

Chapter 5

Identification of Few Influential Parameters

5.1 Introduction

The increase in the urban population is the primary cause for ever-expanding urban sprawl. The growth in the population may be due to natural causes or due to immigration. In case of urban expansion, the latter has a significant role to play. With the ever-increasing size of the population, there is an inherent demand for provisions for accommodation, education, administration, and security, leading to developmental initiatives in the form of infrastructure and services encroaching upon open spaces, green lands, and barren lands.

The East Sikkim District of the State of Sikkim serves as one good example. It has been observed through studies that growth in population is one of the critical factors that has influenced Urban Land Expansion (ULE) of the East District of Sikkim, i.e., increase in the size of the built-up area. Rural-to-urban migration (i.e., intrastate migration) in pursuit of better education, employment, entrepreneurial endeavors, and health provisions has further accelerated rapid urban growth, thereby accelerating sprawl expansion. Further, it has also been observed in case of East Sikkim interstate in-migration for better business/employment opportunities has led to increased demand, thereby accelerating sprawl within a short period of time. For example, the onset of pharmaceutical companies, induction hydropower projects, and the establishment of universities have tremendously escalated demand, resulting in urban expansion.

In this section an effort has been made to unveil all the associated critical factors that directly or indirectly has influenced the urban growth in the East Sikkim District of the State of Sikkim.

5.2 Objective

With respect to the motivation, the objectives of this section are:

- a) identify all the critical factors directly or indirectly influencing sprawl
- b) quantify all of these factors for building the statistics
- c) determine temporal trends wherever there are substantial evidences for analysis

5.3 Methodology pursued

Phase 1: Identify critical factors influencing growth

- Identify demographic factors such as population, households
- Identify other factors such as administration, academics, health, projects, tourism entities, hydro-power projects industries, and government projects

Phase 2: Draw statistical evidence from all the identified factors

Phase 3: Determine temporal trends

5.4 Identification of critical factors influencing growth and statistical evidence

5.4.1 Identification of Demographic Factors

a) Population:

With reference to various census data published by the office of the Registrar General and Census Commissioner, India under Ministry of Home Affairs, Government of

India regarding the state of Sikkim, the description of the population of the State of Sikkim, the urban population of the State of Sikkim, and the urban population of the East Sikkim District of the State of Sikkim from 1981 to 2022 is represented in table 5.1 [212][213][214][215][216].

Table 5.1: Description of the Population Distribution

Description	1981	1991	2001	2011	2022
Urban Sikkim	51084	36984	59870	153578	164432
Urban East Sikkim	43242	31821	52852	122487	131201
Urban Rest of Sikkim	7842	5163	7018	31091	33231
Rural Sikkim	265301	368521	480981	456999	473618
Total Population	316385	405505	540851	610577	638050

a) Determination of Growth rate, Percentage Share and Percentage Increase

Growth rate has been determined using

$$\text{Growth rate (\%)} = \frac{\text{Population}_y - \text{Population}_x}{\text{Population}_x} * 100 \dots\dots\dots \text{Equation 5.1}$$

Here,

- Population_y and Population_x represents population in year consecutive years y and x where y > x

Percentage share has been determined using

$$\text{Share (\%)} = \frac{\text{Population}_y}{\text{Total Population}} * 100 \dots\dots\dots \text{Equation 2}$$

Here,

- Population_y refers to population in category 'y'
- Total Population refers to total population

Percentage Increase has been determined using

$$\text{Percentage Increase (\%)} = \frac{\text{New Value} - \text{Old Value}}{\text{Old Value}} * 100 \dots\dots\dots \text{Equation 3}$$

Here

- New Value and Old Value are instances of same variables at different time frames

Table 5.2: Determination of % share and % Growth Rate

Description	1981	1991	2001	2011	2022	Average
Urban Sikkim	51084	36984	59870	153578	164432	-
Urban East Sikkim	43242	31821	52852	122487	131201	-
Urban Rest of Sikkim	7842	5163	7018	31091	33231	-
% Share of Urban East Sikkim to Urban Pop.	84.65	86.04	88.28	79.76	79.79	83.70
% Share of Urban Rest of Sikkim to Urban Pop.	15.35	13.96	11.72	20.24	20.21	16.30
% Share of Urban Sikkim to State Pop.	16.15	9.12	11.07	25.15	25.77	17.45
% Share of Urban East Sikkim to State Pop.	13.67	7.85	9.77	20.06	20.56	14.38
% Share of Urban Rest of Sikkim to State Pop.	2.48	1.27	1.30	5.09	5.21	3.07
Gro. Rate of Urban East Sikkim	-	-26.41	66.09	131.75	7.11	-
Gro. Rate of Urban Rest of Sikkim	-	-34.16	35.93	343.02	6.88	-
Rural Sikkim	265301	368521	480981	456999	473618	-
% Share of Rural Pop. of Sikkim to State Pop.	83.85	90.88	88.93	74.85	74.23	82.55
Gro. Rate of Rural Sikkim	-	122.94	30.52	-4.99	3.64	-
Total Population	316385	405505	540851	610577	638050	-
Gro. Rate of Total Population	-	28.17	33.38	12.89	4.50	-

Inference 5.1: Population Count of Urban Spaces in Sikkim from 1981 to 2022
(represented in figure 5.1 and table 5.2)

- It has been observed that the urban population in the East Sikkim district of the state Sikkim has increased from 43242 in 1981 to 131201 in 2022 with percentage increase of 203.41 % over an interval of 41 years with an average increase of 4.96 % per year.
- Further, it has been observed that the urban population in the other three districts of Sikkim has increased from 7842 in 1981 to 33231 in 2022 with percentage increase of 323.76 % over an interval of 41 years with an average of only 107.91 % per district and 2.63 % per year.
- Therefore, it is implied that the urban population of East Sikkim is increasing at a faster rate than rest of the state.

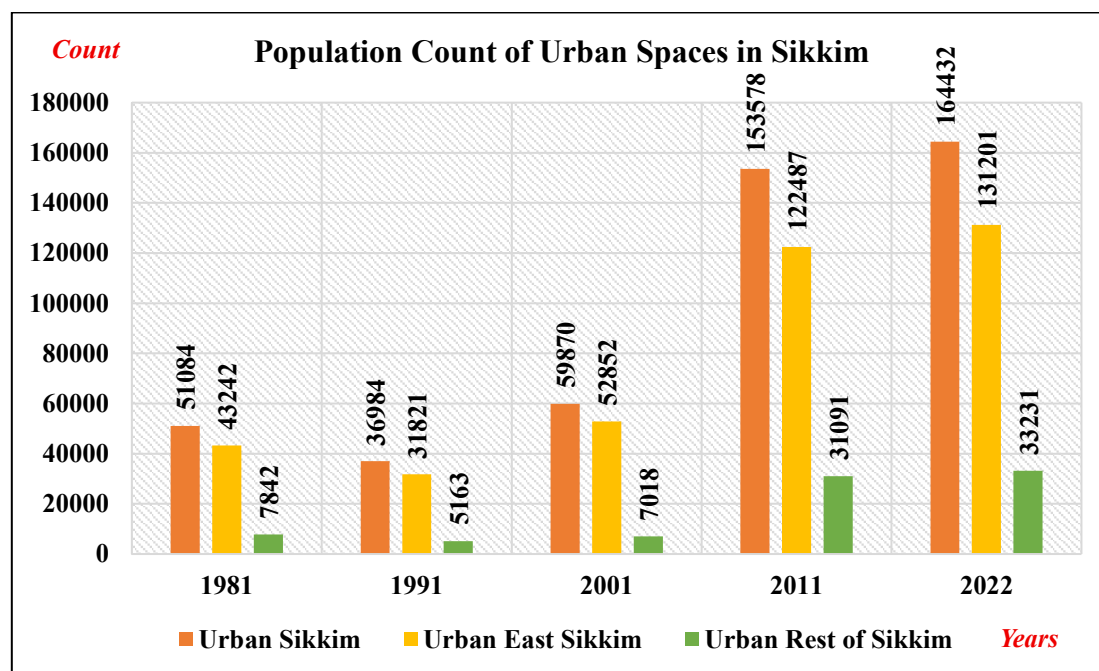


Figure 5.1: Population Count of Urban Spaces in Sikkim from 1981 to 2022

Inference 5.2: Percentage Share of Urban Population (as represented in figure 5.2 and table 5.2)

- It has been observed that the urban population of East Sikkim district of the State of Sikkim has contributed an average of 83.70 % to the total urban population of the state in last 41 years.
- Further, it has been observed that the urban population in the other three districts of Sikkim has contributed on an average of 16.30 % to the total urban population of the state with mere 5.43 % per district in last 41 years.
- Therefore, it is implied that the urban population of State of Sikkim has maximum contribution from the East Sikkim District.

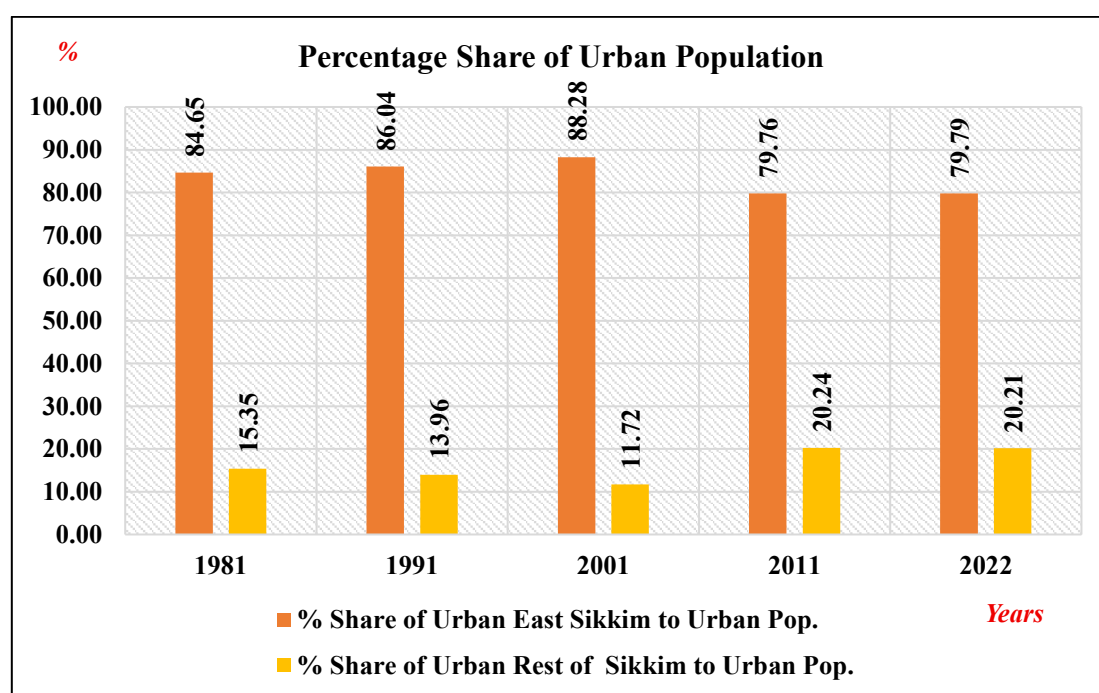


Figure 5.2: Percentage Share of Urban Population from 1981 to 2022

Inference 5.3: Percentage Share of Urban Population to States Population (represented in figure 5.3 and table 5.2)

- It has been observed that the urban population of the East District of Sikkim has contributed an average of 13.67 % to the overall states population over last 41 years.
- Further, it has been observed that the urban population of the other three districts of Sikkim has contributed an average of only 2.48 % to the overall states population over last 41 years with an average of 0.82 % per district.
- Therefore, it is implied that the urban population of East Sikkim contributes maximum urban population to the overall states population.

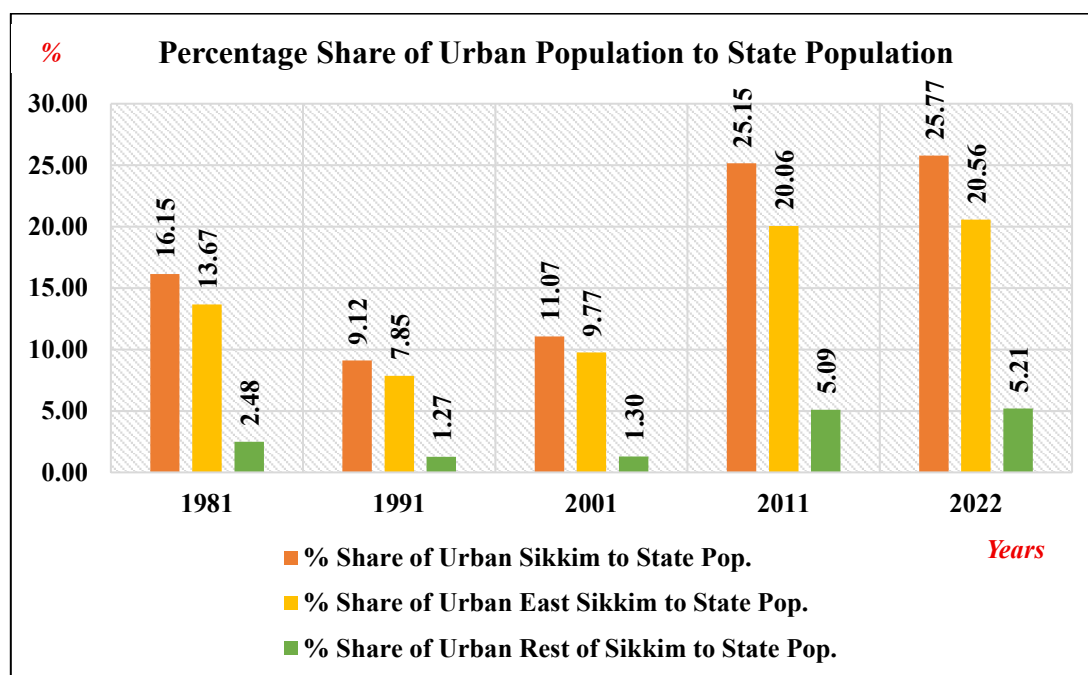


Figure 5.3: Percent age Share of Urban Population to the states population from 1981 to 2022

Inference 5.4: Growth Rate of Urban, Rural and State Population (as represented in figure 5.4 and table 5.2)

- It has been observed that current growth rate of urban poulation in the East Sikkim district is 7.11 %.
- It has also been observed that the current growth rate of urban poulation in the other three districts cumilatively growing at the rate of 6.88 % with an average of 2.29 % per district.
- The rural population of the state is currently growing at the rate of 3.64 %.
- The states population is currently growing at 4.5 %.

Therefore, it can be infered that the urban population in East Sikkim district is increasing in a considerably faster rate.

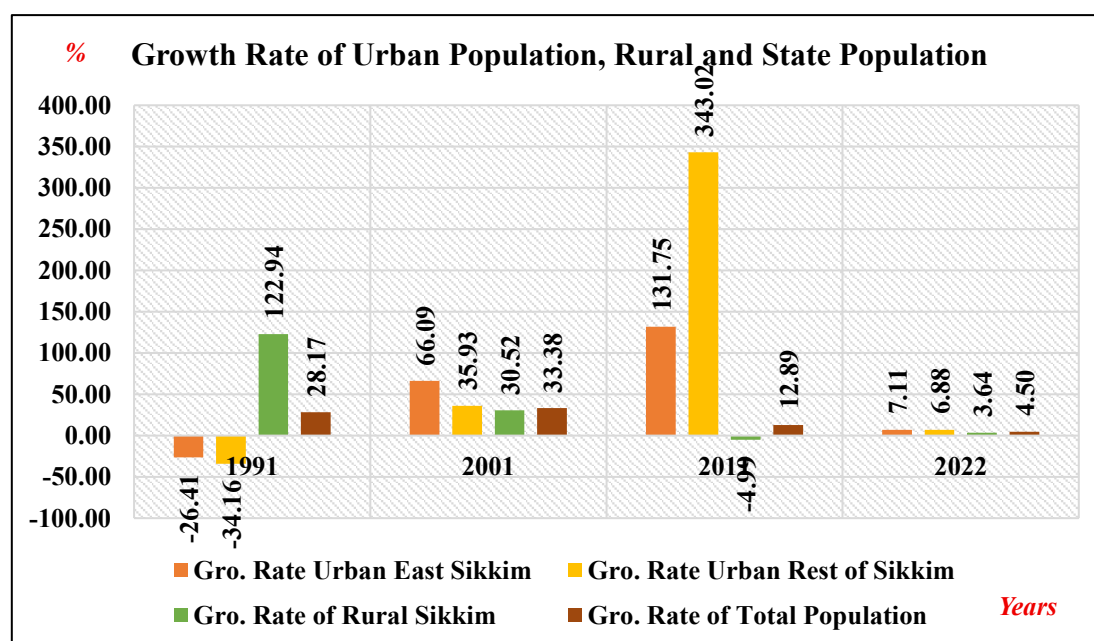


Figure 5.4: Growth Rate of Urban Population, Rural and State Population from 1981 to 2022

b) Households

With reference to various census data published by the office of the Registrar General and Census Commissioner, India under Ministry of Home Affairs, Government of

India regarding the state of Sikkim, the description of the households in the State of Sikkim, the urban households in the State of Sikkim, and the urban households in the East Sikkim District of the State of Sikkim from 1981 to 2022 is represented in table 5.1 [212][213][214][215][216]. The relevant data was found missing in the 1991 census therefore for the purpose of ensuring continuity the values were interpolated considering the respective entries from 1981 and 2001.

Inference 5.5: Disproportionate distribution of Household among various Districts of Sikkim (with reference to table 5.3)

Table 5.3: Household Distribution among various Districts of Sikkim

Household	1981	1991	2001	2011	2022	% increase
Urban East Sikkim	9063	10334	11605	28691	39719	338
Urban Rest of Sikkim	1603	1498	1393	7027	8985	461
Urban Sikkim	10666	11832	12998	35718	48704	357
Rural East Sikkim	18218	30597	42976	32876	41364	127
Rural Rest of Sikkim	30973	44611	58249	60412	72005	132
Rural Sikkim	49191	75208	101225	93288	113369	130
Total East Sikkim	27281	40931	54581	61567	81083	197
Total Rest of Sikkim	32576	46109	59642	67439	80990	149
Total Sikkim	59857	87040	114223	129006	162073	171

In the table 5.3 the census data for the year 1991 was synthesized by determining average of to adjacent years i.e. 1981 and 1991.

- **Regarding Urban Household**

- There has been an unprecedented increase in the number of urban households in East Sikkim District from 9063 in the year 1981 to 39719 in the year 2022 with an alarming increase of 338 %.
- There has been a marginal increase in the number of urban households in other districts of the state of Sikkim from 1603 in the year 1981 to 8985 in the year 2022 with an cumulative increase of 461 % (with an average of increase of 154 per district)
- There has also been a marginal increase in the number of urban households in the entire state of Sikkim from 10666 in the year 1981 to 48704 in the year 2022 with an overall increase of 357 % (with an average of increase of 89.4 % per district).
- Therefore, it is implied that the concentration of urban household is greatly skewed towards East Sikkim District.

- **Regarding Rural Household**

- There has been a marginal increase in the number of rural households in East Sikkim District from 18218 in 1981 to 41364 in the year 2022 with an increase of 127 %.
- The increase in the number of rural households in rest of the districts has been marginal from 30973 in the year 1981 to 72005 in the year 2022 with a cumulative increase of 132 % (with an average of increase of 44.15 per district)
- There has also been a marginal increase in the number of urban households in the entire state of Sikkim from 49191 in the year 1981 to 113369 in the year

2022 with an overall increase of 130 % (with an average of increase of 32.62 % per district).

- Therefore, the dismal increase in the rural household reflects that the priority of the larger section of the Sikkimese society is to converge towards East Sikkim District for various known and unknown reasons.
- The evidences cited does support the findings of the previous sections. The same is neatly expressed in Figure 5.5 and 5.6.

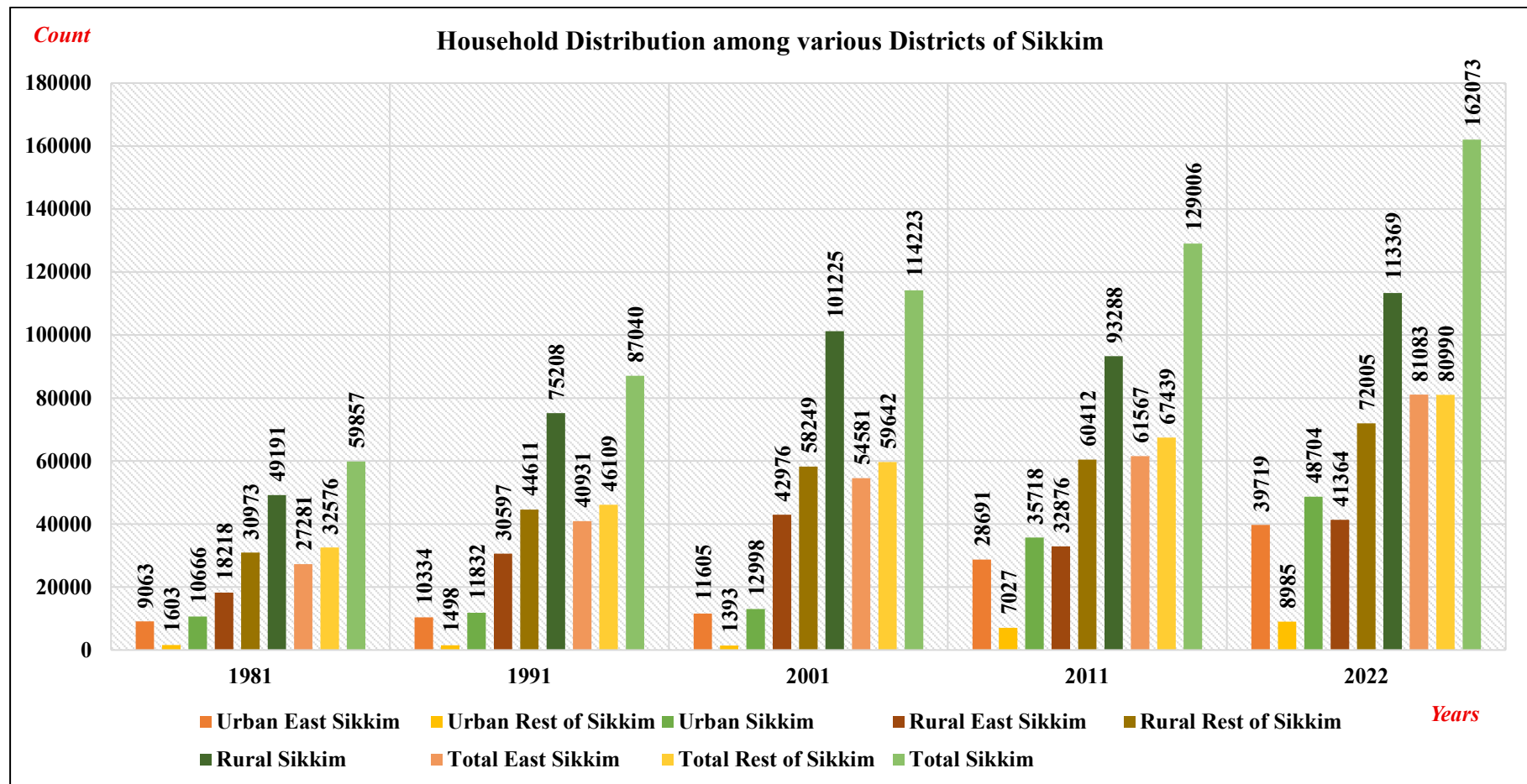


Figure 5.5: Household Distribution among various Districts of Sikkim.

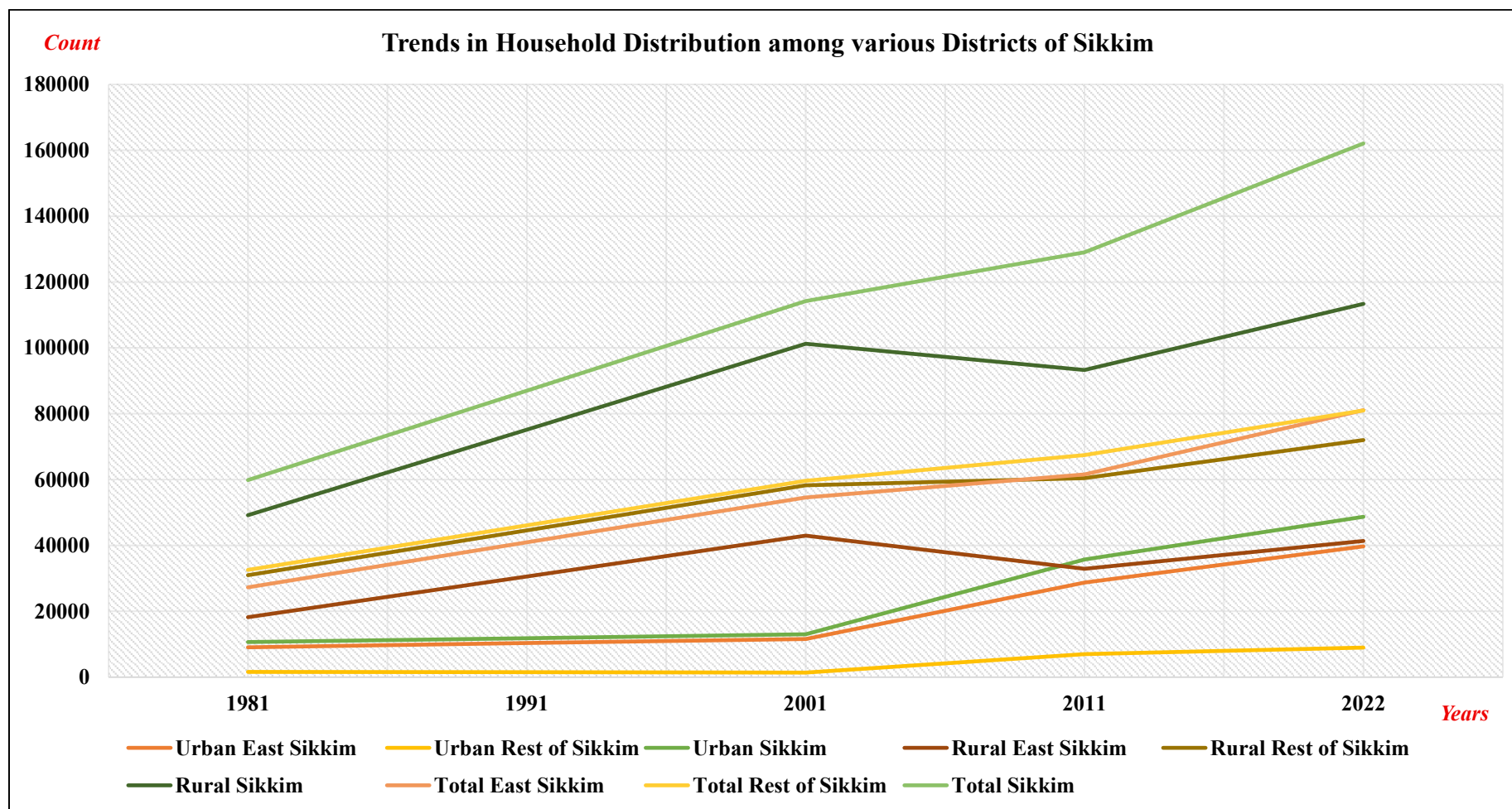


Figure 5.6: Trends in Household Distribution among various Districts of Sikkim

Inference 5.6: Percentage share of Household among various Districts of Sikkim
(with reference to table 5.4)

Table 5.4: Percentage Share of Households among various Districts of Sikkim

Household	1981	1991	2001	2011	2022	Average
Urban East Sikkim	84.97	87.34	89.28	80.33	81.55	84.69
Urban Rest of Sikkim	15.03	12.66	10.72	19.67	18.45	15.31
Rural East Sikkim	37.04	40.68	42.46	35.24	36.49	38.38
Rural Rest of Sikkim	62.96	59.32	57.54	64.76	63.51	61.62
Total East Sikkim	45.58	47.03	47.78	47.72	50.03	47.63
Total Rest of Sikkim	54.42	52.97	52.22	52.28	49.97	52.37

- **Regarding Urban and Rural Household**
 - The proportion of urban household in the East District and the remaining districts over the years from 1981 to 2022 has remained approximately constant at an average of 84.9 % and 15.31 % respectively.
 - The proportion of rural household in the East District and the remaining districts over the years from 1981 to 2022 has also remained approximately constant at an average of 38.38 % and 61.62 % respectively.
 - The proportion of total household in the East District and the remaining districts over the years from 1981 to 2022 has also remained approximately constant at an average of 47.63 % and 52.37 % respectively.
 - Therefore, it can be inferred that urban movement has always been the priority of the society.
- The evidences cited does support the findings of the previous sections. The same is neatly expressed in Figure 5.6, 5.7 and 5.8.

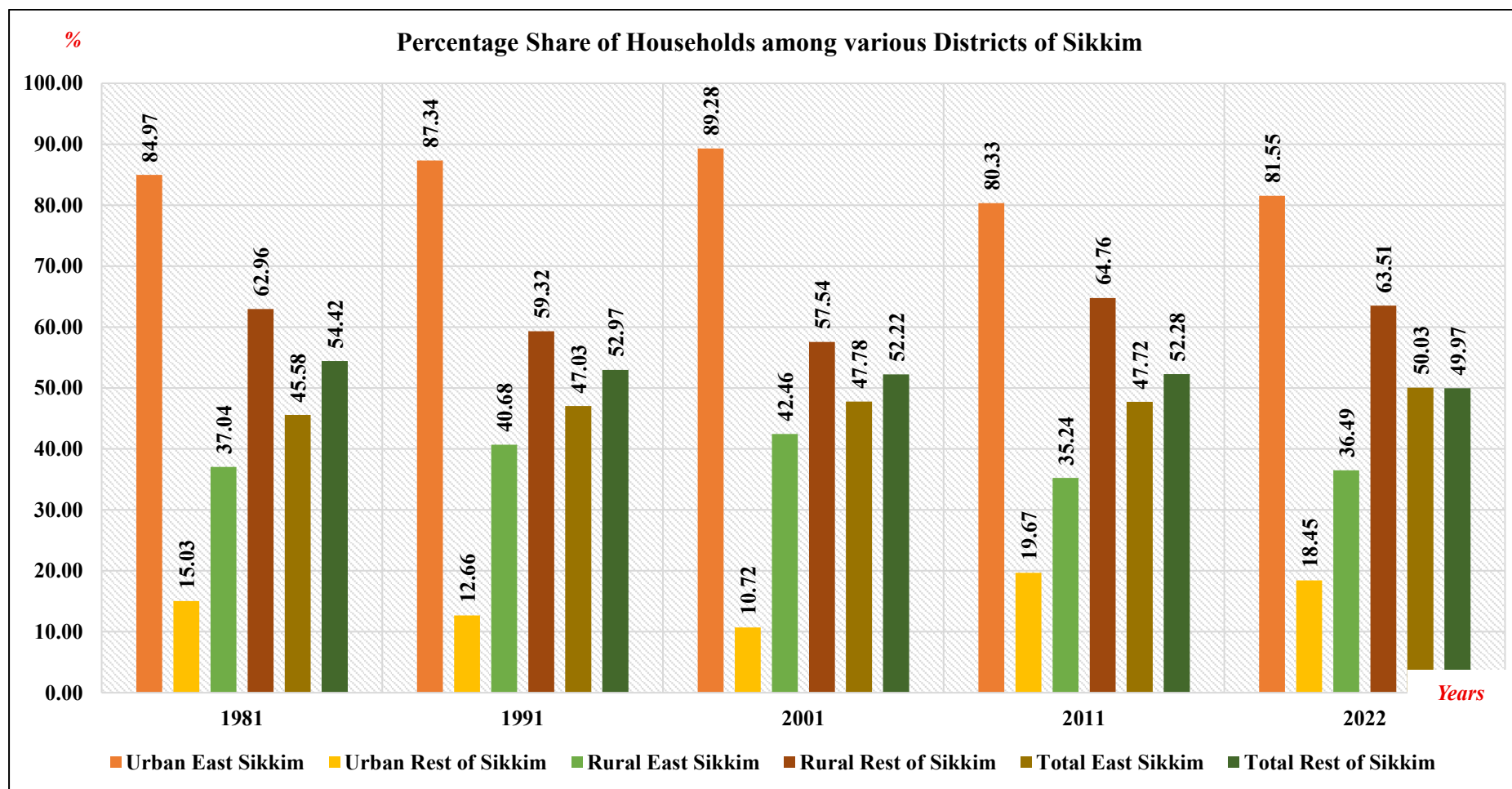


Figure 5.7: Percentage Share of Households among various Districts of Sikkim

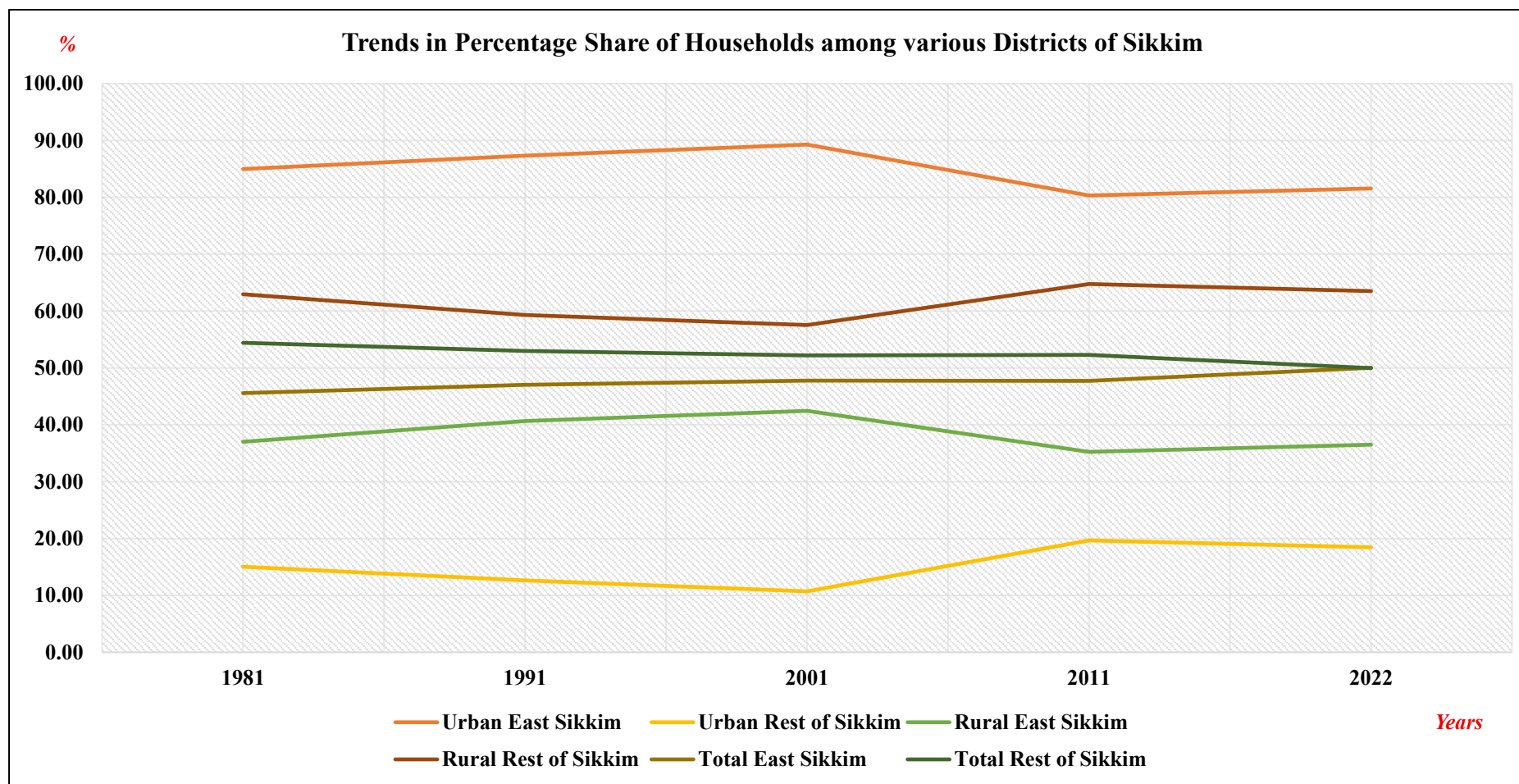


Figure 5.8: Trends in Percentage Share of Households among various Districts of Sikkim

5.4.2 Identification of some of the influential factors:

Inference 5.7: Influential factors (here 13 factors have been considered as represented in figure 5.9 and 5.10)

a) States Institutional Administrative Units:

- There are 46+ departments under the state government of Sikkim [217], all of the 46 departments have their headquarters in the East Sikkim District.

b) Academic Institutions:

- There are 1397+ schools in the State of Sikkim out of which 472+ schools are in East District [218].
- There are 23+ colleges in the State of Sikkim out of which 16+ colleges are in the East District [219].
- There are 17+ universities in the State of Sikkim out of which 7+ premiere universities are in the east district [219].

c) Health Institutions:

- There are 184+ health institutions in the State of Sikkim out of which 60+ institutions are in East Sikkim [220].

d) Tourism Entities:

- There are 768+ hotels in the State of Sikkim out of which 613+ are in the East District [221].
- There are 1305+ homestays in the State of Sikkim out of which 597+ are in the East District.
- There are 30+ tourist destinations in the East District.

e) Infrastructural Projects

- There are 34+ power projects in the State of Sikkim under Independent Power Producer (IPP), Joint venture and Sikkim Power Development Corporation Limited (SPDCL) out of which 10+ power projects are in the East District [222].
- There are more than 10+ government projects in the State of Sikkim out of which 7+ are in the East District.

f) Industries and Manufacturing units [223][224][225]

- There are 28+ Pharmaceutical Companies in the State of Sikkim out of which 21+ are in East District.
- There are 8+ Distilleries in the State of Sikkim out of which 4+ are in East District.
- There are 2+ Breweries in the State of Sikkim out of which 1 is in East District.

There are 10+ manufacturing industries in the State of Sikkim out of which 7+ is in East District.

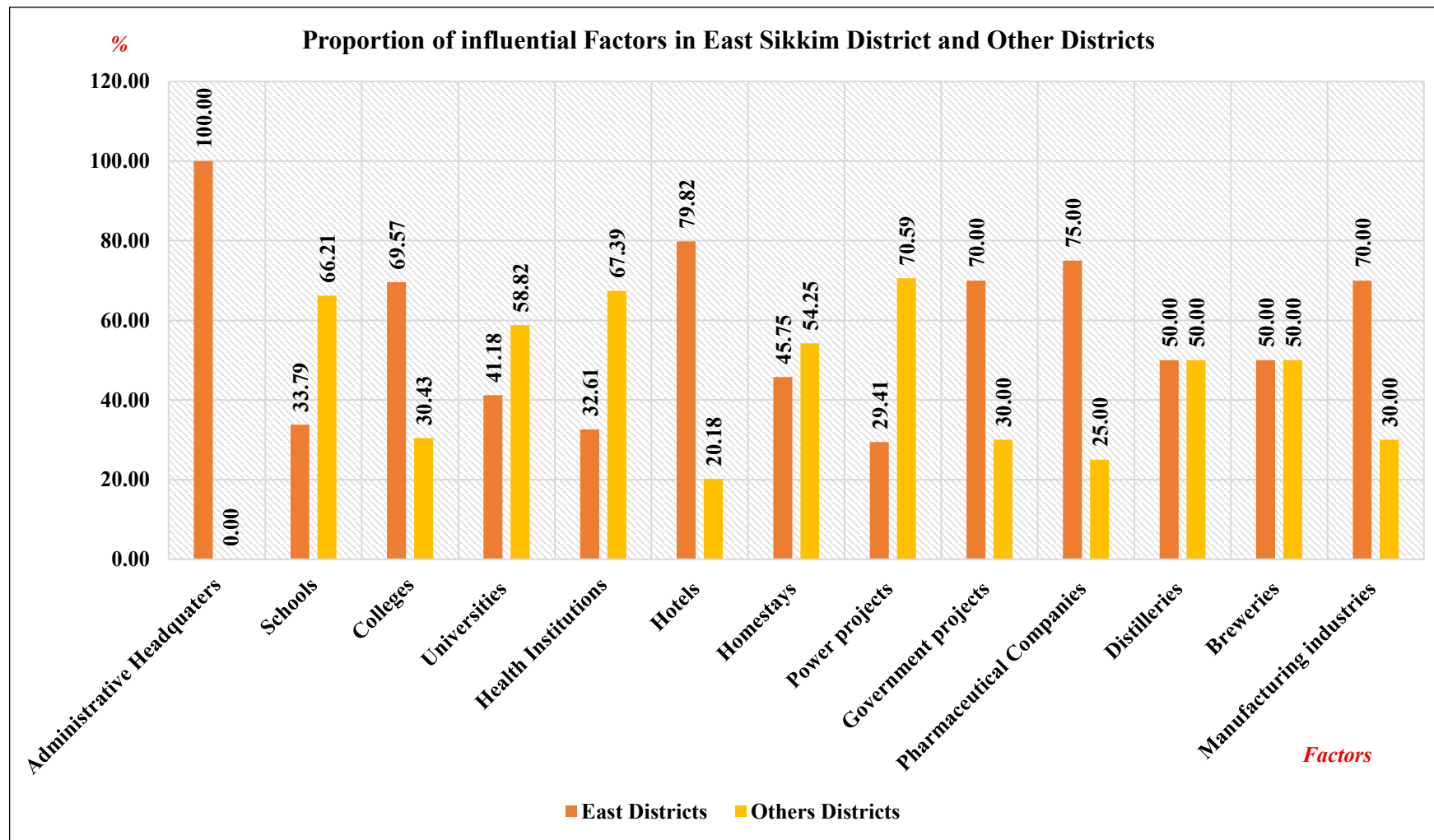


Figure 5.9: Proportion of influential Factors in East Sikkim District and Other Districts

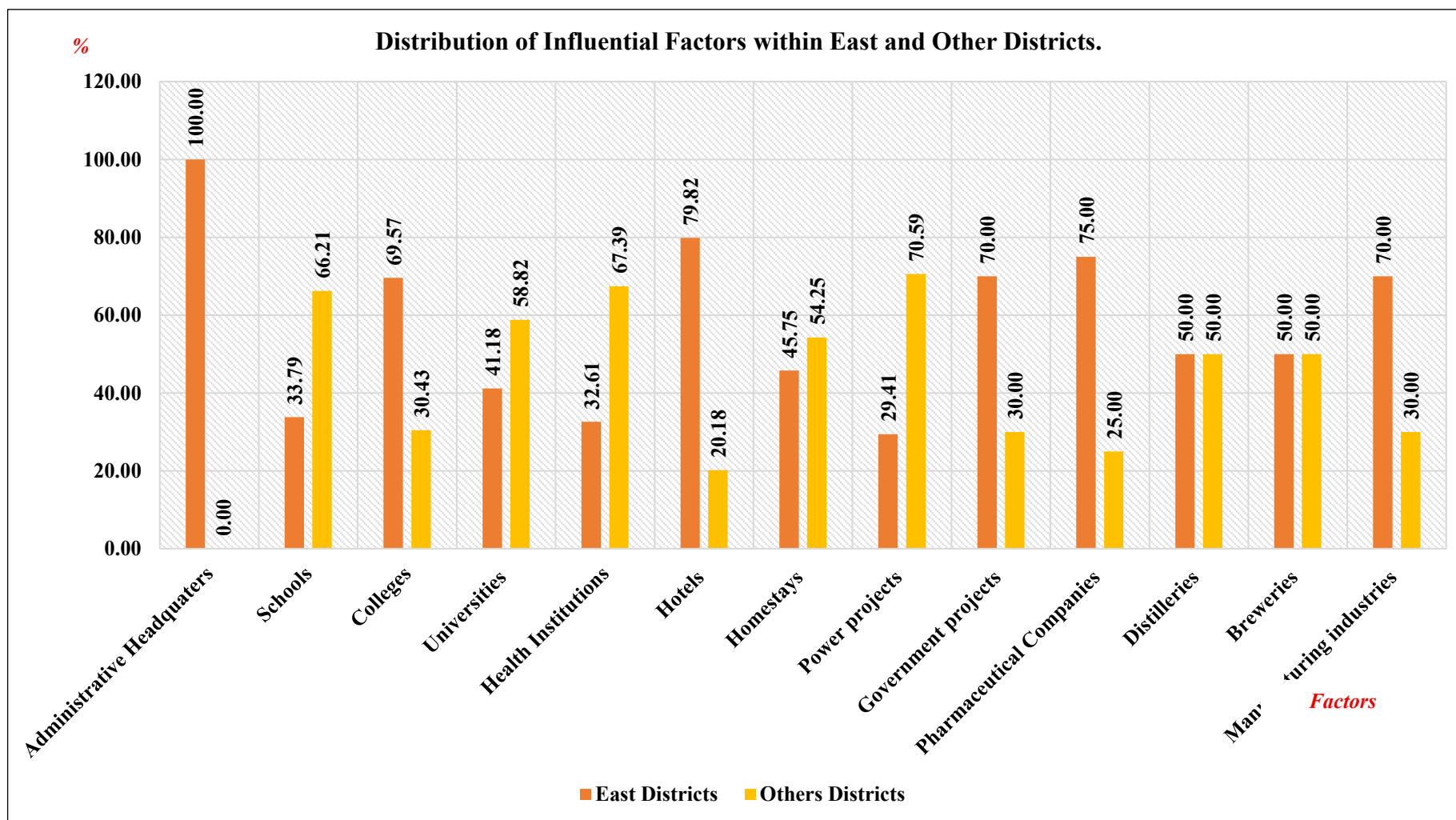


Figure 5.10: Distribution of Influential Factors within East and Other Districts.

5.5 Conclusion

The research initiative has unveiled some critical and concerning issues explicitly responsible for the progression of urban sprawl in the East Sikkim district of the State of Sikkim. Most importantly the disproportionate rate of increase in urban population of East Sikkim. The urban population of the district is growing at a steady rate of 7.11 %, whereas the rest of the districts are cumulatively growing at 6.88 %, rural population is growing at 3.54 % and the state is growing at 4.5 % annually. It has been determined that the urban population of the East Sikkim contributes maximum which is estimated around 83.7 % to the total urban population of the state. It has been observed that there has been an unprecedented increase of 338 % in the number of urban households in East Sikkim District with an average share of 84.69 % from 1981 to 2022. In contrast there is a marginal increase in the urban households in rest of the districts with an average increase of 127 %. There are several factor that has led to the increase of the population some of which are 100.00 % of administrative headquarters, 33.79 % of schools, 69.57 % colleges, 41.18 % universities, 32.61 % of health institutions, 79.82 % of hotels, 45.75 % of homestays, 29.41 % of power projects, 70.00 % of government projects, 75.00 % of pharmaceutical companies, 50.00 % distilleries, 50.00 % breweries and 70.00 % manufacturing industries has been established in the East Sikkim District disproportionately over burdening it causing a toll on public infrastructure. The result was further substantiated by the inferences drawn from processing of remotely sensed data from 2000 to 2023.