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### **A Comparative Analysis of the Materials used in Roof Building in Uttar Pradesh**

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#### **ABSTRACT**

This paper assesses differences in the type of materials used in roof structure, among 71 districts in the state of Uttar Pradesh. The study is based on secondary sources of data obtained from Census of India, 2011. Since Census of India, 2011 has classified roof materials used for residential houses into eight types; here those are categorized into traditional and modern materials to give a comparative analysis. Empirically, data is computed with Z-score technique. According to data, districts are distributed into five categories i.e., Very high, high, medium, low, and very low category which explains their level of development.

The results shows that use of traditional material is high and very high in central and eastern Uttar Pradesh and low in western and south western part of the state. Whereas availability of modern roof material is found in a contiguous belt of high and very high running from western to central and eastern Uttar Pradesh and low in southern part of the state.

**KEYWORDS:** Housing Structure, Housing Quality, Traditional and Modern Roof Material, Districts.

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## **INTRODUCTION**

A house is one of the three basic requirements of the mankind.<sup>1</sup> The term house denotes all human structures, whether they are meant to live in, or work in, or store things in.<sup>2</sup> Houses can be classified according to physical factors, build and architecture, accommodation space, sanitation, occupancy rate, density of buildings etc. Thus in the classification of house-types, their size and shape, building materials used and methods of construction become important, while houses differ in their architectural planning and building materials according to the choice and means of their individual owners.<sup>3</sup> The construction of houses started way back in prehistoric era. 'Man taps resources and builds houses out of local materials.'<sup>4</sup> The availability of local building materials is of primary importance in considering the house-types of the region.<sup>5</sup> And the chief materials amongst them are clay, sand, bamboo, grass, reeds, timber etc. The soil and natural vegetation provide the cheap building materials. But the various cultural groups have used them differently. Industrialization and other developments after independence have resulted in improvements in morphology and other conditions of housing.<sup>6</sup> The resistant and good quality building materials are also made out of the primary products. As we see, clayey soil contains a high percentage of cementing materials and is good for manufacture of tiles, burnt bricks and unburnt bricks.<sup>7</sup>

The socio economic structure of the region determines the regional variations in dwellings. It has been investigated that the settlement structure and roof plan of the houses reflect the physical and social conditions and specify standards of living.<sup>8</sup> There have always been marked differences between the houses of upper and lower classes of people. The economically advanced areas have houses made up of good quality resistant materials whereas economically backward people build houses with relatively poor quality materials. The type of material used in housing structure for flooring, wall and roof, determines the quality of housing. Thus, Census of India at its recently compiled census of the country in 2011 has for the first time published detailed data on material used in constructing residential dwellings.<sup>9</sup> The Census of India has classified the residential houses into three categories on the basis of quality namely good, livable and dilapidated.<sup>10</sup> This categorization is set on the basis of the type of building material used in structuring of the dwellings. In order to classify dwellings and map their distribution, a basic classification system becomes essential.<sup>11</sup> Though, climatic conditions also plays an important role in building of houses. Physiography, drainage, climate and vegetation have profound effects on the rural house types.<sup>12</sup> Due to lack of a scientific and technological approach in the

construction of houses, the basic form and type of houses in the area is influenced by the availability of building materials and its use in response to physical and human agencies.<sup>13</sup> The scope of this paper is confined only to the type of material used for roof in the residential dwellings. The study is done in a comparative way putting materials of roof building into traditional and modern types. Such category rightly describes the condition of houses in a region. The analysis is an attempt to view housing quality in Uttar Pradesh where people have vast differences in their socio economic profiles.

## OBJECTIVE

- The study is an attempt to make a district wise analysis of the types of roof material used in roof building to determine the quality of housing in the state of Uttar Pradesh.

## DATA AND METHODOLOGY

The present research work is entirely based on secondary sources of data collected from Census of India Publications, 2011, New Delhi. In this study, a set of eight types of materials used as building material for roof in residential dwellings have been taken into account and have categorized into traditional and modern materials. In this paper, the good and resistant quality roof materials are considered as modern materials whereas low quality nonresistant or temporary durable materials are considered as traditional materials.

The indicators of traditional material fall into categories like grass/thatch/bamboo/wood/mud, plastic/polythene, handmade tiles, and indicators for modern material are machine made tiles, burnt brick, stone slate, asbestos sheets, concrete. In the first step, the raw data for each variable which determines the spacial variations in the availability of roof material have been computed into standard scores. It is generally known as Z value or Z score. The score quantifies the departure of individual observation, expressed in a comparable form. This means that it becomes a linear transformation of the original data (Smith, 1973). It may be expressed as:

$$Z_{ij} = \frac{X_{ij} - \bar{X}_i}{\sigma_i}$$

Where,  $Z_{ij}$  = standardized value of the variable  $i$  in the districts/ $j$

$X_{ij}$  = Actual value of variable  $i$  in the district  $j$

$X_i$  = Mean value of variable  $i$  in all districts, and

$\sigma_i$  = Standard deviation of variables  $i$  in all districts

In the second step, the Z-Score of all variables have been added districts wise and the average has been taken out for these variables which may be called as composite score for each district (CS)

$$CS = \frac{\sum Z_{ij}}{N}$$

Where, CS stands for composite score,

N refers to the number of indicators (variables), and

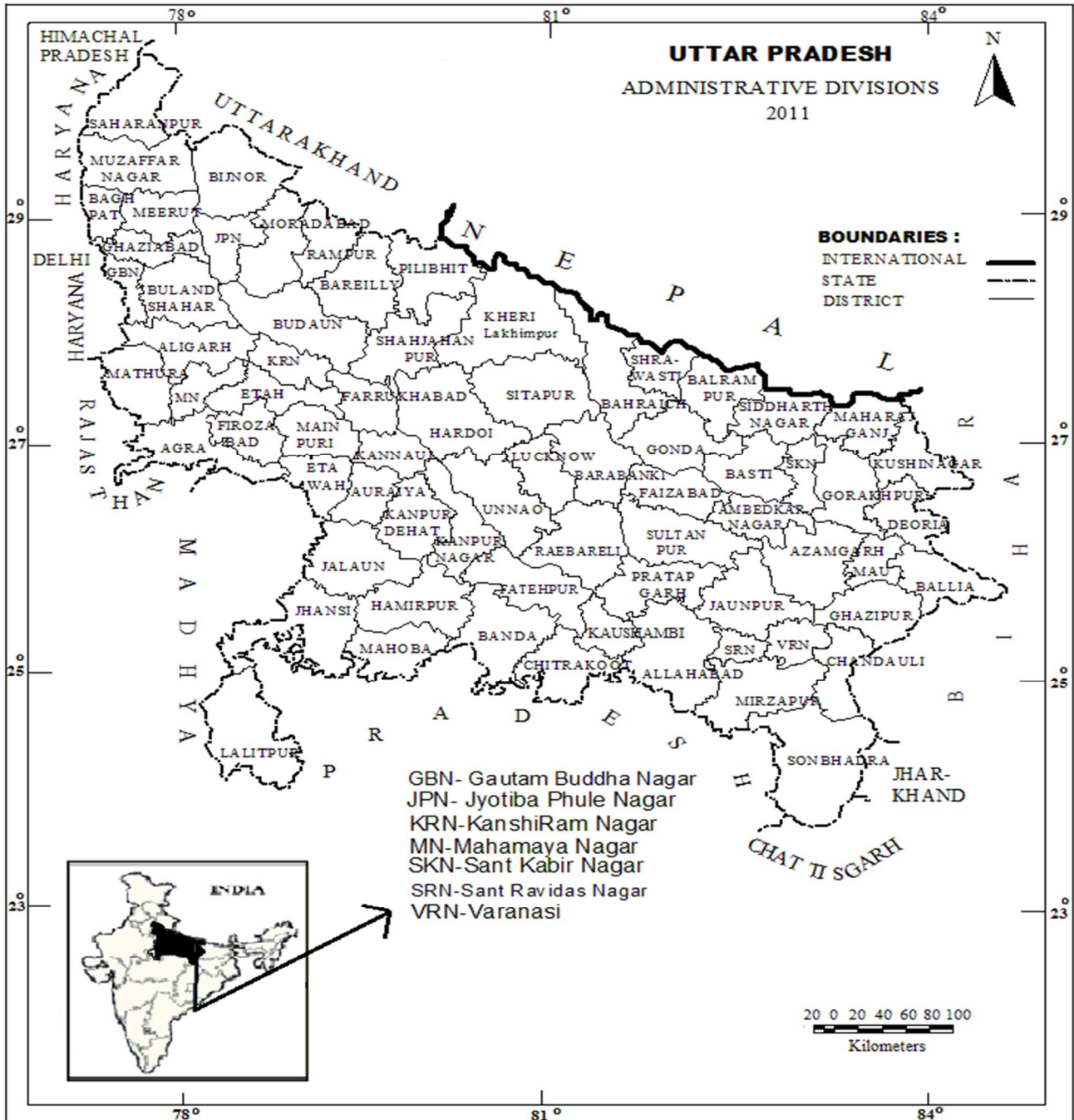
$\sum Z_{ij}$  indicates Z-Score of all variables  $i$  in the districts.

Under the category of modern material, the districts holding positive values of the Z-score explains high level of development and negative values show low level of development whereas districts having positive values under the category of traditional material reflects low level of development and negative values indicates high level of development in the overall status. Advanced cartographic techniques, Arc view programme (version 3.2a) have been applied to show the spatial pattern of traditional and modern roof material among the districts of Uttar Pradesh through maps.

## **STUDY AREA**

Uttar Pradesh as a whole has been chosen as study area for the present research work and boundary of a district has been considered as the smallest unit of study. Uttar Pradesh is a state located in Northern India. Geographically it stretches from 23°52'N and 31°28'N latitudes and 77°30' and 84°39'E longitudes. The state comprises of 71 districts (Census of India, 2011). It has a total geographical area of about 243,286 km<sup>2</sup>, which is equal to 6.88% of the total area of India, and is the fourth largest Indian state by area. The state is bordered by Rajasthan to the west, Haryana and Delhi to the northwest, Uttarakhand and country of Nepal to the north, Bihar to the east, Jharkhand to the southeast, Chhattisgarh to the south and Madhya Pradesh to the southwest. With over 200 million inhabitants, it is the most populous state in the country. Literacy rate in Uttar is 69.72 percent out of which male literacy stands at 77.28 percent and female literacy at 51.36 percent. Sex ratio in the state is 912 females for each 1000 male, which is below national average of 940 as per 2011 census. Uttar

Pradesh is a state where occurs a huge variation in the levels of development due to uneven distribution of population and natural resources, diversified nature of technological innovations, high population growth, high rate of unemployment, unequal opportunities to gain and utilize resources etc.



Source: Census of India, 2011

Figure.1 Administrative Division

## RESULTS AND DISCUSSION

There is a great variation in availability of tradition roof material in different districts of Uttar Pradesh. The range of composit scores of traditional roof material varies from -0.002 score in Gonda to 1.736 score in Allahabad (Table 1). The entire range of differences may be arranges into five categories i.e. very high (above 0.960 score), high (0.320 to 0.960 score), medium (-0.320 to 0.320 score), low (-0.320 to -0.960 score) and very low (below -0.960 score).

**Table 1: District wise distribution of Z-scores of Traditional Roof Material in Uttar Pradesh, 2011.**

Districts	Grass/Thatch/Bamboo/ Wood/ Mud etc.	Plastic/ Polythene	Hand made Tiles	Composite Score
Saharanpur	0.207	-0.432	-0.688	-0.304
Muzaffarnagar	1.233	0.018	-0.282	0.323
Bijnor	0.403	-0.023	-0.687	-0.102
Moradabad	2.037	1.150	-0.612	0.858
Rampur	0.528	0.157	-0.545	0.047
Jyotiba Phule Nagar	-0.409	-0.549	-0.713	-0.557
Meerut	-0.217	0.105	-0.466	-0.193
Baghpat	-0.615	-1.059	-0.201	-0.625
Ghaziabad	-0.474	0.893	-0.482	-0.021
Gautam Buddha Nagar	-1.126	-0.245	-0.735	-0.702
Bulandshahar	-0.396	-0.637	-0.702	-0.578
Aligarh	-0.739	-0.202	-0.763	-0.568
Mahamaya Nagar	-1.132	-1.082	-0.794	-1.003
Mathura	-1.193	-0.947	-0.792	-0.977
Agra	-0.930	-0.062	-0.754	-0.582
Firozabad	-0.764	-0.464	-0.754	-0.661
Mainpuri	-0.339	-0.877	-0.776	-0.664
Badaun	1.498	0.172	-0.679	0.330
Bareilly	0.155	1.451	0.687	0.764
Pilibhit	-0.392	0.229	0.014	-0.050
Shahjahanpur	0.971	0.182	-0.590	0.188
Kheri	1.862	0.781	-0.710	0.644
Sitapur	3.146	1.554	-0.698	1.334
Hardoi	2.529	-0.093	-0.703	0.578
Unnao	2.055	0.202	-0.728	0.510

Luchnow	0.052	4.260	-0.664	1.216
Rae Bareilly	1.923	-0.124	-0.675	0.374
Farukhabad	-0.449	-0.674	-0.764	-0.629
Kannauj	-0.115	-0.628	-0.767	-0.503
Etawah	-0.580	-0.487	-0.765	-0.611
Auraiya	-0.295	-0.940	-0.773	-0.669
Kanpur Dehat	0.751	-0.403	-0.737	-0.130
Kanpur Nagar	0.914	3.974	-0.496	1.464
Jalaun	-0.747	-0.503	0.552	-0.233
Jhansi	-0.846	-0.071	1.101	0.062
Lalitpur	-1.009	-0.782	1.069	-0.241
Hamirpur	-0.994	-0.972	1.344	-0.207
Mahoba	-1.059	-0.799	0.695	-0.388
Banda	-0.658	-0.734	3.070	0.559
Chitrakoot	-1.162	-0.899	1.549	-0.171
Fatehpur	1.810	-0.570	-0.526	0.238
Pratapgarh	0.180	0.105	1.631	0.639
Kaushambi	0.191	-0.779	-0.146	-0.245
Allahabad	1.026	1.640	2.542	1.736
Barabanki	1.154	0.537	-0.715	0.326
Faizabad	-0.011	-0.476	0.354	-0.044
Ambedkar Nagar	-0.551	-0.359	0.927	0.006
Sultanpur	0.633	0.041	2.269	0.981
Bahraich	1.647	0.650	0.691	0.996
Shrawasti	-0.552	-1.055	-0.503	-0.703
Balrampur	-0.593	-0.952	-0.639	-0.728
Gonda	0.313	-0.036	-0.283	-0.002
Siddharthnagar	-0.797	-0.426	-0.403	-0.542
Basti	-0.475	-0.653	-0.471	-0.533
Sant Kabir Nagar	-0.765	-0.529	-0.456	-0.583
Mahrajganj	-0.436	0.017	-0.167	-0.195
Gorakhpur	-0.241	1.271	-0.023	0.336
Kushinagar	0.816	0.000	-0.659	0.052
Deoria	-0.734	0.022	-0.561	-0.425
Azamgarh	0.019	0.561	1.730	0.770
Mau	-0.756	-0.419	-0.159	-0.445

Ballia	-0.149	0.792	-0.151	0.164
Jaunpur	0.034	0.644	1.312	0.663
Ghazipur	-0.108	0.929	0.533	0.452
Chandauli	-0.668	-0.549	0.517	-0.233
Varanasi	-0.815	0.312	0.253	-0.083
Sant Ravidas Nagar (Bhadohi)	-0.979	-0.761	0.039	-0.567
Mirzapur	-0.578	-0.218	1.963	0.389
Sonbhadra	-0.583	1.734	3.078	1.409
Etah	-0.778	-0.966	-0.781	-0.842
Kanshiram Nagar	-0.878	-0.949	-0.783	-0.870

**Source:** Calculation is based on publication of Census of India, 2011, Data on Availability of Roof Material, H-H Series Tables, Data Dissemination Wing, Office of the Registrar General, New Delhi.

Table 2 shows the distribution of traditional material which is very high ( above 0.960score) in 7 districts namely Bahraich, Sitapur, Lucknow, Sultanpur, Kanshiramnagar, Allahabad and Sonbhadra. Only two districts i.e., Bahraich and Sitapur are sharing a common boundary, hence, making a region. Other districts of this category are scattered in central and eastern part of the state and are not following any regional pattern.

There are 15 districts falling in high category of traditional roof material (0.321 to 0.960 score). A long contiguous region is formed by 10 districts from central to eastern part by Kheri, Hardoi, Unnao, Barabanki, Rae Bareilly, Pratapgarh, Ghazipur, Gorakhpur, Azamgarh and Jaunpur. Districts which do not constitute any region are Muzaffarnagar, Moradabad, Bareilly, Banda and Mirzapur distributed in weatern, central and eastern part of the state.

**Table 2: Availability of Traditional Roof Material in Uttar Pradesh.**

Category	Score	No. of Districts	Districts
Very High	Above 0.960	7	Sitapur, Lucknow, Kanpur Nagar. Allahabad, Sultanpur, Bahraich and Sonbhadra.
High	0.321 to 0.960	15	Muzaffarnagar, Moradabad, Bareilly, Kheri, Hardoi, Unnao, Rae Bareilly, Banda, Pratapgarh, Barabanki, Gorakhpur, Azamgarh, Jaunpur, Ghazipur, and Mirzapur.



Medium	-0.320 to 0.320	24	Saharanpur, Kanpur Dehat, Bijnor, Meerut, Rampur, Ghaziabad, Badaun, Pilibhit, Shahjahanpur, Jhansi, Lalitpur, Hamirpur, Chitrakoot, Fatehpur, Kaushambi, Faizabad, Ambedkar Nagar, Gonda, Maharajganj, Kushinagar, Ballia, Chandauli, Varanasi and Jalaun.
Low	-0.321 to 0.960	23	Jyotiba Phule Nagar, Baghpat, Gautam Buddha Nagar, Bulandshahar, Aligarh, Agra, Firozabad, Mainpuri, Farrukhabad, Kannauj, Etawah, Auraiya, Mahoba, Shrawasti, Balrampur, Siddharthnagar, Basti, Sant Kabir Nagar, Deoria, Mau, Sant Ravidas Nagar, Etah and Kanshiram Nagar.
Very Low	Below -0.960	2	Mahamaya Nagar and Mathura.

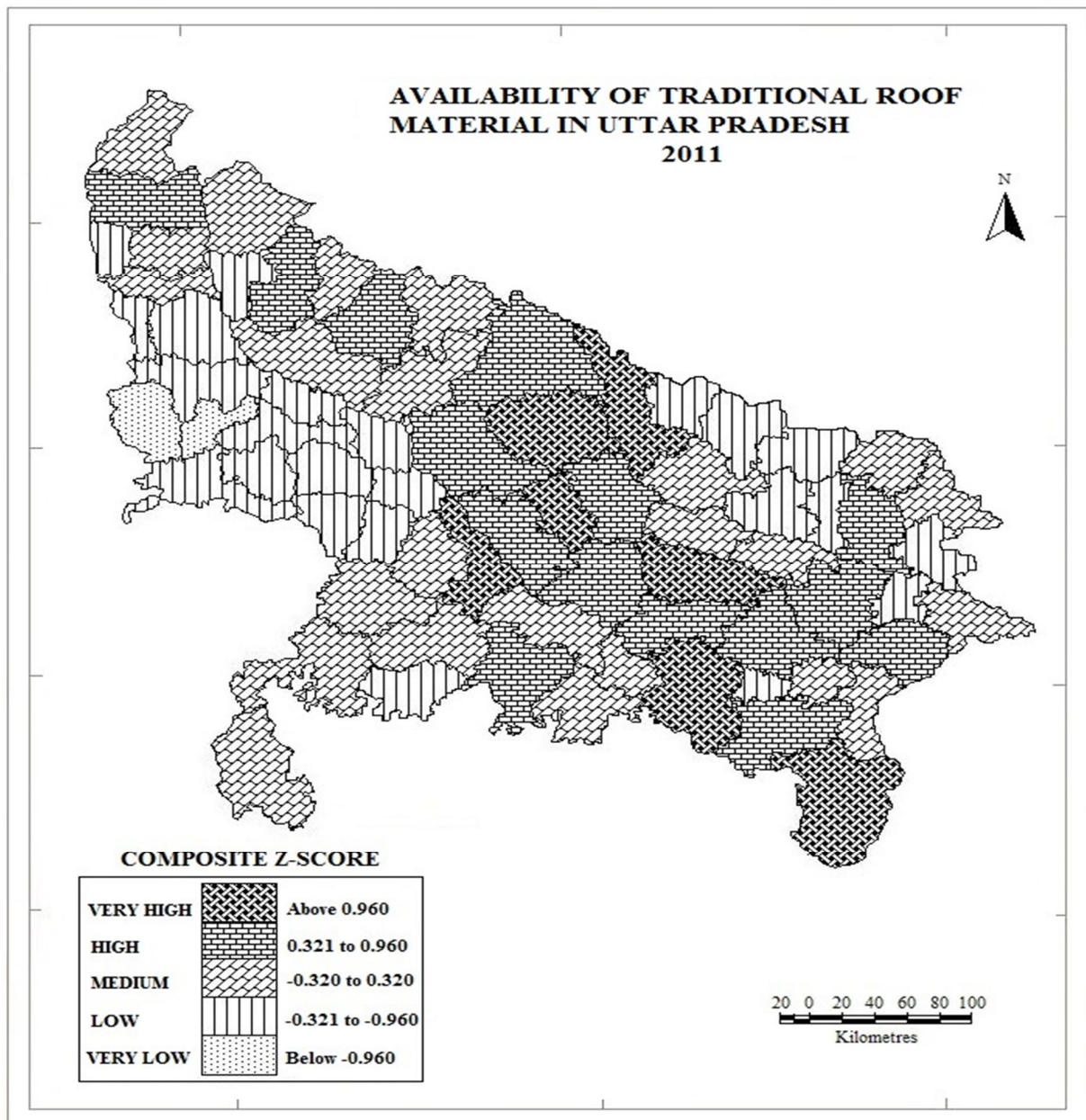
Source: Based on Table 1

Table 2 also exhibits that 24 districts are experiencing medium level (-0.320 to 0.320 score) of traditional roof material, out of which 4 districts i.e., Rampur, Pilibhit, Badaun, and Shahjahanpur makes a small region in western Uttar Pradesh. 3 districts namely Bijnor, Meerut and Ghaziabad are sharing a common district boundaries, thus, observed only in a form of compact pocket in western side of the state. A remarkable region in southern part of the state is framed by 8 districts namely Kanpur Dehat, Jalaun, Jhansi, Lalitpur, Hamirpur, Chitrakoot, Kaushambi and Fatehpur. A small region is formed in eastern Uttar Pradesh by the districts like Gonda, Faizabad and Ambedkarnagar. Maharajganj, Kushinagar, Chandauli and Varanasi are forming another region in the same part. District which do not make any region are Saharanpur and Ballia.

Low level score (-0.321 to -0.960) of total traditional material is observed in 23 districts. There are 12 districts constructing an identifiable region in the western plains of Jyotiba Phule Nagar, Bulandshahar, Gautam Buddha Nagar, Aligarh, Kanshiram Nagar, Etah, Firozabad Agra, Mainpuri, Etawah, Auraiya, Kannauj and Farrukhabad. Another region is formed in eastern part of the state by 5 districts namely Shrawasti, Balrampur, Siddharthnagar, Basti and Sant Kabir Nagar. Two districts i.e.,

Deoria and Mau shares a common district boundary and makes a region in eastern part. Districts which does not constitute any region are Baghpat, Mahoba and Sant Ravidas Nagar.

Only 2 districts are coming in very low level (below -0.960) and they are Mathura and Mahamaya Nagar from western part of the state making a tiny region.



Source: Census of India, 2011

Figure. 2 Traditional roof material availability

An examination of data in Table 3 reveals that use of modern material in residential dwellings among the districts of Uttar Pradesh also has a wide variation inside the state. It varies from -0.011 composit z-score in Mathura to 2. 358 composit z-score in Ghaziabad. The whole range is categorized within five groups i.e. very high (above 0.885 score), high (-0.296 to 0.885 score), medium (-0.295 to 0.295score), low (-0.295 to -0.885score) and very low (below -0.885score). Brick built roofs, however, are few and belong only to the rich.<sup>14</sup> Urban influence coupled with relatively higher incomes and better transport are accountable for its occurrence.<sup>15</sup> They are indicative of the general prosperity of the region.<sup>16</sup>

**Table 3:-District wise Distribution of Z-scores of Modern Roof Material in Uttar Pradesh, 2011.**

Districts	Machine made Tiles	Burnt Brick	Stone Slate	Asbestos G.I./Metal/ Sheets	Concrete	Composite Score
Saharanpur	-0.104	0.630	-0.563	0.534	1.568	0.413
Muzaffarnagar	1.483	0.923	-0.488	-0.254	0.878	0.508
Bijnor	0.221	1.560	-0.531	-0.139	0.308	0.284
Moradabad	0.264	1.891	-0.278	-0.094	-0.337	0.289
Rampur	0.227	-0.225	-0.539	0.168	-0.101	-0.094
Jyotiba Phule Nagar	0.431	-0.087	-0.089	-0.604	-0.803	-0.230
Meerut	1.815	0.525	0.091	0.270	0.833	0.707
Baghpat	0.560	-0.830	-0.235	-0.970	-0.806	-0.456
Ghaziabad	5.895	-0.238	1.510	0.849	3.772	2.358
Gautam Buddha Nagar	0.708	-0.931	0.259	-0.295	0.942	0.137
Bulandshahar	0.664	-0.204	2.015	-0.389	0.137	0.445
Aligarh	0.182	-0.902	3.267	-0.276	0.353	0.525
Mahamaya Nagar	-0.717	-1.102	1.489	-0.831	-1.004	-0.433
Mathura	-0.595	-0.998	2.806	-0.325	-0.940	-0.011
Agra	0.451	-0.908	4.336	0.382	-0.095	0.833
Firozabad	-0.166	-0.906	0.798	-0.164	1.126	0.138
Mainpuri	-0.687	-0.947	-0.459	-0.924	1.237	-0.356
Badaun	-0.085	0.677	-0.085	-0.281	-0.185	0.008
Bareilly	0.979	2.051	-0.480	0.413	0.205	0.634
Pilibhit	-0.044	0.418	-0.594	0.100	-0.909	-0.206
Shahjahanpur	-0.357	0.656	-0.542	1.368	-0.527	0.120
Kheri	-0.545	1.936	-0.562	1.792	-1.055	0.313

Sitapur	-0.831	1.928	-0.572	-0.052	-1.013	-0.108
Hardoi	-0.784	1.657	-0.585	-0.350	-0.919	-0.196
Unnao	-0.638	-0.029	-0.504	-0.681	0.527	-0.265
Luchnow	-0.165	2.190	-0.330	1.964	1.566	1.045
Rae Bareilly	-0.688	0.854	-0.542	-0.494	-0.223	-0.219
Farukhabad	-0.804	-0.325	-0.571	-0.793	0.366	-0.425
Kannauj	-0.008	-0.809	-0.555	-0.907	0.388	-0.378
Etawah	-0.649	-1.031	-0.232	-0.807	0.802	-0.383
Auraiya	-0.764	-1.038	-0.523	-1.042	0.597	-0.554
Kanpur Dehat	-0.444	-0.943	-0.488	-0.920	0.289	-0.501
Kanpur Nagar	0.028	0.633	-0.141	1.162	3.055	0.947
Jalaun	-0.629	-0.985	-0.310	-0.804	0.334	-0.479
Jhansi	0.129	-1.139	0.309	-0.686	0.401	-0.197
Lalitpur	-0.782	-1.184	0.183	-1.120	-0.937	-0.768
Hamirpur	-0.764	-1.133	-0.570	-1.112	-0.296	-0.775
Mahoba	-0.628	-1.178	-0.604	-1.123	-0.324	-0.772
Banda	-0.672	-1.127	-0.396	-1.056	-0.466	-0.743
Chitrakoot	-0.701	-1.131	-0.492	-1.158	-0.924	-0.881
Fatehpur	-0.342	-0.189	-0.561	-0.834	-0.249	-0.435
Pratapgarh	-0.117	0.763	-0.521	-0.352	-0.815	-0.208
Kaushambi	-0.867	-0.316	-0.614	-1.049	-1.078	-0.785
Allahabad	0.621	1.819	0.211	0.711	-0.410	0.590
Barabanki	-0.709	0.585	-0.519	-0.348	0.389	-0.121
Faizabad	-0.513	0.621	-0.595	-0.482	-1.001	-0.394
Ambedkar Nagar	0.951	-0.301	-0.553	0.731	-0.208	0.124
Sultanpur	1.288	0.601	-0.458	0.417	-0.407	0.288
Bahraich	0.326	0.679	-0.585	1.071	-1.010	0.096
Shrawasti	-0.827	-0.403	-0.629	-1.010	-1.106	-0.795
Balrampur	-0.837	0.693	-0.617	-0.818	-1.076	-0.531
Gonda	-0.695	1.605	-0.601	-0.545	-1.030	-0.253
Siddharthnagar	-0.687	0.916	-0.552	-0.681	-0.764	-0.354
Basti	-0.796	0.957	-0.614	-0.600	-1.015	-0.414
Sant Kabir Nagar	-0.729	0.106	-0.607	-0.663	-0.911	-0.561
Mahrajganj	0.082	0.257	-0.369	0.277	0.017	0.053
Gorakhpur	0.169	1.654	-0.375	2.297	0.709	0.891
Kushinagar	-0.427	0.539	-0.371	2.220	0.089	0.410

Deoria	-0.210	-0.291	-0.336	1.780	1.984	0.586
Azamgarh	1.345	-0.221	-0.181	2.462	1.762	1.034
Mau	-0.269	-0.616	-0.514	1.567	0.526	0.139
Ballia	0.249	-0.940	0.071	1.468	1.799	0.529
Jaunpur	1.716	-0.623	2.381	1.209	-0.562	0.824
Ghazipur	1.558	-0.841	1.134	2.386	0.052	0.858
Chandauli	-0.149	-0.982	0.328	-0.378	-0.590	-0.354
Varanasi	0.964	-0.606	1.716	1.242	0.246	0.712
Sant Ravidas Nagar (Bhadohi)	-0.390	-1.070	0.467	-0.368	-1.002	-0.473
Mirzapur	0.175	-0.952	0.778	-0.499	-0.977	-0.294
Sonbhadra	-0.122	-1.168	-0.536	0.095	-0.477	-0.442
Etah	-0.730	-0.197	-0.126	-0.738	-0.344	-0.427
Kanshiram Nagar	-0.816	-0.279	-0.454	-0.915	-0.359	-0.564

**Source:** Calculation is based on publication of Census of India, 2011, Data on Availability of Roof Material, H-H Series Tables, Data Dissemination Wing, Office of the Registrar General, New Delhi.

Table 4 shows that there are 5 districts in very high category of modern roof material (above 0.885 score) namely Ghaziabad, Kanpur Nagar, Lucknow, Gorakhpur and Azamgarh. There is no such pattern among these districts which could make a region except Gorakhpur and Azamgarh which shares a common district boundary in eastern part of the state.

High level (0.296 to 0.885 score) in modern roof material has been noticed in 15 districts. A region is constructed by Saharanpur, Muzaffarnagar, and Meerut and another one by Bulandshahar and Aligarh. The principle region in this category is found in a linear belt with 7 districts namely Allahabad, Jaunpur, Varanasi, Ghazipur, Ballia, Deoria and Kushinagar in eastern part of the state. 3 districts which do not form any distinct region are Agra, Bareilly and Hardoi in western Uttar Pradesh.

Medium level (-0.295 to 0.295) of modern roof material has been figure out in 24 districts. A vast contiguous region is formed in the state covering from western to eastern part of the state by 17 districts mainly Bijnor, Jyotiba Phule Nagar, Moradabad, Rampur, Badaun, Pilibhit, Shahjahanpur, Hardoi, Sitapur, Unnao, Barabanki, Bahraich, Gonda, Rae Bareilly, Pratapgarh, Sultanpur and Ambedkarnagar. In this category, there are 7 districts which fail to make any noticeable region and they are Gautam Buddha Nagar, Mathura, Firozabad in western part, Jhansi in central Uttar Pradesh and Mirzapur Maharajganj and Mau from eastern part of the state.

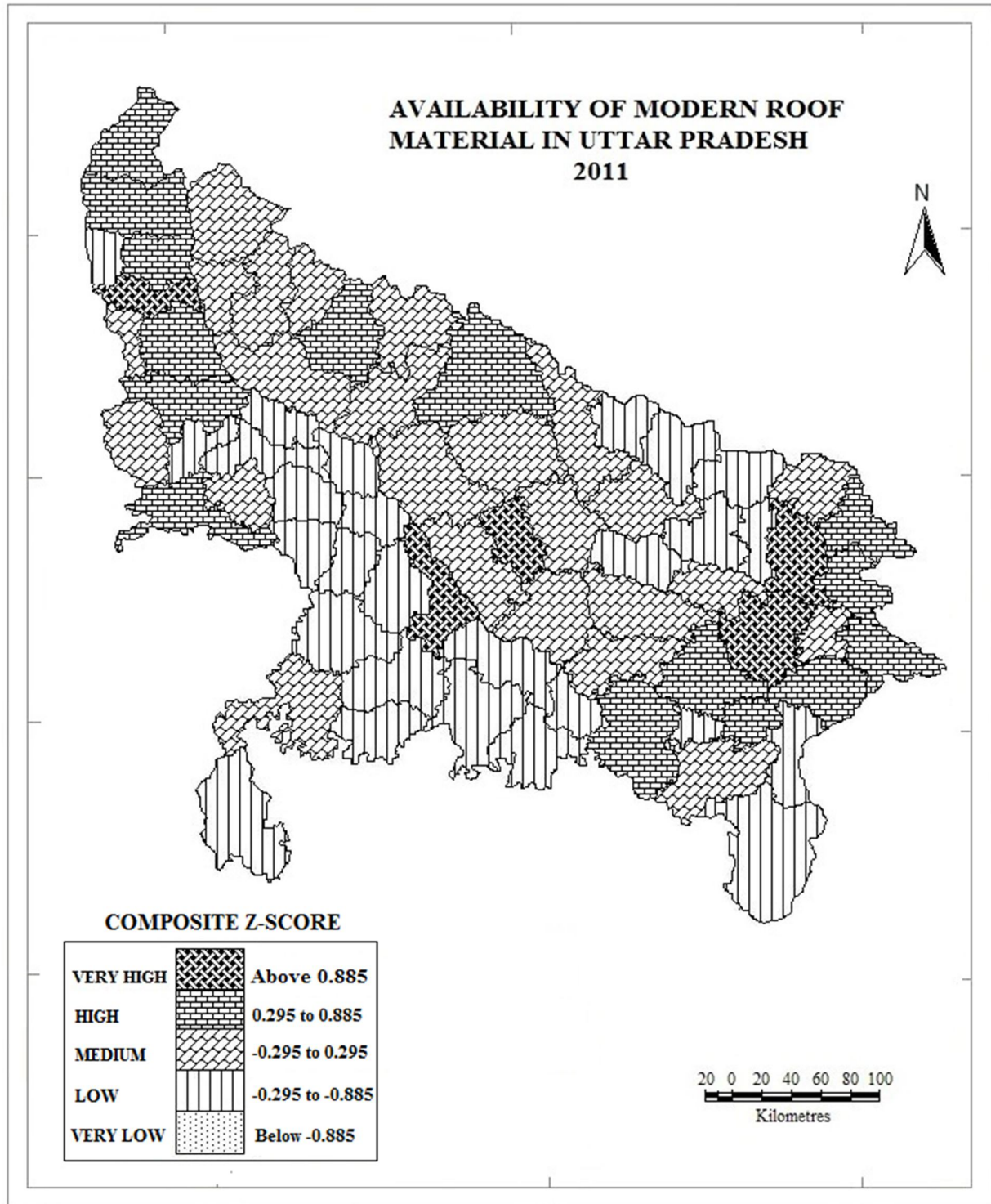
**Table 4: Availability of Modern Roof Material in Uttar Pradesh.**

Category	Score	No. of Districts	Districts
Very High	Above 0.885	5	Gorakhpur, Ghaziabad, Lucknow, Kanpur Nagar and Azamgarh
High	0.295 to 0.885	15	Saharanpur, Muzaffarnagar, Merut, Bulandshahar, Aligarh, Agra, Bareilly, Kheri, Allahabad, Kushinagar, Deoria, Ballia, Jaunpur. Ghaazipur and Varanasi.
Medium	-0.295 to 0.295	24	Rampur, Jyotiba Phule Nagar, Mathura, Pilibhit, Sitapur, Hardoi, Unnao, Rae-Bareilly, Pratapgarh, Barabaanki, Gonda, Mirzapur, Bijnor, Moradabad, Gautam Buddha Nagar, Firozabad, Badaun, Shahjahanpur, Ambedkarnagar, Sultanppur, Bahraich, Maharajganj, Mau and Jhansi.
Low	-0.295 to -0.885	27	Baghpat, Mahamaya Nagar, Mainpuri, Farrukhabad, Kannauj, Auraiya, Kanpur Dehat, Jalaun, Lalitpur, Hamirpur, Mahoba, Banda, Fatehpur, Kaushambi, Faizabad, Shrawasti, Balrampur, Siddharthnagar, Basti, Sant Kabir Nagar, Chandauli, Sant Ravidas Nagar, Sonbhadra, Etah, Kanshiram Nagar, Etawah and Chitrakoot.
Very Low	Below -0.885	-	-

**Source:** Based on Table 3

The distributional pattern of low level (-0.295 to -0.885) of modern roof material which covers 27 districts is also quite uneven. A remarkable region is identified in 16 districts namely Mahamayanagar, Etah, Kanshiram Nagar, Farrukhabad, Mainpuri, Kannauj, Etawah, Auraiya, Kanpur Dehat, Jalaun, Hamirpur, Mahoba, Banda, Fatehpur, Chitrakoot, and Kaushambi in southern part of the state. Another patch of a region in north eastern part of the state is composed by 6 districts namely Shrawasti, Balrampur, Siddharthnagar, Sant Kabir Nagar Basti and Faizabad. A region with only two districts is formed by Sonbhadra and Chandauli in eastern Uttar Pradesh. Districts which do not fall under region are Sant Ravidas Nagar, Lalitpur and Baghpat.

No district is found in very low (below -0.885) category.



Source: Census of India, 2011

**Figure.3 Modern Roof Material Availability**

## **CONCLUSION AND SUGGESTIONS**

The overall analysis of the study reveals that the use of traditional roof material is more in eastern and central parts of the state with dominant regions of very high, high and medium category. And the use of modern roof material among all the districts in Uttar Pradesh is found very high, high or medium in a belt running from western to eastern covering few districts from central part of the state. The uneven distribution of different roof materials in all the districts of the state is may be because of unequal distribution of resources to the people on one hand and on the other, economic and social disparity in the standards of living of the people. The traditional roof material is used by poor people for building their dwellings as they are unaffordable for good quality housing material, whereas modern roof materials are affordable by economically well off class. The study also depicts that few districts are common in the same categories of both traditional and modern roof material. This may be because of high population density and vast level of horizontal and vertical inequality in the state. The following measures may be adopted for minimizing the inter-district variations in respect of availability of roof material in Uttar Pradesh.

- Proper implementation and regular monitoring of schemes and programs launched by Government the state and the country for better housing and poverty alleviation.
- The engineers and scientist have to be inspired to develop new techniques of house construction, that the comparatively cheaper and durable house may be constructed in various part of the state on the basis of easily available construction material.
- Government should develop such housing policies which promote cooperative and group housing societies for the poor and low-income people of urban areas and provide easy access to poor in finance as well as land and materials for building houses at reasonable rates and it may also review the entire gamut of laws relating to land tenure, land acquisition and ceiling to apartment, ownership, municipal regulations and rental laws (Ahuja, 2007).
- The State should encourage the development of Cooperative Housing Societies among industrial workers. Both Government and the employers should advance loans to the cooperative societies or their members at concessional rate of interest.
- The existing Subsidized Industrial Housing Schemes should continue.
- Housing Boards should be set up in the state and the Central Government should continue to finance these Boards as at present, but on a much larger scale.



- Adequate fiscal and monetary incentives should be provided to employers to encourage them to build houses for their employees.
- Incentives for workers' housing by employers should be so designed as to keep rents within a range of 10 per cent of the workers' earnings.

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