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Population and Development
Morphology of Villages in
India

Aalok Ranjan Chaurasia

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POPULATION AND DEVELOPMENT MORPHOLOGY OF VILLAGES IN INDIA

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ABSTRACT

This paper uses data from India's 2011 population census to analyse population and development morphology of villages in India. The village population and development situation is captured through a composite population and development index. The analysis suggests that the villages in India can be grouped into eight clusters having distinct population and development morphology. The analysis also suggests that the population and development scenario in the village is strongly influenced by the village population structure characterised in terms of gender balance and social class composition of the village population. The analysis also suggests that while demographic transition is linked with the level of literacy in the village, it has no link with level of participation in productive activities at the village level. The paper emphasises the need of a spatial approach to population and development planning and programming with the village as the basic planning and implementation unit.

INTRODUCTION

The aim of this paper is to analyse the population and development morphology of villages in India. Population and development morphology may be defined on the lines of social morphology which is the study of forms and structures of the society (Durkheim, 1982). According to Davis (1955), social morphology can be developed in terms of 'structure', 'process' and 'stage' of any social phenomenon. Accordingly, population and development morphology may be described in terms of 'structure' or composition of the population, 'state' of development and 'stage' demographic transition. The structure of the population is essentially a sociological perspective; the state of development may be perceived as an economic perspective; and the stage of demographic transition is nothing but the demographic perspective. In order to describe the population and development morphology in the villages of India, the three components of population and development landscape need to be connected by assembling them under one rubric so as to evolve an integrated population and development perspective at the village level. We construct a composite population and development index for this purpose and use this index to analyse population and development morphology in the villages of the country. Finally, we attempt to compose an explanatory model that delineates patterns of population and development landscape across the villages of the country.

An analysis of population and development morphology in villages matters for India as almost 70 per cent of India's population lives in the rural areas which are organised into villages according to the 2011 population census. At the 2011 population census, there were more than 640 thousand villages of varying population size were identified in the country (Government of India, 2011). Villages in India have always been an integral part of the agricultural, industrial and commercial landscape of the country. People living in villages are conditioned by a very diverse and heterogeneous set of social, religious, cultural, natural and economic environmental factors that shapes their productive capabilities and decides their participation in the social and economic production system. Obviously, India's population and development landscape is defined to a significant extent by the population and development landscape of villages in India.

Another reason to analyse the population and development morphology in villages of India is the recent shift in the official approach towards well-being and welfare of the rural people from rural development to village development. A number of schemes have recently been launched in the country and in its constituent states to set the trend in this direction and there are efforts to mainstream this trend in the development policies and programmes of the country. Rural development in India has traditionally followed the sectoral approach in which government development policies and programmes are conceived and organised along different development sectors with little or limited integration among them. The village development approach, on the other hand, is essentially a spatial approach that addresses village specific population and development issues and concerns in an integrated manner. The shift to village development approach, therefore, requires characterisation of the village population and development situation and analysing how the population and development scenario varies across the villages of the country.

At present, very little is known about the distinguishing features of population and development scenario in Indian villages. Indian villages have been studied extensively through sociological and anthropological perspectives since the colonial period. These studies have however been focussed primarily on the structure of the village, especially, in the context of social class (Beteille, 1969). The underlying argument of these studies is that social class or caste made the village a social reality in India. (Srinivas, 1952; Bailey, 1957, 1963; Beteille, 1965; Kessinger, 1971; Shah, 1973; Chakravarty, 1975). Village, in these studies, has also been a suitable locale for the study of peasant society and culture (Redfield, 1955). However, the village, as a population and development entity, has rarely been paid the attention in either the development discourse or in the demographic research in India. This is so when issues of national development have been closely identified with the upliftment of villages even before the independence (Gandhi, 1944; Nehru, 1961) and projection of the village as a template for nation building after independence (Thakur, 2014). There are some studies that have attempted to analyse the relationship of village characteristics with the use of maternal and child health services (Ghosh and Singh, 2004; McNay, 2002; Stephenson and Tsui, 2002). In a recent study, it has been observed that

the size of the village population matters as far as the state of development in the village is concerned and the large villages are relatively better developed than the small or medium size villages in India (Singh, Chakraborty and Roy, 2008). The study, however, considers only the size of the village population in exploring the village population and development morphology. It does not take into consideration other dimensions of village level population and development landscape.

An analysis of the village population and development morphology also contributes to the long and enduring but inconclusive debate on population and development interrelationships. The complexity of this relationship is well reflected in frequent oscillations in the scientific wisdom about macroeconomic consequences of population growth. Three alternative positions define these oscillations: population growth either restricts or promotes or is independent of economic growth (Bloom, Canning and Sevilla, 2001). These studies have followed a typical population and development morphology characterised by countries as structures; gross domestic product reflecting the state of development in the country and fertility decline as the indicator of demographic transition. There are some studies that have attempted to explore population and development relationship at micro - household - level (Sinding, 2009) but there is no study that has studied population and development morphology at meso - village - level. This paper develops and employs a comprehensive framework to take into account the three dimensions of population and development morphology at the village level in an integrated manner.

The paper is organised as follows. The next section discusses the concept of the village as adopted in the Indian population census. The village is essentially an administrative unit rather than a human settlement in the Indian population census and may comprise of more than one human settlements of varying population size. Section three describes the data source and the indicators used to characterise population structure, state of development and stage of demographic transition in the village. The fourth section analyses the variation in population structure, state of development and demographic transition across villages of the country. Village population and development morphology is analysed in the fifth section while the last section summarises the findings and discusses their policy implications.

VILLAGE IN THE INDIAN POPULATION CENSUS

The concept of the village followed in the Indian population census is different from the conventional concept of the village as a human settlement. A village is conventionally defined as a human settlement which is larger than a hamlet and smaller than a town - a hamlet has a tiny population less than 100 (Doxiadis, 1968). The Indian population census, however, defines the village as an administrative unit rather than a human settlement. For the purpose of population enumeration, the entire geographical area of the country is first divided into urban and rural areas. Urban areas are defined according to a clearly articulated definition with clearly defined administrative boundaries. Population living in the urban areas is classified as the urban population while the rest of the population is classified as the rural population and is organised into administrative areas following the administrative boundaries of revenue villages (Government of India, 2011a). These administrative areas are termed as villages in the Indian population census. A village, defined in this manner, is not a human settlement but the lowest level administrative unit having well-defined administrative boundaries. There may be more than one human settlement in a village. The population of this administrative unit is the number of persons enumerated in all human settlements within the administrative boundaries of the village on the day of the census. This definition implies that a village in India can have only one human settlement within its administrative boundaries or may have more than one human settlement or no human settlement at all. If there is no human settlement within the administrative boundaries of the village then the population of the village is zero and the village is christened as the uninhabited village. On the other hand, if there is more than one human settlement within the administrative boundaries of the village then the population of all human settlements within the village is added to obtain the village population. Moreover, no attention is paid to the permanent or the temporary nature of human settlements in the Indian population census. A village, as defined in the Indian population census may therefore be perceived as the lowest level administrative unit rather than a human settlement. There is however little information available about population and development situation in human settlements in the rural areas of the country.

The definition of the village adopted in the Indian population census has implications for analysing population and development morphology at the local level as the population and development situation - population structure, state of development and stage of demographic transition - of different human settlements within the same administrative unit (village) may be different.

According to the 2011 population census, there were 640949 villages of varying population size in the country out of which 43330 (6.8 per cent) villages were uninhabited. The population of the remaining 597619 (93.2 per cent) inhabited villages ranged from 1 to 66062 at the time of the 2011 population census. More specifically, there were 40958 (6.4 per cent) villages which had a population less than 100. These villages are essentially hamlets according to the settlement hierarchy proposed by Doxiadis (1968). On the other hand, there were 22905 villages which had a population of at least 5000 at the time of 2011 population census. These villages could not be classified as an urban area as they did not conform fully to the definition of the urban area adopted at the 2011 population census.

DATA AND INDICATORS

The analysis is based on the data available through the primary census abstract of India's 2011 population census (PCA 2011) which is the only source of village level population and development data in India. The PCA 2011 provides data about the total number of households; total population; population below 7 years of age along with the social class composition of the population for every village of the country as identified at the time of the 2011 population census. PCA 2011 also provides data about the educational and work status of the population. Workers are classified into main and marginal workers. Main workers are those workers who have worked at least six months during the year prior to the census. All other workers are classified as marginal workers. A worker, either main or marginal, is further classified into one of the four occupational categories - cultivator; agricultural labourer; household industry worker and other worker (Government of India, 2011).

Describing the village population and development morphology requires characterisation of village population structure, state of

development in the village and stage of demographic transition. We measure population structure in terms of the gender balance and the social class composition of the village population. On the other hand, the state of development is measured in terms of the participation of the village people in productive activities and in terms of the level of education. Although, the interaction between productive participation, education, disposable income, welfare expenditure and income inequality is quite complex and multi-directional, yet, it is well known that non-participation in productive activities reduces disposable income and increases income inequality. A high level of non-participation in productive activities is also associated with high crime rate, violence and social unrest. Non-participation in productive activities also reflects waste of human resources. Lastly, the stage of demographic transition is measured in terms of the age composition of the population as the linkages between the demographic transition and the transition in the population age composition is well-known. At the early stages of demographic transition, the population remains young with the age pyramid typically triangular in shape with broad base and thin top. As demographic transition progresses, the population gets older and the shape of the population pyramid changes from a triangular one to a rectangular one.

The data available through PCA 2011 permit estimation of the following eight indicators for every village of the country to characterise population structure, describe the state of development and classify the stage of demographic transition:

- 1.1 *Population sex ratio (PSR)*. The ratio of the number of males to the number of females. This ratio reflects the gender balance of the village population. The lower is this ratio, the gender balance is favourable more to females in the population and vice versa.
- 1.2 *Proportion Scheduled Castes (PSC)*. The ratio of the Scheduled Castes population to the total population of the village. Scheduled Castes constitute the disadvantaged population group in the Indian society and are recognised by the Indian Constitution.
- 1.3 *Proportion Scheduled Tribes (PST)*. The ratio of Scheduled Tribes to the total population of the village. Like Scheduled Castes, Scheduled Tribes also constitute the marginalised population group in the Indian society. The proportion of Scheduled Castes

and the proportion of Scheduled Tribes reflect the social class composition of the population.

- 2.1 *Illiteracy rate (ILT)*. The proportion of population aged 7 years and above who are not able to read and write with understanding. It is obvious that the higher is the illiteracy rate, the poorer is the level of education in the population. This indicator is complimentary to the effective literacy rate which is the commonly used indicator of the educational status of the population.
- 2.2 *Proportion of non-workers (NWR)*. Work, in the Indian population census 2011, is defined as participation in any economically productive activity with or without compensation, wages or profit (Government of India, 2011). Participation may be physical and/or mental. Work involves not only the actual work but also supervision and direction. Part time help or unpaid work on farm or family enterprise or in any other economic activity has also been classified as work. Persons who are not engaged in any type of work are classified as non-workers. This indicator reflects the extent of participation in the productive activities at the village level. The higher is this ratio, the lower is the level of participation in the productive activities and vice-versa.
- 2.3 *Proportion of marginal workers to total workers (MAR)*. This ratio reflects the opportunities of full participation available at the village level. The higher is this proportion, the lower is the opportunities of full participation in the village level productive activities. This proportion also reflects the casualisation in village level productive opportunities.
- 3.1 *Proportion of population aged 0-6 years (ASI)*. This ratio reflects the age structure of the population. The higher is this ratio, the younger is the population. In this way, this ratio gives an idea about the stage of transition in the population. The higher is this ratio, the earlier is the stage of demographic transition.
- 3.2 *Ratio of the population aged 0-6 years to the female population aged 7 years and above (FTI)*. This ratio is very similar to the conventional child-woman ratio (Shryock and Siegel, 1976). It gives an idea of the level of fertility that prevails in the village population. It may be assumed that the higher is this ratio, the higher is the level of fertility in the village.

The first three of the eight indicators reflect the gender and social class structure of the population. The next three indicators are related to the state of development in the village. Finally, the last two indicators reflect the stage of demographic transition. It may be noticed that indicators reflecting the state of development and the stage of demographic transition are essentially very crude. This limitation is however compelled by the availability of data at the village level as estimation of more refined indicators of the state of development and the stage of demographic transition is not possible from PCA 2011. However, the present analysis shows that even the crude indicators of the state of development and the stage of demographic transition can describe the village population and development morphology quite effectively.

The eight indicators of population and development listed above have been estimated for each of the 556661 villages in the country which had a population of at least 100 inhabitants at the 2011 population census. An exploratory analysis of inter-village distribution of these indicators has however revealed that 39356 (7.1 per cent) villages have exceptionally high or low value of at least one of the eight indicators. These villages have therefore been excluded so that the present analysis is restricted to 517305 villages which accounted for 93.2 per cent of the rural population of the country. These 517305 villages have a median population of 970 while the inter-quartile range (IQR) is 1367. More than half of the villages are small villages with population less than 1000 whereas 22905 (4.4 per cent) villages are very large villages with a population of at least 5000 (Table 1). Village Fursungi in district Pune in the state of Maharashtra is the largest village of the country with a population of 66062 at the 2011 population census. Village Edakkara in district Mallapuram of the state of Kerala also had a population of more than 60000 at the 2011 population census. There are, in all, 30 villages in the country with at least 40 thousand population at the 2011 population census.

Inter-village distribution of the eight indicators of population and development is summarised in table 2 which suggests that inter-village distribution of different indicators is essentially different. The coefficient of skewness is positive in all but two indicators meaning that in majority of the villages, the value of these indicators is lower than the average. It is only in case of the population sex ratio and the non-worker population ratio, that the value of the indicators is higher than the average in

majority of villages. On the other hand, in all but two indicators, the distribution is essentially platykurtic in shape. It is only in case of proportion Scheduled Castes and proportion Scheduled Tribes, that the inter-village distribution is leptokurtic which means high to very high value of these indicators in only a small proportion of villages.

DOMAINS OF POPULATION AND DEVELOPMENT

We have used the exploratory factor analysis procedure (Beavers et al, 2013; Sharma, 1996) to construct a composite population and development index (*PDI*) encompassing the five indicators of population and development. For the construction of the index, all indicators were first normalised to range between 0 and 1 in the sense that the lower is the normalised value, the better is the situation from the population and development perspective. The exploratory factor analysis revealed that the five indicators can be combined into two distinct factors or domains that account for almost 72 per cent of the total variance (Table 3). The KMO measure of sampling adequacy and Bartlett's test for sphericity suggest that the application of the exploratory factor analysis technique is appropriate for combining the indicators.

Table 3 indicates that the first of the two domains has high loadings in three indicators - *ASI*, *FTI* and *ILT* - and accounts for nearly 49 per cent of the variance in the original data set or almost 68 per cent of the total variance explained by the exploratory factor analysis model. This domain may be termed as the demographic transition domain of the population and development situation. The second domain, on the other hand, has high loadings in *NWR* and *MAR* and accounts for about 23 per cent of the variance in the original data set or around 32 per cent of the variance explained by the model. This domain may be termed as the development domain of the population and development situation. The exploratory factor analysis thus suggests that the village population and development situation can be characterised on a two-dimensional space - one reflecting the stage of demographic transition while the other reflecting the state of development and the two dimensions of the population and development situation are essentially mutually independent. Table 3 also suggests that the educational status of the village measured in terms of the illiteracy rate does not have any impact on participation in productive activities.

Results of the exploratory factor analysis have been used to construct the index of demographic transition (*DTI*) and the development status index (*DSI*) and then the population and development index (*PDI*) following the methodology suggested by OECD (2008). A high value of *DTI* reflects high proportion of young population; high fertility; and high illiteracy implying an early stage of demographic transition and vice versa. Similarly, a high value of *DSI* reflects low participation in productive activities and a high proportion of marginal workers in the work force implying poor state of development and vice versa. Finally, the higher is the *PDI*, the poorer is the population and development situation and vice versa.

Table 4 summarises inter-village distribution of *PDI*, *DSI* and *DTI*. The inter-village distribution of *PDI* as well as that of *DTI* and *DSI* is positively skewed or skewed to the left. This means that the number of villages having *PDI* below the average are more than the number of villages having *PDI* above the average. In other words, in majority of the villages, the population and development situation is below the average. Table 4 also suggests that in majority of the villages, the state of development is relatively poor while the pace of demographic transition is relatively slow, although the degree of skewness is marginally higher in case of *DSI* than in case of *DTI*. On the other hand, the inter-village distribution of the *PDI* as well as *DTI* and *DSI* is platykurtic in shape having thick tails. Moreover, the degree of the flatness in the inter-village distribution of *DTI* is substantially higher as compared to the degree of flatness in the inter-village distribution in case of *DSI* as reflected by excess kurtosis.

POPULATION AND DEVELOPMENT MORPHOLOGY

We have followed the classification modelling approach (Tan, Steinbach, Kumar, 2006; Han, Kamber, Pei, 2012) to examine how *PDI* is related to the structure of the village population. Classification modelling involves classifying villages on the basis of *PDI* as the indicator of village population and development situation and population structure variables - population sex ratio, proportion Scheduled Castes and Proportion Scheduled Tribes - as independent or classifying variables. We have used the classification and regression tree (CRT) technique (Breiman et al, 1984)

for the purpose of classification. CRT is a nonparametric method that divides villages into different categories in such a way that within category homogeneity with respect to the classification variables is maximised. The technique sorts villages according to the dependent variable into mutually exclusive categories based on the independent variable that causes the most effective split on the basis of a similarity measure. The process is repeated till either the perfect similarity is achieved or the stopping criterion is met (Ambalavanan et al, 2006; Lemon et al, 2003). A category in which all villages have the same value of the classification variable is termed as “pure.” If a category is not “pure”, then the impurity within the category can be measured through a number of impurity measures. We have used the Gini coefficient of impurity in the present analysis.

For the purpose of the classification, villages have been categorised into five categories on the basis of the *PDI*: 1) very good (<0.400); 2) good (0.400-0.699); 3) average (0.699-0.998); 4) poor (0.998-1.297); and 5) very poor (≥ 1.297). Similarly, village population has been categorised as very small (<500); small (500-1000); average (1000-3000); large (3000-5000) and very large (≥ 5000). Similarly, the population sex ratio measured as ratio of males to females has been categorised as highly favourable to females (< 0.98); favourable to females (0.98-1.03); neither favourable nor unfavourable to females (1.03-1.08); unfavourable to females (1.08-1.13); and highly unfavourable to females (≥ 1.13). Finally, the proportion Scheduled Castes and the proportion Scheduled Tribes in the village have been categorised as very low (< 0.20); low (0.20-0.40); average (0.40-0.60); high (0.60-0.80); and very high (≥ 0.80).

Results of the classification modelling exercise are presented in table 5 while the classification tree is depicted in figure 1. The most important classification variable is the proportion Scheduled Tribes (*PST*) followed by the population sex ratio (*PSR*). Compared to proportion Scheduled Tribes (*PST*), the relative importance of population sex ratio (*PSR*) is 97.3 per cent but the importance of the population size (*POP*) is only 24.0 per cent and that of proportion Scheduled Castes (*PSC*) is just 3.3 per cent. Out of the 15 nodes in the classification tree, 8 are terminal nodes. This means that 517305 villages of the country can be classified into 8 groups or clusters, each having distinct population and development morphology as may be seen from table 6. Villages in cluster

1 have high to very high proportion of Scheduled Tribes (*PST*). Villages in cluster 4 have very high population sex ratio (*PSR*) meaning that the gender balance in these villages is highly unfavourable to females. Villages in cluster 7, on the other hand, have very low proportion Scheduled Tribes (*PST*). Villages of cluster 10 are characterised by large to very large population size (*POP*) whereas villages of cluster 13 have very high proportion of Scheduled Castes (*PSC*). Villages of other clusters do not have very distinct features but it is clear that the population structure of villages of different clusters is, on average, essentially different.

Among the 8 clusters, cluster 4 is the largest one. More than one third of the villages of the country belongs to this cluster. Cluster 13 having 23 per cent of the villages of the country and cluster 7 having 20 per cent of the villages are also relatively large clusters so that more than three-fourth villages of the country are distributed across these three clusters. Rest of the clusters are relatively small with cluster 14 being the smallest one. More than 91 per cent of the population of the villages included in this cluster is Scheduled Castes (*PSC*).

Table 6 suggests that population and development scenario is relatively the best in villages of cluster 10. In more than 60 per cent villages of this cluster, *PDI* is either good or very good. There are only 9 per cent villages in this cluster where *PDI* is either poor or very poor. By contrast, the population and development scenario appears to be relatively the poorest in villages of cluster 1. In almost 30 per cent villages of this cluster, the *PDI* is either poor or very poor whereas the *PDI* is good or very good in only about one-fifth villages. The feature that differentiates villages of the two clusters is the proportion of Scheduled Tribes (*PST*) and size of the village population (*POP*). Villages belonging to cluster 10 have low to very low proportion Scheduled Tribes (*PST*) and very large population size (*POP*) whereas villages belonging to cluster 1 have high to very high proportion Scheduled Tribes (*PST*) but very small population size (*POP*).

The remarkably different stage of demographic transition and the state of development in the villages of different clusters is also very much evident from table 6. This means that village population structure influences both the stage of demographic transition and the state of development. Population and development situation is relatively better

in villages which are large in population size, where gender balance is favourable to females and where the proportion of Scheduled Castes and Scheduled Tribes is low. By contrast, population and development situation remains poor to very poor in those villages which have a very high concentration of Scheduled Tribes. These villages, incidently, are small to very small in population size, although the gender balance is relatively more favourable to females in these villages. Population and development situation is also poor in villages with heavy concentration of Scheduled Castes.

Any discussion on population and development in India is not complete without regional analysis. Table 7 presents the distribution of villages in different states/Union territories by different clusters which reflects the population and development morphology in different states of the country. In some states, there is very high concentration of villages belonging to a particular cluster. For example, more than 95 per cent of the villages in the state of Kerala belong to cluster 10. Similarly, at least 40 per cent of the villages in the states of Arunachal Pradesh, Nagaland, Manipur, Mizoram, Tripura and Meghalaya belong to cluster 1 whereas at least 40 per cent villages in the states of Punjab, Haryana, Delhi, Rajasthan, Uttar Pradesh, Bihar belong to cluster 4. Finally, at least 40 per cent villages in the states of Himachal Pradesh, Uttarakhand, Karnataka and Tamil Nadu belong to cluster 13. The population and development morphology of these states is obviously guided by the typical population and development morphology of these clusters.

DISCUSSIONS AND CONCLUSIONS

The present analysis demonstrates that village population and development situation in India is conditioned by the village population structure as characterised by the size of the village population and its gender balance and social class composition. Population structure variables are essentially exogenous to the social and economic development system. They are deep rooted in the culture and tradition of the Indian society. This means that the cultural and traditional divisions of the Indian society remain largely unaffected by population and development efforts in the rural India. The dividends of population and development efforts appear to be confined to only those villages which are large in terms of population size, where gender balance is favourable

to females and where Scheduled Tribes and Scheduled Castes are not in majority. There are however very few villages in the country which meet all the above three conditions. More than half of the villages in India are small villages with a population of less than 1000 at the 2011 population census. Similarly, the gender balance is unfavourable to females in more than 60 per cent villages of the country. There appears little impact of population and development efforts in these villages as the population and development situation in these villages remains relatively poor to very poor.

The social class effects of population and development appear to be even more dominating. The gender balance is relatively more favourable in Scheduled Tribes but even this bias in the gender balance has little impact on the population and development situation in villages with a heavy concentration of Scheduled Tribes. The reason is that villages having heavy concentration of Scheduled Tribes are usually very small in population size so that the positive effect of gender balance is countered by the negative effect of the size of the population. Similarly, villages with heavy concentration of Scheduled Castes are also very small in population size, although the gender balance in these villages remains favourable to females.

The analysis also confirms that education matters as far as demographic transition is concerned. This means that universalisation of education in Indian villages may contribute significantly towards hastening the pace of demographic transition. However, a more revealing finding of the present analysis is that neither the level of education nor the stage of demographic transition appears to have any impact on the participation of the people in the village level social and economic productive activities. It appears that opportunities of participation in social and economic productive activities are limited at the village level, especially for an educated person. The village economy in India remains primarily agrarian and traditional. Workers engaged in agriculture related activities account for almost three fourth of the rural work force in the country. A transformation of the village social and economic production system is widely recognised as a prerequisite for increasing participation, especially of females, in the village social and economic production system. There is however little indication of such a transformation in rural India. As a result, whatever limited demographic

bonus is generated from demographic transition at the village level, it largely remains unrepaid in productive terms.

It is also very much evident from the present analysis that regional variation in population and development situation in the villages of the country is largely an offshoot of the regional variation in the village population structure. This appears to be the reason why population and development efforts have not been able to reduce regional population and development disparities and inequalities that are so pervasive in India. The contrasting population and development situation in villages of different population structure suggests that villages with different population structure require different approaches to addressing population and development issues and concerns.

From the policy perspective, the analysis presented here calls for a spatial approach to population and development planning and programming with the village as the basic planning and implementation unit so that the prevailing population structure of the village is taken into consideration. The first and perhaps the most important prerequisite for institutionalising the spatial approach is the decentralisation of the public and development administration system. This is challenging in India as, despite all talks of decentralisation at the policy level, the public and development administration system in the country remains the traditional command and control system introduced during the colonial period.

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Table 1
Distribution of villages in India by population size, 2011

Population	Number of villages according to 2011 population census		Number of villages included in the present analysis	
	Number	Per cent	Number	Per cent
Uninhabited	43330	6.8	0	0.0
< 100	40958	6.4	0	0.0
100 - 500	156700	24.4	131481	25.4
500-1000	141500	22.1	133637	25.8
1000-3000	195062	30.4	189915	36.7
3000-5000	40091	6.3	39367	7.6
≥ 5000	23308	3.6	22905	4.4
Total	640949	100.0	517305	100.0

Source: Author's calculations

Table 2

Inter-village distribution of population and development indicators in India, 2011

Particulars	Population sex ratio (PSR)	Proportion Scheduled Castes (PSC)	Proportion Scheduled Tribes (PST)	Illiteracy rate (ILT)	Non-work population ratio (NWR)	Marginal workers (MAR)	Age structure index (ASI)	Fertility index (FTI)
<i>Frequency Distribution</i>								
Very low	20.17	63.56	76.03	7.04	2.20	42.45	0.15	1.08
Low	20.25	23.38	6.14	32.09	28.03	22.58	12.13	36.15
Average	23.83	8.32	4.12	38.08	39.51	17.99	45.82	43.97
High	18.82	2.86	3.76	17.74	29.49	9.95	33.52	16.69
Very high	16.93	1.85	9.95	5.05	0.77	7.03	8.38	2.11
N	517305	517305	517305	517305	517305	517305	517305	517305
<i>Summary measures</i>								
Minimum	0.813	0.000	0.000	0.000	0.147	0.000	0.031	0.060
Median	1.050	0.130	0.001	0.313	0.557	0.262	0.142	0.337
Maximum	1.285	1.000	1.000	0.695	0.979	1.000	0.258	0.676
IQR	0.112	0.259	0.178	0.176	0.147	0.423	0.055	0.157
Skewness	-0.043	1.533	1.732	0.327	-0.116	0.704	0.268	0.465
Excess Kurtosis	-0.072	2.544	1.512	-0.212	-0.623	-0.477	-0.396	-0.236

Source: Author's calculations.

Table 3
Results of exploratory factor analysis

Factor I		Factor II	
Indicator	Loadings	Indicator	Loadings
1. Age structure index (<i>ASI</i>)	0.968	1. Proportion of non workers (<i>NWR</i>)	0.838
2. Fertility index (<i>FTI</i>)	0.965	2. Proportion of marginal workers to total workers (<i>MAR</i>)	-0.574
3. Illiteracy rate (<i>ILT</i>)	0.671		
Sum of squared loadings			
	2.462		1.16
Proportion of total variance explained			
	48.52		23.2

Remark: Only those indicators are shown in each factor which have a factor loading of more than 0.55.

Source: Author's calculations

Table 4
Inter-village distribution of *PDI*, *DTI* and *DSI*

<i>PDI</i>		<i>DTI</i>		<i>DSI</i>	
Very good (< 0.400)	1.46	Very good (< 0.346)	2.11	Very good (< 0.393)	7.70
Good (0.400-0.699)	35.61	Good (0.346-0.663)	32.78	Good (0.393-0.783)	43.14
Average (0.699-0.998)	45.34	Average (0.663-0.981)	42.67	Average (0.783-1.173)	37.81
Poor (0.998-1.297)	16.58	Poor (0.981-1.298)	19.35	Poor (1.173-1.563)	10.65
Very poor (≥ 1.297)	1.01	Very poor (≥ 1.298)	3.09	Very poor (≥ 1.563)	0.71
N	517305		517305		517305
Summary measures					
Minimum	0.101		0.028		0.002
Median	0.775		0.765		0.777
Maximum	1.596		1.616		1.954
IQR	0.311		0.362		0.380
Skewness	0.289		0.336		0.379
Kurtosis	-0.405		-0.368		-0.169

Source: Author's calculations

Table 5
The classification table

Node	Village characteristics				Population and development situation					N	
	Scheduled Tribes	Population sex ratio	Population size	Scheduled Castes	Very good	Good	Average	Poor	Very poor		
0	<i>All</i>	<i>All</i>	<i>All</i>	<i>All</i>	1.5	35.6	45.3	16.6	1.0	517305	
1	≥ 0.6	<i>All</i>	<i>All</i>	<i>All</i>	0.8	20.9	49.2	26.9	2.3	70940	Terminal
2	< 0.6	<i>All</i>	<i>All</i>	<i>All</i>	1.6	38	44.7	14.9	0.8	446365	
3	< 0.6	< 1.08	<i>All</i>	<i>All</i>	1.9	43	41.6	12.7	0.7	275471	
4	< 0.6	≥ 1.08	<i>All</i>	<i>All</i>	1.1	29.8	49.7	18.5	0.9	170984	Terminal
5	< 0.4	< 1.08	<i>All</i>	<i>All</i>	1.9	43.8	41	12.5	0.7	259291	
6	$0.4-0.6$	< 1.08	<i>All</i>	<i>All</i>	0.7	30.8	51.7	15.9	0.9	16180	Terminal
7	< 0.4	$1.03-1.08$	<i>All</i>	<i>All</i>	1.2	40.3	43.1	14.6	0.8	104511	Terminal
8	< 0.4	< 1.03	<i>All</i>	<i>All</i>	2.4	48.1	39.6	11.2	0.7	154780	
9	< 0.4	< 1.03	< 3000	<i>All</i>	2.6	44.4	40.8	11.5	0.7	137182	
10	< 0.4	< 1.03	≥ 3000	<i>All</i>	1.2	59.8	30.2	8.6	0.2	17598	Terminal
11	< 0.2	< 1.03	< 3000	<i>All</i>	2.7	44.9	40	11.7	0.7	123741	

Node	Village characteristics				Population and development situation					N	
	Scheduled Tribes	Population sex ratio	Population size	Scheduled Castes	Very good	Good	Average	Poor	Very poor		
12	0.2-0.4	< 1.03	< 3000	All	1.1	40.1	48.1	10.1	0.6	13441	Terminal
13	< 0.2	< 1.03	< 3000	< 0.8	2.8	45.3	39.7	11.5	0.7	120174	Terminal
14	< 0.2	< 1.03	< 3000	≥ 0.8	0.9	30.9	48.2	17.6	2.4	3567	Terminal

Source: Author's calculations

Table 6
Population and development morphology of different village clusters in India

Population and development indicators	Cluster Number								All
	1	4	6	7	10	12	13	14	
<i>Cluster Characteristics</i>									
<i>Proportion Scheduled Tribes</i>	≥ 0.6	< 0.6	0.4-0.6	< 0.4	< 0.4	0.2-0.4	< 0.2	< 0.2	All
<i>Population sex ratio</i>	All	≥ 1.08	< 1.08	1.03-1.08	< 1.03	< 1.03	< 1.03	< 1.03	All
<i>Population size</i>	All	All	All	All	≥ 3000	< 3000	< 3000	< 3000	All
<i>Proportion Scheduled Castes</i>	All	All	All	All	All	All	< 0.8	≥ 0.8	All
<i>Population and Development Index (PDI)</i>									
Very good (< 0.400)	0.78	1.07	0.74	1.24	1.19	1.06	2.80	0.90	1.46
Good (0.400-0.699)	20.87	29.78	30.75	40.29	59.84	40.06	45.27	30.89	35.61
Average (0.699-0.998)	49.17	49.74	51.72	43.09	30.17	48.14	39.74	48.19	45.34
Poor (0.998-1.297)	26.87	18.49	15.90	14.56	8.58	10.15	11.50	17.58	16.58
Very poor (≥ 1.297)	2.31	0.92	0.88	0.82	0.23	0.59	0.69	2.44	1.01
Minimum	0.120	0.133	0.236	0.155	0.284	0.214	0.101	0.268	0.101
Median	0.874	0.808	0.792	0.747	0.639	0.740	0.710	0.800	0.775
Maximum	1.586	1.582	1.516	1.596	1.471	1.504	1.554	1.576	1.596
IQR	0.304	0.293	0.237	0.303	0.270	0.251	0.304	0.299	0.311
Skewness	0.042	0.176	0.285	0.414	0.829	0.480	0.456	0.440	0.289
Kurtosis	-0.377	-0.383	-0.207	-0.335	0.046	0.152	-0.222	-0.101	-0.405
N	70940	170894	16180	104511	17598	13441	120174	3569	517305

Population and development indicators	Cluster Number								All
	1	4	6	7	10	12	13	14	
<i>Cluster Characteristics</i>									
<i>Proportion Scheduled Tribes</i>	≥ 0.6	< 0.6	0.4-0.6	< 0.4	< 0.4	0.2-0.4	< 0.2	< 0.2	<i>All</i>
<i>Population sex ratio</i>	<i>All</i>	≥ 1.08	< 1.08	1.03-1.08	< 1.03	< 1.03	< 1.03	< 1.03	<i>All</i>
<i>Population size</i>	<i>All</i>	<i>All</i>	<i>All</i>	<i>All</i>	≥ 3000	< 3000	< 3000	< 3000	<i>All</i>
<i>Proportion Scheduled Castes</i>	<i>All</i>	<i>All</i>	<i>All</i>	<i>All</i>	<i>All</i>	<i>All</i>	< 0.8	≥ 0.8	<i>All</i>
<i>Demographic Transition Index (DTI)</i>									
Very good (< 0.346)	0.81	1.63	0.74	1.97	3.02	1.12	3.85	1.46	2.11
Good (0.346-0.663)	16.33	27.68	27.58	36.98	53.20	37.50	43.36	29.35	32.78
Average (0.663-0.981)	42.64	45.48	49.65	42.07	34.06	47.12	39.03	45.44	42.69
Poor (0.981-1.298)	32.18	22.34	19.68	16.59	8.64	12.77	12.14	19.74	19.35
Very poor (≥ 1.298)	8.03	2.87	2.34	2.40	1.08	1.48	1.62	4.01	3.09
Minimum	0.041	0.028	0.103	0.064	0.074	0.062	0.056	0.101	0.028
Median	0.912	0.800	0.793	0.732	0.628	0.723	0.681	0.777	0.765
Maximum	1.615	1.599	1.559	1.593	1.542	1.588	1.611	1.573	1.616
IQR	0.372	0.350	0.313	0.345	0.291	0.289	0.336	0.346	0.362
Skewness	0.044	0.194	0.352	0.447	0.803	0.552	0.523	0.415	0.336
Kurtosis	-0.476	-0.434	-0.171	-0.204	0.504	0.210	-0.027	-0.157	-0.368
N	70940	170894	16180	104511	17598	13441	120174	3569	517305

Population and development indicators	Cluster Number								All
	1	4	6	7	10	12	13	14	
<i>Cluster Characteristics</i>									
<i>Proportion Scheduled Tribes</i>	≥ 0.6	< 0.6	0.4-0.6	< 0.4	< 0.4	0.2-0.4	< 0.2	< 0.2	<i>All</i>
<i>Population sex ratio</i>	<i>All</i>	≥ 1.08	< 1.08	1.03-1.08	< 1.03	< 1.03	< 1.03	< 1.03	<i>All</i>
<i>Population size</i>	<i>All</i>	<i>All</i>	<i>All</i>	<i>All</i>	≥ 3000	< 3000	< 3000	< 3000	<i>All</i>
<i>Proportion Scheduled Castes</i>	<i>All</i>	<i>All</i>	<i>All</i>	<i>All</i>	<i>All</i>	<i>All</i>	< 0.8	≥ 0.8	<i>All</i>
<i>Development Status Index (DSI)</i>									
Very good (< 0.393)	11.27	5.32	8.74	6.93	6.15	9.90	9.50	7.74	7.70
Good (0.393-0.783)	39.98	42.73	40.67	45.14	56.36	42.66	42.43	38.69	43.14
Average (0.783-1.173)	34.94	41.52	38.40	37.69	32.16	36.69	35.32	34.15	37.81
Poor (1.173-1.563)	13.21	9.71	11.86	9.63	5.29	10.43	11.79	17.44	10.65
Very poor (≥ 1.563)	0.59	0.73	0.33	0.61	0.05	0.33	0.97	1.99	0.71
Minimum	0.002	0.009	0.029	0.006	0.221	0.045	0.004	0.083	0.002
Median	0.772	0.794	0.787	0.770	0.702	0.762	0.768	0.809	0.777
Maximum	1.884	1.954	1.832	1.938	1.635	1.742	1.933	1.846	1.954
IQR	0.475	0.317	0.435	0.358	0.339	0.428	0.437	0.469	0.380
Skewness	0.283	0.411	0.243	0.435	0.552	0.316	0.407	0.367	0.379
Kurtosis	-0.629	0.213	-0.602	-0.037	-0.090	-0.521	-0.343	-0.572	-0.169
N	70940	170894	16180	104511	17598	13441	120174	3569	517305

Population and development indicators	Cluster Number								All
	1	4	6	7	10	12	13	14	
<i>Cluster Characteristics</i>									
<i>Proportion Scheduled Tribes</i>	≥ 0.6	< 0.6	0.4-0.6	< 0.4	< 0.4	0.2-0.4	< 0.2	< 0.2	<i>All</i>
<i>Population sex ratio</i>	<i>All</i>	≥ 1.08	< 1.08	1.03-1.08	< 1.03	< 1.03	< 1.03	< 1.03	<i>All</i>
<i>Population size</i>	<i>All</i>	<i>All</i>	<i>All</i>	<i>All</i>	≥ 3000	< 3000	< 3000	< 3000	<i>All</i>
<i>Proportion Scheduled Castes</i>	<i>All</i>	<i>All</i>	<i>All</i>	<i>All</i>	<i>All</i>	<i>All</i>	< 0.8	≥ 0.8	<i>All</i>
<i>Population Structure</i>									
Villages (<i>per cent</i>)	13.7	33.0	3.1	20.2	3.4	2.6	23.2	0.7	100
Average population per village	794	1703	1163	1904	5838	997	1014	581	1557
Population sex ratio (<i>M/Fx100</i>)	101	113	100	106	98	98	97	98	105
Scheduled Tribes (<i>per cent</i>)	86	3.0	49.6	4.0	3.8	29.2	2.4	0.9	10.6
Scheduled Castes (<i>per cent</i>)	3.1	21.0	10.5	19.9	17.3	15.0	20.2	91.5	18.7
<i>Development Status</i>									
Effective literacy rate (<i>per cent</i>)	60.2	67.2	64.1	69.0	73.1	66.9	69.6	66.6	68.2
Work participation rate (<i>per cent</i>)	50.7	38.2	49.0	41.4	42.7	49.2	43.9	44.2	41.8
Marginal workers (<i>per cent</i>)	38.4	29.5	36.8	27.9	22.4	34.8	29.9	35.8	29.3
<i>Demographic Transition</i>									
Age structure index (<i>per cent</i>)	16.2	15.4	14.4	14.3	12.2	13.6	13.3	14.5	14.4
Fertility index (<i>per cent</i>)	39	39	34	34	27	31	30	34	35

Source: Author's calculations

Table 7

Distribution of villages in states/Union Territories by different population and development morphology

Country/State	Proportion (per cent) of villages in cluster								Number of villages
	1	4	6	7	10	12	13	14	
Jammu & Kashmir	8.67	39.07	2.56	23.94	1.78	1.46	22.01	0.52	5401
Himachal Pradesh	3.87	23.70	1.06	16.67	0.14	1.67	51.23	1.66	11742
Punjab	0.00	59.91	0.00	20.89	0.47	0	17.53	1.2	11443
Uttarakhand	2.65	24.23	1.22	13.68	0.34	0.70	55.34	1.83	8254
Haryana	0.00	81.74	0.00	14.17	0.06	0.00	3.90	0.13	6209
Delhi	0.00	93.81	0.00	5.15	0.00	0.00	1.03	0	97
Rajasthan	14.68	40.16	2.40	20.59	1.48	1.99	18.38	0.3	37919
Uttar Pradesh	0.23	55.88	0.07	18.19	2.03	0.09	23.01	0.51	88207
Bihar	1.15	54.58	0.33	24.32	2.66	0.23	16.37	0.36	35099
Sikkim	21.37	30.34	11.35	17.94	0.53	8.97	9.50	0	379
Arunachal Pradesh	82.87	7.59	2.80	2.40	0.00	1.10	3.25	0	2002
Nagaland	95.30	1.95	1.77	0.27	0.00	0.44	0.27	0	1128
Manipur	76.22	3.76	0.46	3.46	4.33	0.26	11.14	0.36	1939
Mizoram	98.78	0.52	0.35	0.00	0.00	0.17	0.17	0	572
Tripura	49.10	9.22	7.90	20.72	7.90	1.20	3.95	0	835
Meghalaya	94.81	1.57	0.84	0.78	0.05	0.18	1.70	0.08	3950
Assam	21.30	20.28	3.36	23.21	2.30	2.68	26.50	0.39	21778

Country/State	Proportion (per cent) of villages in cluster								Number of villages
	1	4	6	7	10	12	13	14	
West Bengal	7.34	26.90	3.79	32.50	3.74	4.35	19.19	2.19	35224
Jharkhand	35.01	23.71	7.26	15.94	0.72	3.73	13.02	0.62	24558
Odisha	23.74	18.17	8.15	16.76	1.16	6.57	24.74	0.71	37526
Chhattisgarh	36.65	6.25	11.67	10.59	1.81	9.81	21.78	1.44	17459
Madhya Pradesh	23.20	37.58	5.04	16.89	0.63	3.53	12.92	0.21	45659
Gujarat	24.13	24.30	3.64	27.00	2.97	1.30	16.60	0.04	17013
Maharashtra	13.56	29.71	3.38	25.31	2.03	3.20	22.67	0.14	38117
Andhra Pradesh	11.17	8.00	2.84	19.11	17.18	3.15	38.19	0.36	23232
Karnataka	2.62	16.46	2.48	23.75	6.20	4.21	43.03	1.24	25229
Goa	8.56	14.04	7.19	19.18	10.96	7.19	32.88	0	292
Kerala	0.20	0.40	0.50	1.19	95.05	0.10	2.57	0	1010
Tamil Nadu	1.61	9.41	0.23	20.64	20.79	0.25	45.24	1.83	14630
Union Territories	23.38	29.35	1.24	12.69	14.43	0.25	18.66	0	402
India	13.71	33.04	3.13	20.20	3.40	2.60	23.23	0.69	517305

Figure1
The Classification Tree



