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STATISTICAL APPRAISAL OF URBAN GROWTH IN BARMER DISTRICT (RAJASTHAN)

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ABSTRACT

The path coefficient and multiple regression analyses revealed percentage literacy and population, followed by percentage of non-agricultural workers, as the crucial variables for urbanization in Barmer district. Step-up regression analysis determined the major contributors to urbanization as percentage literacy, followed by population, percentage of non-agricultural workers, population density and infrastructure facilities. The high values of coefficient of determination ($R^2 = 55.77\%$) implied that the estimated regression equations could safely be used for planned growth of urbanization in arid areas.

INTRODUCTION

Urban growth in arid regions of the country is not high as compared to their counterparts humid and sub-humid areas. Lack of infrastructure facilities and poor resource base, apart from frequent occurrence of natural calamities, are the major impediments for urban growth in arid regions. As a result of increase in population pressure, new emergent potential urban centres help urbanization. However, there is little understanding of urbanization process in arid regions.

Mulay and Ray (1973) and Gupta and Purohit (1980) considered five distinct variables for the determination of urbanization. The existing knowledge about inter-relationship amongst these variables vis-a-vis extent of urbanization, is quite inadequate. The present study was undertaken to investigate the correlations and magnitude of direct and indirect effects of variables responsible to urban growth. The relative contributions of each of the selected variables, individually and jointly, towards urbanization were also measured.

MATERIAL AND METHODS

The arid district of Barmer envisages 855 villages (Anon 1981). Five per cent of these villages were selected by systematic sampling technique. The data from the District Census Hand Book, 1971 were compiled for population (X_1), distance (km) from towns (X_2), accessibility index (X_3), density of population (X_4), per cent literacy (X_5), percentage of non-agricultural workers (X_6), infrastructure index (X_7) and total scores of urbanization (Y).

Measures of central and dispersal tendencies were worked out across the sample villages. Path coefficient analysis was carried out following Dewey and Lu (1959). To quantify the relative contribution of variables in explaining the variance in total scores, a step-up-wise regression programme was run (Snedecor and Cochran, 1968). Since selections of the entry of variables by coefficient of determination is arbitrary (Rao and Miller, 1972), another summary statistics $\overline{R}^2$ was computed for the result generated by ordinary step-up-wise regression programme. The relative importance of the variables under consideration was similarly worked out by employing 'F' test. Hypotheses formulated for empirical testing were :

1. The extent of urbanization is higher with dense population, per cent literacy, and per cent non-agricultural workers.

2. The long distances from town and higher accessibility index retard urban growth.

RESULTS AND DISCUSSION

Population, followed by accessibility index, distance from town, infrastructure index, density of population, percentage of non-agricultural workers, total score and per cent literacy had the maximum range of variability. The coefficient of variation was highest for percentage of non-agricultural workers and lowest for total scores. Correlation coefficients between all the pairs of selected varibles are presented in Table 1. Out of the seven variables studied, percentage literacy, population, percentage of non-agriculture workers, infrastructure index and density of population were significantly and positively correlated with urbanization, whereas accessibility index and distance from town showed negative significant correlations. This supports the hypothesis (2). The direct and indirect effects of the selected variables on urbanization are italicised in Table 2. Evidently, population (X_1), percentage literacy (X_5), percentage of non-agriculture workers (X_6), density of population (X_4) and infrastructure index (X_7) has more direct effect on urbanization. Variables like distance from town and accessibility index, on the other hand, revealed negative direct effects. Path coefficients when considered in relation to correlation coefficient indicated that population, having significantly positive correlation with urbanization, does contribute directly and also indirectly via percentage literacy, accessibility index, density and infrastructure index. Similarly percentage literacy also indicated high direct effect on urbanization. Population and percentage literacy thus appear to be the most important variables for urban growth.

By step-up regression analysis, per cent literacy (X_5) explained the highest urban growth, followed by population (X_1), percent of non-agricultural workers (X_6), density of population (X_4) and infrastructure index (X_7). Based on the ratio of error variance and total variance, R^{-2} was significantly reduced by the population density in the model suggesting that analysis beyond the fifth step is not useful (Table 3).

Table 1. Correlation coefficient matrix between social indicators and urbanization

Variable	X^1	X^2	X^3	X^4	X^5	X^6	X^7	Y
Population (X_1)	1.0000	-0.1439	-0.1843	0.4197**	0.2792	-0.1202	0.4763**	0.5625**
Distance from towns (X_2)	-0.1439	1.0000	0.9637**	0.0311	-0.4269**	-0.2317	-0.0850	-0.5442**
Accessibility index (X_3)	-0.1843	0.9637**	1.0000	0.0146	-0.4219**	-0.1801	-0.1440	-0.5605**
Density of population(X_4)	0.4198**	0.0301	0.0146	1.0000	0.1176	0.1381	0.1863	0.3443*
Percentage literacy (X_5)	0.2792	-0.4269**	-0.4219**	0.1176	1.0000	0.3888**	0.1600	0.7494**
Percentage of non-agricultural workers (X_6)	-0.1202	-0.2317	-0.1801	0.1381	0.3888*	1.0000	0.0023	0.3836*
Infrastructure index (X_7)	0.4763**	-0.0850	-0.1440	0.1863	0.1600	-0.0023	1.0000	0.3726*

**Significant at P = 0.01 *Significant at P = 0.05

Table 2. Direct (diagonal, italicized figures) and indirect effects of selected variables (X_1 .....X_7) on urbanization

Variable	X^1	X^2	X^3	X^4	X^5	X^6	X^7	Y
Population (X_1)	*0.31638*	0.00394	0.04480	0.05094	0.12497	-0.02175	0.04322	0.56249**
Distanee from towns (X_2)	-0.04553	*-0.02736*	-0.23426	0.00365	-0.19108	-0.04192	-0.00772	-0.54420**
Accessibility index (X_3)	-0.05531	-0.2637	*-0.21309*	0.00177	-0.18888	-0.03258	-0.01307	-0.56052**
Density of Populatinn (X_4)	0.13280	-0.00082	-0.00354	*0.12135*	0.05266	0.02498	0.01690	0.34433*
Percentage literacy (X_5)	0.08832	0.01168	0.10257	0.01428	*0.44764*	0.07035	0.01452	0.74395**
Percentage of non-agricultural workers (X_6)	-0.03803	0.00634	0.04377	0.01675	0.17404	*0.18094*	0.00027	0.38360*
Infrastructure Index (X_7)	0.15068	0.00233	0.03501	0.02260	0.07161	-0.00041	*0.09074*	0.37257*

Residual effect : 0.43641

**Significant at P = 0.01 *Significant at P = 0.05

Table 3. Step-up-wise regressions equation for relative contribution of selected variables (X_1.....X_7) on urbanization

Step	Regression equations	$\bar{R}^2$	R^2	F value
I	$Y = 12.9919 + 0.8366X_5$ (0.1155)	0.5508	0.6739	50.27**
II	$Y = 11.7571 + 0.0024X_1 - 0.7172X_5$ (0.006) (0.1012)	0.6817	0.7211	16.45**
III	$Y = 14.8428 + 0.0024X_1 - 0.0378X_3 + 0.5940X_5$ (0.0005) (0.0126) (0.1012)	0.7344	0.7334	7.74**
IV	$Y = 14.5035 + 0.0027X_1 - 0.0352X_3 + 0.4977X_5 + 0.0991X_6$ (0.0005) (0.0120) (0.1072) (0.0411)	0.7639	0.7488	4.75**
V	$Y = 13.9856 + 0.0023X_1 - 0.0375X_3 + 0.0357X_4 + 0.505X_5 + 0.0846X_6$ (0.0006) (0.0119) (0.0251) (0.1060) (0.0416)	0.7700	0.5508	5.73**
VI	$Y = 13.7759 + 0.0020X_1 - 0.0375X_3 + 0.066X_4 + 0.5052X_5 + 0.0815X_6 + 0.0223X_7$ (0.0006) (0.0118) (0.0249) (0.1053) (0.0164) (0.0179)	0.7733	0.7457	0.52
VII	$Y = 13.6098 + 0.0020X_1 - 0.0032X_3 - 0.0084X_3 + 0.0361X_4 + 0.4997X_5 + 0.0875X_6 + 0.0194X_7$ (0.0006) (0.0518) (0.0124) (0.0253) (0.1121) (0.0524) (0.0183)	0.7715	0.7427	0.28

** Significant at P = 0.01 * Significant at P = 0.05

Figures in parentheses are standard errors for each coefficient.

The value of incremental coefficient of determination and its consequent F-test revealed per cent literacy to have the highest contribution, followed by population, distance from town, percentage of non-agricultural workers and population density. Accessibility and infrastructure indices, however, were of no significance. The multiple regression equations are reliable predictors of urban growth since the variables in question cover 55.77% of variability in urban growth.

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