the following:

$$X_c = \frac{\sum(x_1.m_1 + x_2.m_2 + x_3.m_3 + \dots x_n.m_n)}{\sum(m_1 + m_2 + m_3 + \dots m_n)}$$

$$Y_c = \frac{\sum(y_1.m_1 + y_2.m_2 + y_3.m_3 + \dots y_n.m_n)}{\sum(m_1 + m_2 + m_3 + \dots m_n)}$$

Where,  
 Xc & Yc = Co-ordinates of the Centroid of mass (employee of the outlets) of the region;

X = the distance from the y-axis to the centroid;  
 Y = the distance from the x-axis to the centroid;  
 M = mass (employee of the outlets of different markets)

**For this purpose the steps are followed as:**

- i) The market centres study within the district is done considering the columns on the x-axis and rows on the y-axis.
- ii) The number of units of each column is the measured on the map scale and multiplied with the market employee. The value of Xc is found out by summing up the products of  $x_1.m_1$  and then dividing by the total number of markets. Yc is also calculated as the same process used in case of Xc.
- iii) The co-ordinate of the Centroid Xc, Yc is plotted on the map according to the scale which is divided the district into four quadrants. From this four quadrant it is easy to prepare the market cluster zone of Paschim Medinipur district.

Table No-1: Co-ordinates and Number of Employee of selected markets of Paschim Medinipur

Sl. No	Name of The Hat	No. of Employee	X (Km)	X*NE	Y(Km)	Y*NE
1	Kharagpur Market (Gol Bazar)	1100	86.63	95295.20	66.64	73304.00
2	Jhargram Rail Market Vegetable Bazar	335	50.81	17022.36	79.14	26510.23
3	Anandapur Bazar	350	98.29	34402.90	92.46	32362.05
4	Ghatal Kuthi Bazar	700	134.95	94462.20	104.96	73470.60
5	Godapiyasal Hat	70	88.30	6180.86	88.30	6180.86
6	Jalchak Bazar	550	129.95	71471.40	55.81	30696.05
7	Panchkhuri Hat	370	6.66	2465.68	78.30	28971.74
8	Chandrakona Road Bazar	285	89.13	25402.34	111.62	31812.27
9	Nadangoria Hat	200	55.81	11162.20	58.31	11662.00
10	Nilda Bazar	150	93.30	13994.40	3.33	499.80
11	Ramjiban Pur Natun Hat	240	122.45	29388.24	122.45	29388.24
12	Amlagora Hat	140	89.96	12594.96	124.95	17493.00
13	Belki Bazar	500	115.79	57893.50	46.65	23324.00
14	Chirakuti Hat	90	12.50	1124.55	99.96	8996.40
15	Dasgram Hat	580	109.96	63774.48	39.15	22707.58
16	Gopiballavpur Bazar	380	38.32	14560.84	49.98	18992.40
17	Kshirpai Municipal Market	220	122.45	26939.22	109.12	24007.06
18	Raja Bazar	295	88.30	26047.91	75.80	22361.89
19	Sagarpur Bazar	450	138.28	62225.10	95.80	43107.75
20	Sonamui Hat	450	136.61	61475.40	85.80	38609.55
21	Radhanagar Hat	350	124.95	43732.50	105.79	37026.85
22	Sarai Bazar Daily Bazar	320	82.47	26389.44	19.16	6130.88
23	Dabcha Hat	230	91.63	21074.90	112.46	25864.65
24	Debra Hat	250	114.95	28738.50	69.14	17284.75
25	Garhbeta Hat	120	92.46	11095.56	126.62	15193.92
26	Jenkapur Hat	325	94.13	30591.93	14.99	4873.05
27	Keshiari Hat	165	78.30	12919.83	39.98	6597.36
28	Khalina Hat	250	99.13	24781.75	38.32	9579.50

29	Khukurdaha Bazar	170	137.45	23365.65	82.47	14019.39
30	Kshirpai Hat	230	122.45	28163.73	108.29	24906.70
31	Lalgarh Hat	200	59.98	11995.20	98.29	19658.80
32	Lankagarh Hat	320	120.79	38651.20	92.46	29588.16
33	Narayagarh Hat	250	95.80	23948.75	45.82	11453.75
34	Pangchapur Hat	70	39.98	2798.88	95.80	6705.65
35	Sevagarh Hat	110	87.47	9621.15	124.95	13744.50
36	Belda Nonda Market	150	89.96	13494.60	35.82	5372.85
37	Dahijuri Hat	155	49.98	7746.90	84.97	13169.73
38	Daspur Bazar	110	134.11	14752.43	97.46	10720.71
39	Debra Bazar	200	91.63	18326.00	109.96	21991.20
40	Goaltore Hat	210	70.81	14869.05	109.12	22915.83
41	Gopiganj Hat	340	153.27	52112.48	87.47	29738.10
42	Jayantipur Bazar	40	114.12	4564.84	109.12	4364.92
43	Khakrit Hat	320	59.98	19192.32	34.99	11195.52
44	Khas Bazar	200	123.28	24656.80	72.47	14494.20
45	Kushbasan Hat	200	104.13	20825.00	34.99	6997.20
46	Maratala Hat	300	127.45	38234.70	84.97	25489.80
47	Nedhua Kulasari Hat	290	116.62	33819.80	39.15	11353.79
48	Ranichak Bazar	250	144.94	36235.50	98.29	24573.50
49	Turka Hat	300	95.80	28738.50	19.99	5997.60
50	Barasat Bazar	240	144.94	34786.08	96.63	23190.72
51	Baulasini Hat	100	117.45	11745.30	84.97	8496.60
52	Belia Hat	180	39.98	7197.12	80.80	14544.18
53	Benapur Hat	150	90.80	13619.55	59.98	8996.40
54	Bural Hat	240	125.78	30187.92	44.98	10795.68
55	Dadpur Hat	160	130.78	20924.96	93.30	14927.36
56	Dubra Hat	185	39.15	7242.94	80.80	14948.19
57	Harirampur Hat	300	129.95	38984.40	94.96	28488.60
58	Hoomgarh Hat	150	79.14	11870.25	122.45	18367.65
59	Jhakra Hat	200	114.95	22990.80	106.62	21324.80
60	Jot Ghanashyam Hat	280	147.44	41283.48	87.47	24490.20
61	Kalichandi Hat	235	87.47	20554.28	17.49	4110.86
62	Kesabchak Nimtala Ghat Hat	220	140.78	30970.94	97.46	21441.42
63	Kesiapada Hat	130	65.81	8554.91	50.81	6605.69
64	Khajra Hat	200	80.80	16160.20	50.81	10162.60
65	Kharar Hat	200	129.12	25823.00	110.79	22157.80
66	Kukrakhupi Hat	150	54.98	8246.70	49.98	7497.00
67	Logineary Hat	180	63.31	11395.44	121.62	21891.24
68	Madpur Hat	240	101.63	24390.24	69.14	16593.36
69	Mugbasan Hat	90	9.16	824.67	104.96	9446.22
70	Nabin Manua Hat	212	140.78	29844.72	85.80	18189.39
71	Naraole Bazar	220	121.62	26755.96	92.46	20341.86
72	Ramgarh Hat	140	57.48	8046.78	106.62	14927.36
73	Ranichak Hat	220	144.94	31887.24	98.29	21624.68
74	Rohini Hat	110	61.64	6780.62	46.65	5131.28

75	Sonakhali Hat	200	139.11	27822.20	90.80	18159.40
76	Talibhat Hat	250	134.11	33528.25	92.46	23115.75

Source: Prepared by authors

**5.1 Market Cluster Analysis:** Within the four quadrants there are different cluster size has been identified (fig no-2) and these are as follows:

- i) One large size cluster with more than ten markets.
- ii) Three medium size clusters with at least three markets each.
- iii) Two small size clusters with at least two markets each are located within it.

The clustering of markets has been done on the basis of

the nearness of the markets. In the present analysis for quantitative measure and spatial assessment of the mean centre and market clustering give a visual impression about the status of spatial leadership at micro level planning and development. The larger the size of the cluster, the maximum the attraction which leads to the growth of urbanization or the tendency towards urban market economic activities. The detail calculation has been shown in the table 2.

**Table-2 Market Clusters of Purba Medinipur based on Centroid and Co-relation analysis**

Cluster Size	No. of Cluster	Name of the Markets	Correlation	Name of the Markets	Correlation	Name of the Markets	Correlation
Large	1	Sonamui hat, Khukur-daha hat, Belda Nonda market, Nabin Manua hat, Sonakhali hat, Talibhata hat, Keshbchak Nimtala hat, Dadpur hat, Harirampur hat, Daspur hat, Ranichak hat, Barasat hat, Sagarpur hat	0.98				
Medium	3	Amlagora hat, Garbeta hat, Sevagarh hat	0.99	Chandrakona road bazar, Debcha, Debra	0.99	Radhanagar hat, Khirpai Municipality hat, Khirpai hat	0.99
Small	2	Dubra hat, Belia hat	1.00	Jyantipur bazar, Jhaktra hat	1.00		

Source: Prepared by authors

Out of the six clusters of markets five are lying in linear orientation but other one is found in isolation and situated far away from the five. Correlation value of each clusters show very high positive relation among the markets (Table no-2).

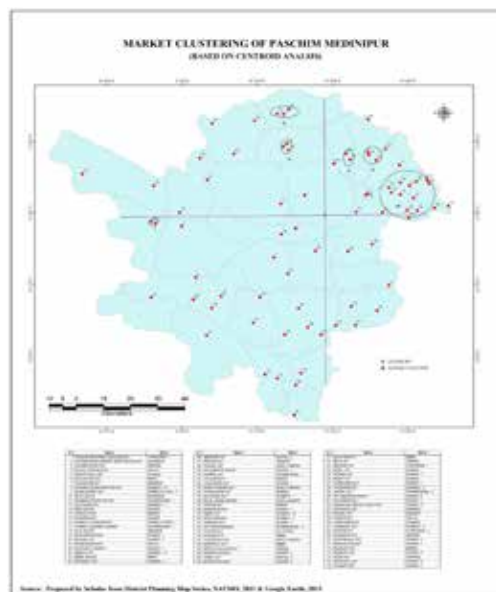


Fig No-2: Location of Market Clusters

Spatial distributions of the market clusters are portray distributional polarization of the district (figure no-2). Blockwise cluster pattern also reveal the fact of concentration of markets within few number of blocks i.e. six clusters are found in seven blocks and details are enlisted in table no-3. Cluster-I is found in Jamboni block due to poor development of the economy of the block. This area is mainly inhabitant by the backward and tribal people of the district where economic development is very poor and concentration of market centres are limited within only nodal centres of the block. For this reason agglomeration is taken place in the block head-quarter. Cluster-II has found in much closer to the urban centre where good transportation is available. Cluster-III, IV and V are found in Garbeta-I, II and Chandrakona-II blocks respectively as function of agricultural and transportation development of the regions. Having a long development history one large cluster formed within two blocks and these are Daspur-I & II. Cluster comprises thirteen markets within it. These cluster formed due to economic agglomeration in terms of agricultural development that may lead to development of urban system in near future. Though it this zone is purely rural in character but further agglomeration will create faster independency from its surrounding and emerged as economic focal centre of the district as well as of the West Bengal.

Table:3 Spatial concentration of Market Cluster of Paschim Medinipur

Zones	Name of the Markets	No. of Markets	Name of the Blocks	Name of the Sub-Division
I	Dubra hat, Belia hat	2	Jamboni	Jhargram
II	Jayantipur bazar, Jhaktra hat	2	Chandrokona-II	Ghatal
III	Amlagora, Garbeta hat, Sevaqarh hat	3	Garbeta-I	Medinipur Sadar
IV	Chandrakona road bazar, Debra hat, Debra hat	3	Garbeta-III	Ghatal
V	Radhanagar hat, Khirpai market, Khirpai hat	3	Chandrokona-I	Ghatal
VI	Sonamui hat, Khukurdaha hat, Belda Nonda market, Nabin Manua hat, Sonakhali hat, Talibhata hat, Keshbchak Nimtala hat, Dadpur hat, Harirampur hat, Daspur hat, Ranichak hat, Barasat hat, Sagarpur hat	13	Daspur-I & II	Ghatal

Source: Prepared by authors

**5.2 Quadrant Analysis:** Entire district has been divided into four quadrant based on the Xc and Yc co-ordinate of the centroid (Figure no-2). The seventy six markets are distributed within four quadrants with large amount of variability in frequency. Markets are largely found in NE and SW quadrant i.e. 35.53 percentage and 32.89 percentage respectively of total market (Table no-4). The spatial cluster of market is based on territorial divisions is also a function of the individual area and population of a market to the total of region or territorial unit. This cluster can help to develop a spatial segmentation pattern of the market. Daspur-I, Daspur-II blocks show higher level of Clustering. Higher clustering indicates highly development in agricultural production, population distribution and road network development. These markets are carter large number of population of the district and nearest market centres. Moderate clustering are found in Chandrokona-I, Chandrokona-II, Garbeta-I and Garbeta-III blocks due to agricultural development and local demand of the inhabitants helps to develop larger number of market development. Markets of SE and NW are mainly developed as because of the low variability of geographical phenomena like agricultural production, transport pattern and also the local demand of the customers.

Quadrants	No. of Markets	% of Markets	No. of Cluster
NE	27	35.53	3
SE	8	10.53	0
SW	25	32.89	1
NW	16	21.05	2
TOTAL	76	100.00	6

Source: Prepared by author

**5.3 Standard Distance Analysis:** Standard distance provides the most concise description of the spread of the points around the mean centre of the point pattern. To locate concentric circles at the centre spatial mean with standard distance as radius are drawn to identify the levels of cluster of the market within a particular ring. In nor-

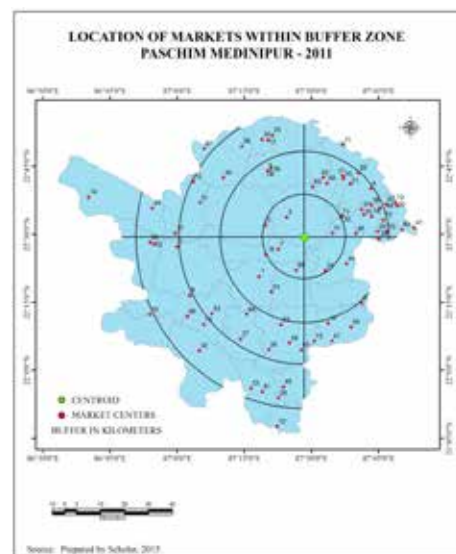
mal distribution about 68.2 percentage of the sample will lie within the inner most circle, 95.4 percentage within the intermediate circle and 99.7 percentage within the largest circle.

Table-5: Buffer zone with percentage of Market concentration

Zones	Value	No. of Markets	Percentage of Markets	Cumulative Percentage of Markets
I	Mean+1SD	7	9.21	9.21
II	Mean+2SD	26	34.21	43.42
III	Mean+3SD	26	34.21	77.63
IV	Mean+4SD	14	18.42	96.05
V	Mean+5SD	3	3.95	100
Total		76	100	-

Source: Prepared by author

In present study four concentration rings has been drawn based on mean+SD technique to find out market cluster within each buffer and five zones are constructed. Within first circle only 9.21 percentage markets are found (Table no-5) in contrast of 68.2 percentages according to hypothetical value of normal distribution. Deviation from hypothetical value is found as because of cluster concentration of market within few growth centres of the region. Markets are generally found in NE and SW quadrants and location of the centroid is lying in between two but slightly tending towards North-Eastern portion of the district. Market population distribution does not follow the normal distribution rather it is randomly distributed. Market distributions within second and third ring from the centroid are 43.92 percentages and 77.63 percentages respectively which show lesser amount of difference in comparison to first buffer. But surprisingly within the last two buffer concentration of market near about match with hypothetical value. The study reveals that regional factors like agricultural development, transport efficiency and levels of economic development play crucial role in the development of market centre. Historical background is also responsible in the concentration of the markets in the Paschim Medinipur. Major markets of the Daspur-I, Daspur-II, Ghatal, Chandrokona-I and II was act as feeder centres for nearest larger market like Panskura and Mecheda and also greater source of agri-products to the near metropolitan city, Kolkata before the division of the Medinipur district. So many small markets are yet to be include in database so that distributional pattern reveal the real picture.



Source: Prepared by Schube, 2012

**6. Major Findings:** Analysis traces out following findings:

- i) One large cluster is found with the agglomeration of 13 markets which can lead to development of urban market system. This agglomeration may lead to the larger economic hub in near future. Except this other five clusters are found with three to two numbers of markets of lesser importance. These small agglomerations are found just because of administrative advantages and to fulfil the local demands.
- ii) The markets of all clusters are positively correlated at higher degree because of their nearness in location and interdependence in trade.
- iii) Markets are mainly developed in SW and NE quadrants of the district as because of development in agricultural production and greater population pressure.
- iv) Standard distance analysis provides peculiarities in normal distribution pattern. Percentage of location of markets in first three buffers is highly deviated from hypothetical value in comparison to fourth and fifth zones.

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