Role of Road Connectivity in Socio-Economic Development of Shrirampur Tehsil of Ahmednagar District (Maharashtra)

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Abstract: *The transport is playing a vital in socio-economic development of rural areas hence the attempted has been made to find out the role of road connectivity in socio-economic development in Shrirampur tehsil. The road network map was prepared on basic of Google map; Connectivity Composite Score was calculated with the help of Beta Index and Cyclomatic Index. Here lower the CCS value, higher the connectivity and vice versa. Therefore high connectivity villages are Shrirampur(2), Taklibhan(6), Belapur Bk.(8), Haregaon(10), Padhegaon(15) and Shirasgaon(18) etc. while low connectivity found in the villages, Eklahare(107), Gurjarwadi (107), Naygaon (107), Rampur(107), and Wangi(106.5) etc. After that Socio-Economic Development Composite Score was also calculated using population density, Sex Ratio, Literacy Rate, Share of worker to total population and NSA's Rank Orders. Here lower the composite score value, higher the socio-economic development and vice versa. Therefore high socio-economic development villages are Kadit Kh (64), Narsari (81), Kadit bk (92.5), Matapur (97) and Muthewadgaon (99.5) etc. whereas low socio-econominc development found in the villages, Wangi (237.5), Bhamathan & Nipaniwadgaon (193), Kamalpur (190.5), Khokar (186.5) and Naur (183.5) etc. The correlation coefficient (r value) between road connectivity and socio-economic development is 0.01 which indicates very weak correlation between road connectivity and socio-economic development in Shrirampur tahsil.*

Keywords: Beta Index, Cyclomatic Index, Connectivity, Socio-economic Development, Correlation

1. Introduction

The transport is playing a vital role in development of any region, basically, transport network is regarded as a set of an interconnected route linking of numerous destinations within and outside the region and provide a pace for movement to people and commodities. It real sense, it serves manifold functions for regional development. The relation between transport and economic or regional development is a matter of practical as well as theoretical importance and one that has received considerable attention over many years in both advanced and developing countries. The geographer is more concerned with spatial implications of such developments and their impact upon the activities in a particular region. Geographical study of transportation and its relationship with socio-economic development is an important and developing field of research. Transport network is a set of geographic locations inter connected in a system by a number of routs (Kansky, 1963) whereas the connectivity of a network is the degree of completeness of links between nodes', (Robinson & Bamford, 1978). Some scholars has been attempted to find out correlation between connectivity and development such as Saxena H. M. (1980) had try to find out correlation of connectivity with development in all districts of Rajasthan State. Sadhana H. Bhendkar (1985) she attempted to examined road connectivity for Vidarbha in Maharashtra. R. V. Vinod et all. (2003) study transport network of roads and railways in Kasaragod taluk, Kasaragod district of Kerala and found that the coastal area is well connected with road network and the eastern hilly region has poor connectivity and accessibility. Therefore attempt has been made to study the correlation between road connectivity and socio-economic development in Shrirampur tehsil.

2. Study Area

Shrirampur Tahsil is located in the North part of Ahmednagar district of Maharashtra state and is extended between 19° 45 to 20° 30 N latitudes and 74° 00 to 74° 30 E longitudes. The total geographical area of the tahsil is 579.87sq.km which covers 54 villages. The net cultivated area in 2006–07 was 480 sq. km. About 70% of the area is irrigated by canal and dug wells, putting high pressure on groundwater resources of the Tahsil. The total population of tahsil is 2, 56,441 (Census, 2001) and almost 80 % of the workforce is engage in the agriculture, horticulture, animal husbandry and Sugar Industries. The Tahsil has a sub-tropical monsoon climate. March, April, and May are the hottest months while December and January are the coldest. The maximum temperature recorded during summers is about 44°C and it is as low as 8°C in winters. The Tahsil receives an approximate average rainfall of 550 mm and more than 75% of which occurs during the monsoon period (July–September).

3. Methodology

The present study is based on secondary data. The secondary of data was obtained from socio-economic review and district census handbook. In present study edges and nodes are calculated on tahsil map with the help computer software and road transport connectivity has calculated by two indices, i.e. Beta index and Cyclomatic index. Composite Connectivity Score calculated give with Rank Order with the help of MS Excel and maps were prepared in Arc GIS 9.3 Software.

Socio-Economic Development Score also calculated using population density, Sex Ratio, Literacy Rate, Share of worker to total population and NSA's Rank Orders in MS Excel and maps were make using Arc GIS 9.3 Software.

Finally, Correlation between Road Connectivity and Socio-Economic Development was calculated applied with Karl Person Correlation method. Suggestions made for improving road connectivity in support of sustainable Socio-Economic Development.

4. Results and Discussions

Transport is plays a vital role in socio-economic development of area, road types, mode of transports, connectivity, frequency and traffic flows etc. are key elements in transport system. Therefore attempted has been made to analysis the role of road connectivity in socio-economic development of Shrirampur tehsil. Road network was prepared with Beta Index and Cyclomatic Index. Beta Index is expressed by the relationship between the number of links (edges) over cycle has a value of 1. More complex networks have a value greater than 1 in a network with a fixed number of nodes. Complex network have a high beta index. The connectivity values obtained through Beta Index in Shrirampur tahsil varies from 2 to 6. While Cyclomatic Index is also one of the good measures of connectivity, higher the index value, higher the connectivity (Table 1).

Table 1: Village wise Rank of Connectivity of Shrirampur Tahsil

Sr. No.	Village Name	Beta Index	Cyclomatic Index	Total (CCS)	Sr. No.	Village Name	Beta Index	Cyclomatic Index	Total (CCS)
1	Ainatpur	43	45.5	**88.5**	29	Kuranpur	9.0	22.5	**31.5**
2	Belapur Bk	2.0	6	**8**	30	Ladgaon	43.0	35	**78**
3	Belapur Kh	21.5	35	**56.5**	31	Mahankal Wadgaon	30	22.5	**52.5**
4	Gondhavani	6	9	**14.5**	32	Malewadi	30	22.5	**52.5**
5	Bhamathan	22	35	**56.5**	33	Malunje Bk	43.0	22.5	**65.5**
6	Bherdapur	22	35	**56.5**	34	Malwadgaon	30	15	**45**
7	Bhokar	12.0	9	**21**	35	Mandve	30.0	15	**45**
8	Bramhangaon Vetal	43.0	52.5	**95.5**	36	Matapur	9.0	22.5	**31.5**
9	Dattanagar	43.0	52.5	**95.5**	37	Matulthan	22	35	**56.5**
10	Dighi	43.0	35	**78**	38	Muthewadgao	22	11.5	**33**
11	Ekalahare	54.0	52.5	**106.5**	39	Narsari	43	45.5	**88.5**
12	Fatyabad	43.0	35	**78**	40	Naur	22	35	**56.5**
13	Galnimb	43.0	35	**78**	41	Naygaon	54.0	52.5	**106.5**
14	Ghumandeo	21.5	35	**56.5**	42	Nimgaon Khairi	9.0	11.5	**20.5**
15	Gondegaon	13.5	15	**28.5**	43	Nipani Wadgaon	9	22.5	**31.5**
16	Govardhanpur	43.0	35	**78**	44	Padhegaon	9.0	6	**15**
17	Gurjarwadi	54.0	52.5	**106.5**	45	Rampur	54.0	52.5	**106.5**
18	Haregaon	5.5	4	**9.5**	46	Sarala	21.5	35	**56.5**
19	Jafrabad	43.0	45.5	**88.5**	47	Shirasgaon	3.0	15	**18**
20	Kadit Bk	43	45.5	**88.5**	48	Takalibhan	4.0	2	**6**
21	Kadit Kh	22	35	**56.5**	49	Ukkalgaon	43.0	22.5	**65.5**
22	Kamalpur	13.5	15	**28.5**	50	Umbargaon	30	22.5	**52.5**
23	Kanhegaon	43.0	52.5	**95.5**	51	Undirgaon	15.5	3	**18.5**
24	Karegaon	15.5	6	**21.5**	52	Wadala Mahadeo	34.0	9	**43**
25	Khanapur	30.0	22.5	**52.5**	53	Waladgaon	43.0	45.5	**88.5**
26	Khandala	22	35	**56.5**	54	Wangi	54	52.5	**106.5**
27	Khirdi	43.0	35	**78**	55	Wangi Kh	43	45.5	**88.5**
28	Khokar	30.0	22.5	**52.5**	56	Shrirampur	1.0	1	**2**

(Source: Computed by Researcher)

The levels of Socio-Economic development can be determined by different socio-economic parameters, population density, Sex Ratio, Literacy Rate, workers of Total population (%), Net Sown Area (%) etc. All the 56 villages have been ranked separately for each variable according to their levels of development. Thus every village has five rank values. The composite connectivity scores (CCS) have been computed by adding respective ranks of all socio-economic parameters (Table 2).

Table 2: Village wise rank of Socio-Economic Development

| Sr. No.	Village Name	Population Density	Sex Ratio	Literacy Rate (%)	Workers of Total Population (%)	Net Sown to Total Area (%)	Composite Scores
1	Ainatpur	3	14	27.5	53	16.5	**114.0**
2	Belapur Bk	5	12.5	17.5	51	27.0	**113.0**
3	Belapur Kh	9	37	3	41	33.5	**123.5**
4	Gondhavani	11	9	35.5	45.5	39.0	**140.0**
5	Bhamathan	51	45	45.5	20.5	31.0	**193.0**
6	Bherdapur	37	20	45.5	28	38.0	**168.5**
7	Bhokar	32	21	35.5	20.5	51.0	**160.0**
8	Bramhangaon Vetal	14	41	27.5	28	7.5	**118.0**
9	Dattanagar	2	9	4.5	49	53.0	**117.5**
10	Dighi	45	6	27.5	32	29.5	**140.0**
11	Ekalahare	6	31	53	54	4.0	**148.0**
12	Fatyabad	10	15.5	12.5	6	41.5	**85.5**
13	Galnimb	48	3	38.5	24.5	54.0	**168.0**
14	Ghumandeo	33	17.5	45.5	49	2.0	**147.0**
15	Gondegaon	21	46.5	12.5	12	11.0	**103.0**
16	Govardhanpur	55	34	45.5	4	29.5	**168.0**
17	Gurjarwadi	25	27	56	24.5	27.0	**159.5**
18	Haregaon	46	3	35.5	38	55.0	**177.5**
19	Jafrabad	47	22	55	38	9.5	**171.5**
20	Kadit Bk	13	49	22	3	5.5	**92.5**
21	Kadit Kh	39	15.5	7.5	1	1.0	**64.0**
22	Kamalpur	52.5	56	7.5	56	18.5	**190.5**
23	Kanhegaon	31	24	22	41	16.5	**134.5**
24	Karegaon	36	28	35.5	12	48.5	**160.0**
25	Khanapur	43	41	42	9.5	7.5	**143.0**
26	Khandala	24	7	35.5	17	27.0	**110.5**
27	Khirdi	15	51.5	50.5	9.5	14.5	**141.0**
28	Khokar	30	41	35.5	35	45.0	**186.5**
29	Kuranpur	19	48	12.5	14.5	14.5	**108.5**
30	Ladgaon	40.5	50	22	30	33.5	**176.0**
31	Mahankal Wadgaon	52.5	51.5	42	6	24.5	**176.5**
32	Malewadi	23	26	38.5	12	21.0	**120.5**
33	Malunje Bk	18	1	50.5	20.5	22.0	**112.0**
34	Malwadgaon	28	5	27.5	38	32.0	**130.5**
35	Mandve	27	29	7.5	35	18.5	**117.0**
36	Matapur	8	46.5	12.5	24.5	5.5	**97.0**
37	Matulthan	50	53	48	6	12.0	**169.0**
38	Muthewadgaon	17	32.5	12.5	24.5	13.0	**99.5**
39	Narsari	29	32.5	2	8	9.5	**81.0**
40	Naur	38	35	42	32	36.5	**183.5**
41	Naygaon	54	19	38.5	17	44.0	**172.5**
42	Nimgaon Khairi	34	11	7.5	20.5	47.0	**120.0**
43	Nipani Wadgaon	4	55	50.5	35	48.5	**193.0**
44	Padhegaon	12	12.5	22	45.5	40.0	**132.0**
45	Rampur	40.5	23	50.5	32	3.0	**149.0**
46	Sarala	56	44	12.5	2	43.0	**157.5**
47	Shirasgaon	7	9	1	55	46.0	**118.0**
48	Takalibhan	26	25	27.5	28	52.0	**158.5**
49	Ukkalgaon	35	30	17.5	17	50.0	**149.5**
50	Umbargaon	20	43	27.5	41	24.5	**156.0**
51	Undirgaon	16	3	17.5	52	35.0	**123.5**
52	Wadala Mahadeo	22	37	4.5	45.5	41.5	**150.5**
53	Waladgaon	42	39	22	45.5	20.0	**168.5**
54	Wangi	44	54	54	49	36.5	**237.5**
55	Wangi Kh	49	37	38.5	14.5	23.0	**162.0**
56	Shrirampur	1	17.5	17.5	43	56.0	**135.0**

(Source: Computed by Researcher)
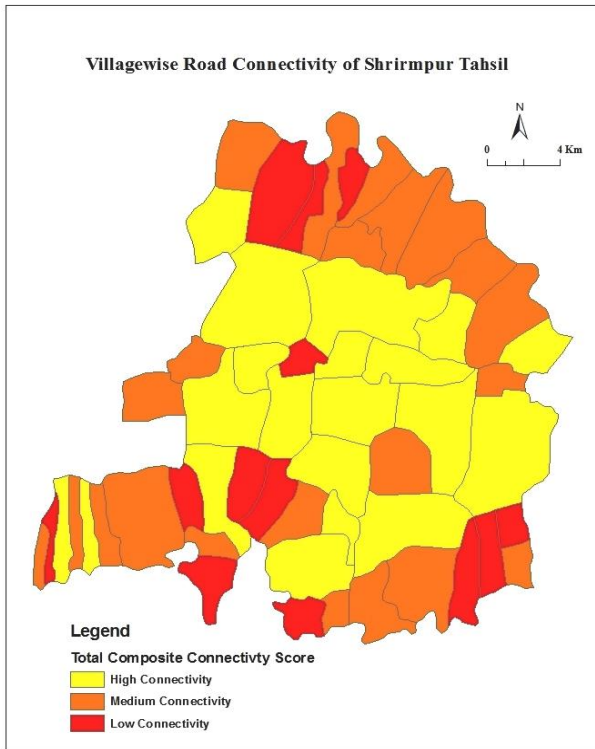
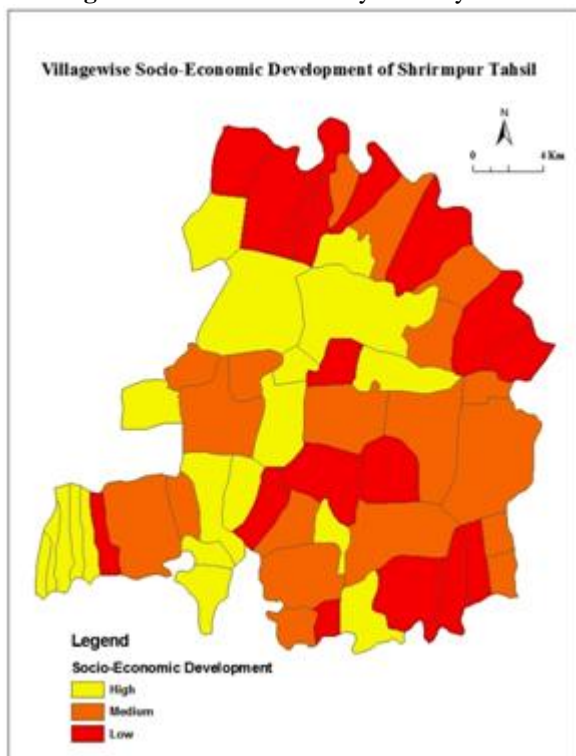**Figure 1:** Road Connectivity in Study Area

Figure 2: Socio-Economic Development in Study Area

Composite Connectivity Score

The composite connectivity scores (CCS) have been computed by adding respective ranks of Beta and Cyclomatic number. On the basis of CCS, Shrirampur tahsil has been divided into three categories of high, medium and low connectivity. Here lower the CCS value, higher the connectivity and vice versa. Therefore high connectivity villages are Shrirampur(2), Taklibhan(6), Belapur Bk.(8), Haregaon(10), Padhegaon(15), Shirasgaon(18), Bhokar (21), Nimgaon Khairi(21) while While low connectivity found in

the villages, Eklahare(107), Bramhangaon Vetal(95.5), Wangi(106.5), Kanhegaon(95.5), Gurjarwadi(107), Naygaon(107), Jafrabad(89), Ladgaon(78), Rampur(107), because most of the villages are away from the central place (Fig.1).

Socio-Economic Development Composite Score

In order to facilitate analysis, three categories of high, medium and low economic development have been determined on the basis of composite scores by adding population density, sex ratio, literacy rate, workers of total population (%) and net sown to total area (%). Here lower the composite score value, higher the socio-economic development and viceversa. Therefore high socio-economic development villages are Kadit Kh (64), Narsari (81), Kadit bk(92.5), Matapur (97), Muthewadgaon(99.5), Ainatpur, Bramhangaon vetal, Dattanagar, Fatyabad, Gondegaon, Khandala, Kuranpur, Malewadi, Malunje, Mandve, Nimgaon Khairi, Shirasgaon etc. while low socio-econominc development found in the villages, Wangi (237.5), Bhamathan & Nipaniwadgaon (193), Kamalpur (190.5), Khokar (186.5), Naur (183.5), Matulthan, Naygaon, Jafrabad, Govardhanpur, Mahankalwadgaon etc. and medium connectivity villages including Shrirampur, Dighi, Rampur, Sarala, Khanapur, Ghumandeo, Taklibhan, Bhokar, Wadalamahadev, Karegaon etc. (fig.2).

Correlation Analysis

The correlation co-efficient has been computed between Road connectivity and socio-economic development on the basis of the Karl Pearson's correlation co-efficient (r) method which is as follows:

$$r = \frac{n(\Sigma xy) - (\Sigma x)(\Sigma y)}{\sqrt{\left(n(\Sigma x^2) - (\Sigma x)^2\right)\left(n \times (\Sigma y^2) - (\Sigma y)^2\right)}}$$

Where,
r = is the co-efficient of correlation.
x, y = are the two given variables.
n = is the number of observations.

The rank correlation coefficient between levels of development and degrees of connectivity is 0.11.
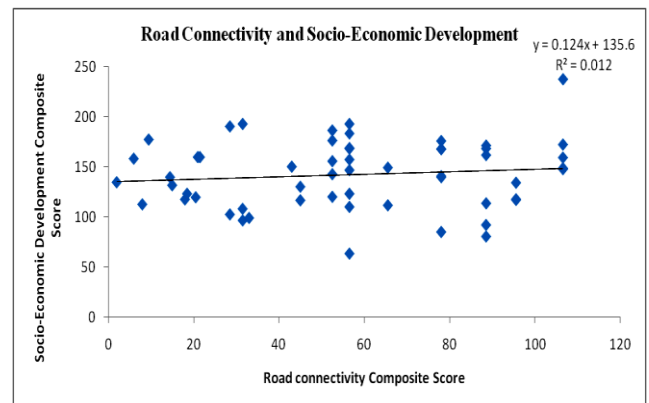

Figure 3: Road Connectivity and Socio-Economic Development in Shrirampur Tahsil

The Karl Pearson's correlation coefficient (r value) is 0.01, which is statistically insignificant. This means that the factors governing the development of road connectivity are not related to the factors governing the regional pattern of economic development. Therefore there is very weak correlation between road connectivity and socio-economic development in Shrirampur tahsil (Fig.3).

5. Conclusions

Data has been analyzed regarding Road Connectivity and Socio-Economic factors. Composite Connectivity Scores (CCS) has been computed by adding respective ranks of beta and Cyclomatic number. On the basis of CCS, Shrirampur has been divided into three categories of high, medium and low connectivity. Here lower the CCS value, higher the connectivity and vice versa. Therefore high connectivity villages are Shrirampur(2), Taklibhan(6), Belapur Bk.(8), Haregaon(10), Padhegaon(15), Shirasgaon(18), Bhokar (21), Nimgaon Khairi(21) while While low connectivity found in the villages, Eklahare(107), Bramhangaon Vetal(95.5), Wangi(106.5), Kanhegaon(95.5), Gurjarwadi(107), Naygaon(107), Jafrabad(89), Ladgaon(78), Rampur(107), because most of the villages are away from the central place.

In order to facilitate analysis, three categories of high, medium and low Socio-Economic development have been determined on the basis of composite scores. On the basis of Composite Score Here lower the composite score value, higher the socio-economic development and viceversa. Therefore high socio-economic development villages are Kadit Kh (64), Narsari (81), Kadit bk(92.5), Matapur (97), Muthewadgaon(99.5), Ainatpur, Bramhangaon vetal, Dattanagar, Fatyabad, Gondegaon, Khandala, Kuranpur, Malewadi, Malunje, Mandve, Nimgaon Khairi, Shirasgaon etc. while low socio-economin development found in the villages, Wangi (237.5), Bhamathan & Nipaniwadgaon (193), Kamalpur (190.5), Khokar (186.5), Naur (183.5), Matulthan, Naygaon, Jafrabad, Govardhanpur, Mahankalwadgaon etc. Shrirampur city has been found medium Socio-Economic development.

Correlation between Composite Connectivity Score (CCS) and Socio-Economic Development Score has been analyzed by Karl Person's Correlation method. The Karl Pearson's correlation coefficient (r value) is only 0.01, which is showing very weak correlation between road connectivity and socio-economic development in Shrirampur tahsil.

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