Development Pattern of Physical Infrastructure in Non-Tribal Areas of Himachal Pradesh

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Abstract

The present study purports to study the regional variations in the development level of physical infrastructure in the non-tribal areas of Himachal Pradesh during last three decades of 20th century. The study has been conducted at tehsil level by utilizing multi-temporal secondary data available for 1971, 1981, 1991, 2001 and 2011 census years. The development pattern in the physical infrastructure has been examined with reference to 23 indicators covered under five broad sectors namely transport, power, communication, agriculture and sanitation infrastructure. The principal component analysis technique has been used to obtain an overall composite score of development. The study reveals that there has been development in overall physical infrastructure between 1971 and 2001 at the tehsil level. However, the development has been highly uneven and irregular over time and space. The growth in physical infrastructural facilities has also been inadequate per size of population. It is more evident from the fact that the share of tehsils in lowly developed category (both low and very low) of physical infrastructure has been more than 50% during all the reference periods.

Introduction

Infrastructure is the hallmark of socio-economic development as the superstructure of a nation's overall wealth hinges on it. The most important part of infrastructure is physical infrastructure which has a direct impact on growth and overall development of any country. Without physical infrastructure, an integrated and independent modern economy cannot function (Kapil, 2010: 3). The physical infrastructure includes all such activities which provide general facilities and services for carrying on economic activities. Such facilities usually take the form of physical capital formation and may include the long lasting engineering structures, equipments, facilities and the services they provide that are used in economic production. It takes shape in the form of public utilities like power, piped gas, telecommunication, water supply, sanitation and sewerage, solid waste collection and disposal and public works such as construction of major dam and canals for irrigation, roads and other mode of transport such as railways, waterways and airports (Tiwari, 2000: 12).

The physical infrastructure is the instrument for the formation of the bases and foundation for origin, generation, stimulation, acceleration and continuous production of economic activities and diffusion, distribution and marketing ideas, researches and inventions, technology and production. It also influences directly or indirectly the process of modernization and transformation of society (Verma and Shahi, 1988: 56). Rosenstein observed that physical infrastructure refers to the social overhead capital which

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comprises of all those basic industries like power, transport or communications which must precede the more quickly yielding directly productive investments and constitute the framework or infrastructure and the overhead cost of the economy as a whole (quoted in Joshi, 1990: 4). Physical infrastructure is capital intensive as this sector requires huge capital expenditure in some cases i.e. port, power, irrigation, transportation etc. (Bagchi, 2010: 13). Physical infrastructure has emerged as the biggest constraint to the country's attempt to achieve 9% plus economic growth. India is ranked 86th out of 139 countries in quality of overall infrastructure. Her position is much below than other emerging countries such as China at 50 and Brazil at 62 in world economic forum's 2010-2011 global competitive index (Economic Times Bureau, 2011:1).

Among various physical infrastructural facilities which are considered essential for promotion of economic development, transport is considered to be the foremost in reducing the gap between the developed and the distressed (Kanchan and Shukla, 1987: 57). Road transport has close linkages with the economic development and social integration of the country. It is the dominant mode of transport for movement of passengers and freight in India. Thus, to promote socio-economic development of a country, it is essential to have adequate transport infrastructural facilities (Arasu, 2008: 155). Power is another basic infrastructural facility which is required for all the sectors of the economy, like agriculture, industry, information and technology etc. (Ponraj, 2001: 293). With the growth of population and increase in the use of electronic infrastructure in daily life, it is quite natural that the demand for electricity has been growing at a faster rate (Selvaraj, 2001: 306). Thus, in order to meet the increasing demand of power, proper infrastructural set up is required to fulfil the supply and to strike a balance.

Today each and every corner of the world has been connected by the modern communication system comprising of computerised system of postal services which forms an integral part of the development process (Buvaneshwari, 2001: 73). Communication plays equally important role in almost all the spheres of activity i.e. agriculture, industry, trade and commerce. Thus, communications as an infrastructure helps in enhancing human welfare so that the barriers of distance are overcome. Among other physical infrastructure, agriculture is the most basic form of infrastructure in India as it forms the source of livelihood for more than 50% of the population. Agriculture in India is rain dependent thereby showing the importance of proper means of irrigation. Irrigation has two significant roles to play-protective and productive. The optimum utilization of irrigational facilities requires infrastructural support in the form of better transport, marketing, communication, banking, veterinary services etc. Hence, it indirectly influences the establishment of these facilities in the related area, thereby reducing the problem of unemployment, underemployment and seasonal unemployment (Kapil, 2010: 20). Rapid development has led to an increase in demand for sanitation services in the urban and rural areas of the country and millions of people still do not have access to it (Dash, 2008: 96). This creates an alarming situation as proper sanitation facilities directly affect the health of the population and thereby affect the manpower of the country.

The physical infrastructure therefore plays an important role in the overall development of the country by fostering the development of all the important sectors of economy. There exists a positive and significant correlation between physical infrastructure, per capita income and human development of the country. Thus, in order to maintain sustained economic and social

growth, physical infrastructure needs to be dealt first (Shah and Patel, 2006: 27). A low level of infrastructure causes the government to face higher marginal cost at every level of production. With better physical infrastructural services, the marginal cost curve shifts downward (Ghosh and De, 1998: 3039).

Himachal Pradesh being a mountainous and hilly state is also a subset of the wider similar national picture. The socio-economic base of the state started with a weak economic support and a low level of human skills essential for modern development (Himachal Pradesh Development Report 2005: 26). The process of development started in Himachal Pradesh with the implementation of first five year plan with a modest size of Rs. 5.27 crores. During the first five year plan of the state of Himachal Pradesh, expenditure on physical and social infrastructure together was more than two-third of the total plan outlay. In fact, the expenditure on physical infrastructure during this period was about five times more than that of social infrastructure. Within physical infrastructure, power and transport sectors received the largest share during the first plan period. However, the expenditure on transport and communication was little less than half 46% of the total plan expenditure on physical infrastructure followed by irrigation and flood control (about 39%). The state government proposes to construct about 7,500 km of roads connecting all the villages and habitations with the population of more than 100 persons. The construction of 2000 km of National Highways and provision of adequate funds for maintenance of the already existing roads are other cardinal points during twelfth five year plan (2012-17). The draft twelfth five year plan documents on energy, agriculture and allied sectors and power sector have made provisions to develop these areas and increase the growth rates (Singh, 2012: 9). It shows we have achieved too less in this regard during the planning period. It has been observed that after achieving the status of full statehood in 1971, a plethora of infrastructural development programmes have been introduced and implemented in the state including tribal areas. Have these development programmes brought any balanced and even development in physical infrastructure at the tehsil level in the study area? It also seeks to investigate the trends and development pattern in the physical infrastructure in the study area.

Objectives of the Study

The present study aims at realizing the following two objectives:

1) To study the trends in the availability of physical infrastructural facilities in the study area.
2) To examine the spatial variations in the level of overall physical infrastructural development at the tehsil level.

Data Base and Methods of the Study

The present study has utilized secondary data of 1971, 1981, 1991, 2001 and 2011Census years and other information published by different departments and corporations of the Himachal Pradesh. Notably, the latest data for 2011 relating to infrastructural development at tehsil level have not yet been finalised and officially released by census department. The multi-temporal secondary data relating to different indices of infrastructure development and other related information have been gathered from District Census Handbooks, Directorate of Census Operations, Shimla, Directorate of Economics and Statistics, Directorate of Land Records, Public Works Department, State Electricity Board and Infrastructure Development Board. The development pattern of physical infrastructure has been examined by considering the following 5 key components, each of which has different number of indicators:

P-1 Transport Infrastructure

i. Road length (km) /10,000 population
ii. Road length (km) /100 sq km area
iii. Metalled road (km) /10,000 population
iv. Metalled road (km) /100 sq km area
v. Motorable double lane road (km) /10,000 population
vi. Motorable double lane (km) /100 sq km area
vii. No. of bridges /1000 km road length

P-2 Power Supply Infrastructure

i. No. of electrified houses /100 residential households
ii. No. of domestic connections /10,000 population
iii. No. of commercial connections /10,000 population
iv. No. of industrial connections /10,000 population
v. No. of agricultural connections /100 sq km net sown area

P-3 Communication Infrastructure

i. No. of post offices /10,000 population
ii. No. of post offices /100 sq km area
iii. No. of telephone sets /1,00,000 population
iv. No. of telephone sets /10,000 residential households

P-4 Agricultural Infrastructure

i. Proportion of net sown area /10,0000 population
ii. Proportion of net irrigated area as percentage of net sown area
iii. Proportion of net sown area to total geographical area
iv. No. of agricultural societies /1,00,000 population
v. No. of agricultural societies /100 sq km of net sown area

P-5 Sanitation Infrastructure

i. No. of toilets /10,000 population
ii. No. of toilets /100 residential households

In all, 23 indicators have been selected to examine the development pattern of physical infrastructure in the study area. The composite index of physical infrastructural development has been constructed by using principal component analysis (PCA) technique. The composite index of infrastructural development is constructed by using PCA technique. Only the 'first principal component' has been used to construct the infrastructural indices of five infrastructural sectors and an overall index of development. The principal component derived for this study is based on the covariance matrix of the relevant variables and weighted average of variables. This method is used as it gives mathematical weightage in a purely objective manner. This method aimed to construct a set of variables Xjs (j=1,2,3…….n) of new variables (Pi) called 'principal component' which are linear combination of the Xs. The first principal component is that linear combination of weighted variables, which captures the highest proportion of the variance in the original variables. The composite scores hence obtained have been categorised into five categories i.e. very high, high, moderate, low and very low levels of development in physical infrastructure. On the basis of these five categories, inter-tehsil wise variations in the level of overall physical infrastructural development have been discussed. The development pattern at the tehsil level has been shown with the help of choropleth maps drawn for all four reference periods. The maps have been prepared on GIS platform using Arc GIS 9.2 package.

Study Area

The study area comprising of non-tribal region of Himachal Pradesh stretches between $30^0$22'40'' to $32^0$58'50" N and $75^0$47'55'' to $78^0$22'47'' E (Fig. 1). It covers about 30,610 sq km area which constitutes about 54.98 % of total

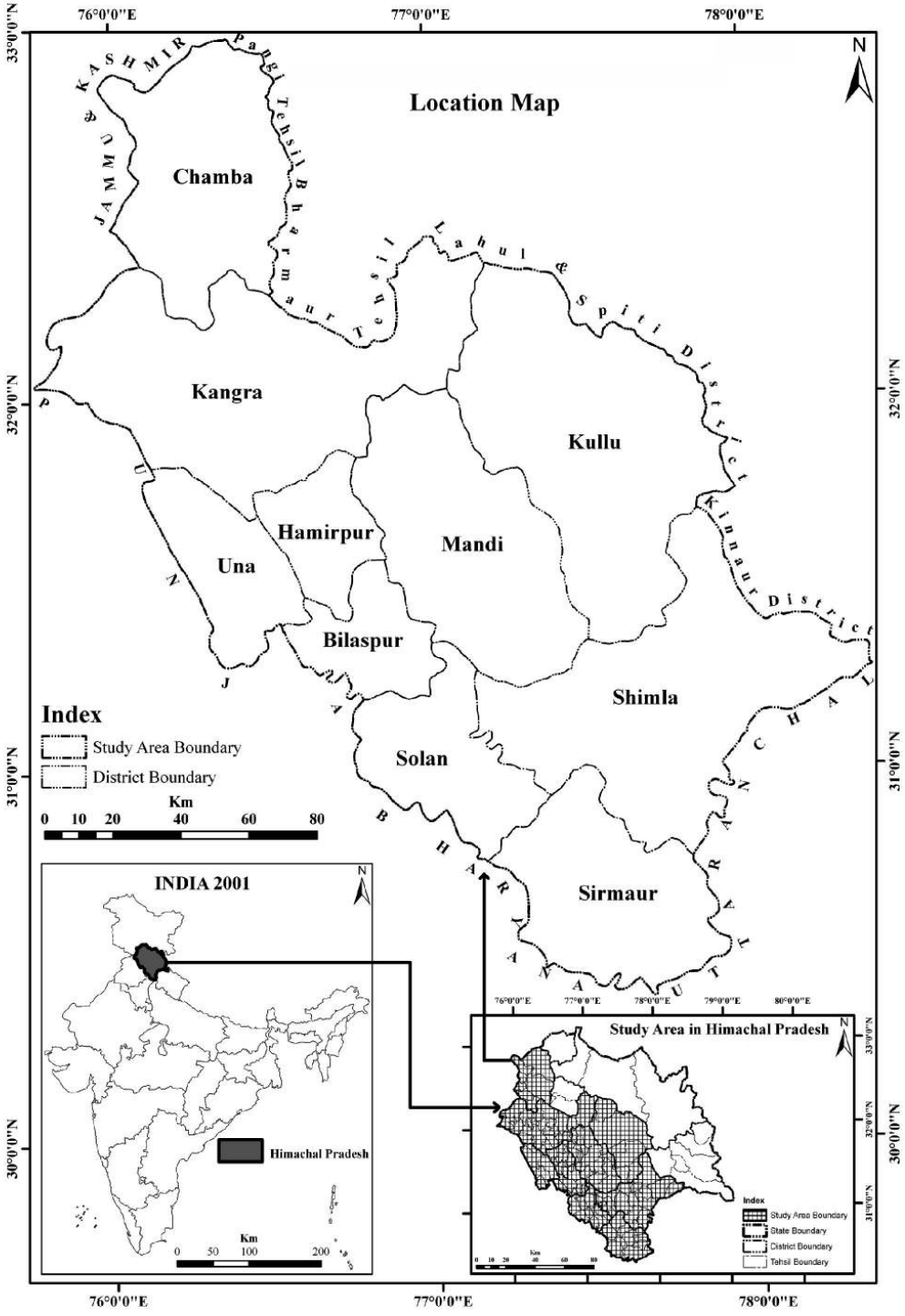

Fig.-1: Location of the study area

area of the state. The study area supports about 66.88 lakh persons which mean about 218 persons /sq km area as per 2011 census. It is bounded by Kinnaur and Lahaul-Spiti districts in the northeast, Uttaranchal in the south-east, Haryana in the south and Punjab in the west (Fig. 1). Topographically, the study region is hilly in nature and the relief varies from the lowest 300m to the highest 4500m above mean sea level. The elevation progressively increases from west to east and from south to north. The Shiwalik belt constitutes the low lying areas in the south west and elements of higher relief are observed in the northeast of the study area. The undulating relief bears a direct relationship with the expansion and development pattern of infrastructural facilities whether physical or socio-economic is overall edifice of development. Administratively, the study region is divided into 10 entire districts and 97 tehsils as per 2001 Census. However, 2 community development blocks i.e. Pangi and Bharmaur of Chamba district along with Kinnaur and Lahaul-spiti districts all notified tribal areas of the state have not been considered for the present study. It has been done due to highly rugged terrain coupled with vast tract of uninhabited land and many infrastructural development programmes initiated under tribal sub-plan entirely for the upliftment of tribal areas. All these factors together make analysis difficult and not easily comparable as per the government norms particularly area based standards set for availability of different infrastructural facilities.

Results and Discussions

Trends in Transport Infrastructure

Transport is an essential category of infrastructure for rapid development of any region. The lack of transport facilities retards the economic development even if a region is endowed with rich natural resources (Dash, 2008: 9). It is necessary for connecting villages with towns, market centres and in bringing together remote and developing regions closer to one another (Arasu, 2008: 155). The lack of transport and communication facilities accentuates regional imbalances and keeps certain areas in perpetual poverty and deprivation (Tiwari, 2000: 15). The study shows that there has been increase in almost all the component indicators of transport infrastructure development during the study period. At the component level, road length has increased from 23 km /10,000 persons in 1971 to 49 km in 2011 in the study area. It indicates about 2.13 times increase in road length per size of population during last four decades. The road density expressed in terms of km /100 sq km area has also registered about four time increase from 25 km in 1971 to 103 km in 2011. The metalled road length an indicator of quality of surfaced road has experienced more than three and half times increase from 8 km /10,000 of persons in 1971 to 29 km in 2011 (Table 1 (a)).

The metalled road density witnessed more than six and half times increase from 9 km /100 sq km area in 1971 to 61 km in 2011. It is a significant improvement in the quality of road conditions. The study brings out the length of motorable double lane road /10,000 of population didn't increase. It was 3.5 km /10,000 persons in 1971 which declined to 3 km /10,000 persons in 2011. The density of motorable double lane road experienced very sluggish growth from 3.85 km /100 sq km area in 1971 to 6.42 km in 2011. It could be attributed to either least expansion of motorable double lane road or misrepresentation of attribute data. The study infers that number of bridges /1000 km of road length also increased from 30 in 1971 to 58 in 2001 and slightly decrease to 53 in 2011 (Table 1(a)). It points out the improving connectivity of areas which were not connected and easily approachable earlier and strengthening in the existing circulation pattern.

Table. 1(a) Study Area: Trends in Transport Infrastructure 1971-2011

Census Year	*Transport Infrastructure Assessment Norms*						
	Road Length (km) /10,000 of Population	*Road Length /100 sq km of Area*	*Metalled Road (km) / 10,000 of Population*	*Metalled Road (km) / 100 sq km of Area*	*Motorable Double Lane Road (km) / 10,000 of Population*	*Motorable Double Lane Road (km) / 100 sq km of Area*	*No. of Bridges / 1,000 km of Road Length*
1971	23.15	25.30	8.33	9.10	3.52	3.85	29.95
1981	33.24	43.56	17.24	22.60	3.75	4.92	36.37
1991	32.16	52.16	13.42	21.77	3.68	5.97	48.92
2001	34.11	65.88	17.42	33.63	2.99	5.77	57.97
2011	49.22	102.91	28.97	60.56	3.07	6.42	52.79

Source: Computed by Authors based on data collected from Census and Public Works Departments, H.P.

Trends in Power Supply Infrastructure

Power is the key infrastructure. It is the backbone and prime mover of the economic development of any country. The state of Himachal Pradesh has power potential of 20,000MW and utilises only one-fifth of the total potential (Himachal Pradesh Development Report, 2005: 290). The ideal topographical conditions for harnessing energy from the rivers provide broad avenues to the state to develop the power sector. The component wise analysis shows that the number of electrified houses has registered an increase from about 37 in 1971 to about 97 in 2011 (Table 1 (b)). This shows the remarkable increase of 60 houses /100 residential households from 1971 to 2011. The number of domestic connections has also increased from 744 /10,000 of population in 1971 to about 2294 connections in 2011. Only 1550 domestic connections have increased during the study period which is clearly far below the required connections.

The number of commercial connections increased from 111 connections /10,000 persons in 1971 to 360 in 2011 witnessing an increase of 249 connections /10,000 of population. The industrial connections have registered increase of merely 61 connections /10,000 of population whereas the agricultural connections have witnessed an increase of 293 connections /100 sq km of net sown area during 1971 and 2011 (Table 1 (b)). The information on power connections in different sectors clearly shows inadequate expansion and paucity of power infrastructure.

Trends in Communication Infrastructure

Improved communication is vital for productivity in all spheres of activity viz. agriculture, education, industry, trade and commerce. In addition, with the increasing movement of people within and outside country, easy communication is essential for enhancing human welfare so that families, friends and acquaintances can overcome the barriers of distances (Jetli and Sethi, 2007: 94). As per Communication Commission of India, communication sector is developed in a competitive and consumer friendly atmosphere and is made available to people at affordable cost especially in the uncovered areas including rural, remote, hilly and tribal areas

Table 1: (b) Study Area Trends in Power Infrastructure 1971-2011

Census Year	Power Infrastructure Assessment Norms				
	No. of Electrified Houses /100 Residential Households	No. of Domestic Connections / 10,000 of Population	No. of Commercial Connections / 10,000 of Population	No. of Industrial Connections / 10,000 of Population	No. of Agricultural Connections /100 sq km of Net Sown Area
1971	36.67	744.33	111.41	11.30	45.37
1981	51.91	1701.59	167.05	32.90	74.42
1991	85.74	1688.90	149.08	36.13	109.93
2001	92.01	2001.59	236.50	73.91	99.36
2011	96.93	2294.05	359.73	72.06	337.88

Source: Computed by Authors based on data collected from Census and State Electricity Board, H.P.

(Arasu, 2008: 112). The component wise examination of communication infrastructure points out that the availability of post offices / 10,000 of population has been 4 in 1971 and has also remained 4 in 2011 (Table 1 (c)). It reveals that there has been increase in absolute number of postal services but in relation to the population size there has not been commensurate increase in post offices between 1971 to 2011. The study reveals that density of post offices has witnessed about two time increase i.e. 4 /100 sq km area in 1971 to 9 in 2011. It shows an improving picture of postal facilities in the study area.

The study indicates that during early 1980s there were merely about 2 telephone sets /1,00,000 of population which indicates poor connectivity among people. However, after next three decades, the availability of telephone sets increased to 3366 /1,00,000 of population in 2001. This phenomenal rise in telephone sets, although inadequate, shows positive transformation in communication sector. The number of telephone sets has also decreased in 2011 due to mobile connections which are much cheaper and easily accessible. It has also been investigated that the number of telephone sets /10,000 residential households increased from merely 1 in 1971 to about 1600 sets in 2001 and decreased to 752 sets during next decade i.e. 2011.

Trends in Agricultural Infrastructure

Agriculture is one of the corner stones of rural development in developing countries. For the balanced development of agricultural sector and achieving highest levels of agricultural productivity, potential investment in physical infrastructure is needed (Wanmali and Islam, 1997: 259). Physical infrastructure in rural areas such as irrigation, electrification, roads etc together play a key role in determining agricultural output in India (Patel, 2009: 11). At the individual component level, the study reveals that the availability of net sown area was about 160 ha /1,00,000 of population in 1971 which decreased considerably to 82.65 ha /1,00,000 in 2011. It indicates small and shrinking size of land under cultivation in the study area. The cultivated land has almost remained stagnant (17%) during last four decades. However, the population continued to grow unabatedly during the same period.

Similarly, the availability of toilets /100 households has increased from almost negligible provision

Table-1(c): Study Area: Trends in Communication Infrastructure 1971-2011

Communication Infrastructure Assessment Norms				
Census Year	*No. of Post Offices / 10,000 Population*	*No. of Post Offices / 100 sq km of Area*	*No. of Telephone Sets / 1,00,000 Population*	*No. of Telephone Sets / 10,000 Residential Households*
1971	3.97	4.34	1.94	1.03
1981	4.57	5.99	4.84	2.88
1991	4.38	7.10	20.56	11.53
2001	4.96	9.58	3366.03	1599.42
2011	4.15	8.69	1690.22	751.94

Source: Computed by Authors from the data collected from Census Department, H.P.

i.e. 2 in 1971 to 69 in 2011 (Table 1 (e)). It means that the availability of toilets has increased sixteen folds but still falls insufficient at the household level. It shows that the initiation of government projects like Total Sanitation Campaign (1999) aimed at improving rural sanitation facilities among rural poor and other sanitation awareness campaigns have started changing the sanitation scenario. However, still there is a long way to achieve 100% safe and hygienic sanitation facilities and open defecation free society.

Pattern of physical Infrastructural Development

The picture of growth and development pattern of overall physical infrastructure between 1971 and 2001 may be clearly understood and examined with reference to following five categories based on composite score:

I. Areas with Very High Composite Index in Physical Infrastructural Development

The changing pattern of physical infrastructure in the study area (Table 2 and Fig. 2 to 5) reveals that in 1971, the share of tehsils with very high level of physical infrastructural development (i.e. above 3.00 composite score) was 21% of total tehsils. It increased to more than one-fourth (27%) of total tehsils in 1981 (Fig. 3). The share of tehsils experiencing very high development in overall physical infrastructure declined considerably to 16% in 1991. It could be attributed to rise in population and low development in physical infrastructural facilities. However, the percentage of tehsils with high composite index again increased to 31% in 2001. It indicates the improving conditions and development of physical infrastructure. The study illustrates that tehsil Kangra, Hamirpur, Amb and Una (Kangra), tehsil Sarkaghat (Mandi), Nankhari, Kasumpati and Solan tehsils (Mahasu) and Shimla tehsil registered very high level of physical infrastructural development during early 1980s (Fig. 2). The study therefore, indicates that development in physical infrastructure doesn't show any uniform pattern and remains highly pocketed and uneven. The very high development has been closely associated with tehsils where historical processes, political willingness and physical controls have been major determinants of development.

In 1981, the development further spread out to adjacent tehsils surrounding the incipient core i.e. tehsils with very high level of physical infrastructural development. The case of Hamirpur which was earlier a tehsil in Kangra

Table-1(d) Study Area: Trends in Agriculture Infrastructure 1971-2011

Agriculture Infrastructure Assessment Norms					
Census Year	*Availability of NSA (ha) /1,00,000 Population*	*Net Irrigated Area as % of NSA*	*Percentage of NSA to Total Geographical Area*	*Agricultural Societies/1,00,000 Population*	*Agricultural Societies/100 sq km of NSA*
1971	160.54	15.44	17.55	41.87	26.08
1981	139.89	15.18	18.34	39.33	28.11
1991	115.22	16.10	18.69	29.65	25.73
2001	91.14	17.50	17.60	36.76	40.33
2011	82.65	18.67	17.28	31.41	38.00

NSA stands for net sown area
Source: Computed by Authors based on data collected from Economic and Statistics, Land Records and Census Departments, H.P.

and became independent district in 1981 stands out here. It implies that the very high level of development diffused from this incipient core to the tehsils of adjoining districts namely Lambagraon (Kangra), Sarkaghat, Sundernagar (Mandi), Ghumarwin and Bilaspur (Bilaspur). Besides, there were other pockets which included Kangra and Fatehpur tehsils (Kangra), Haroli and Una (Una), Shimla and Solan tehsils (Fig. 3). The study therefore, infers that development of physical infrastructure in hilly and mountainous areas under study has been based on core to periphery mode of development during 1971 and 1981. In 1991, the share of tehsils with very high development declined to 16%. Such a considerable decline has largely been associated with reorganisation of administrative boundaries and delineation of new tehsils with inclusion and exclusion of already developed areas and increase in population of the tehsils. The tehsils experiencing very high development were small in geographic area and well served by physical infrastructural facilities and services. In 2001, the tehsils with very high level of development displayed a large stretch of area in the form of a contiguous zone running from northern part of district Kangra through its heart and joining previously highly developed tehsils of district Hamirpur. The incipient core of very high development exhibits its physical expansion in district Mandi on the east, district Una on the west and district Solan in the south (Fig.5).

II. Areas with High Composite Index in Physical Infrastructural Development

The areas experiencing high composite (2.00-3.00) index in physical infrastructural development are positioned adjacent to the areas of very high development. It indicates huge gap in the overall spatial development of the study area. The share of tehsils with high composite index in 1971 was 14% which decreased drastically to 6.45% in 1981 and then marginally increased to 6.52% in 1991. It increased further to 8% in 2001 due to some improvement in infrastructural facilities and services.

The study reveals that in 1971, tehsil Deragopipur (Kangra), Mandi and Sundernagar (Mandi), Arki and Kotkhai (Mahasu) and tehsil Anni (Kullu) registered high composite index in physical infrastructural development (Fig. 2). In 1981,

Table-1(e) Study Area: Trends in Sanitation Infrastructure 1971-2011

Sanitation Infrastructure Assessment Norms		
Census Year	*No. of Toilets / 10,000 Population*	*Availability of Toilets /100 Residential Households*
1971	28.10	1.49
1981	91.95	5.47
1991	137.29	7.70
2001	676.61	32.15
2011	1555.12	69.18

there were three tehsils with high composite index namely Amb (Una), Kasauli (Solan) and Mandi (Mandi) exhibiting the process of diffusion of physical infrastructural development from core i.e. very high developed areas towards the adjoining areas with less development (Fig. 3). In 1991, the pattern of spatial development continued to be same in the high development category. It covered tehsils namely Baijnath (Kangra), Jogindernagar and Mandi (Mandi), Sujanpur and Bhoranj (Hamirpur), and Bilaspur. It happened due to strengthening of almost all component indicators (Fig. 4). In 2001, about 8% tehsils namely Bhalai (Chamba), Deragopipur and Shahpur (Kangra), Kotli (Mandi), Arki and Kandaghat (Solan), Kotkhai (Shimla) and Nahan (Sirmaur) registered high composite index in development. It could be attributed to improved conditions of facilities, amenities and services and close proximity with very highly developed tehsils (Fig. 5).

I. Areas with Moderate Composite Index in Physical Infrastructural Development

The areas with moderate composite index (1.00-2.00) in physical infrastructure experienced many ups and downs from 1971 to 2001. There were about 7% tehsils in moderate development category in 1971 which declined to zero in 1981. The share of tehsils again rose to 14% in 1991 and declined to about 7% in 2001 (Fig. 2 to 5). There were three tehsils i.e. Panjgraon (Kangra), Ghumarwin (Bilaspur) and Seoni (Mahasu) in 1971 (Fig. 2). Due to reorganisation of boundaries and decrease in geographic size of tehsils and improvement in expansion of physical infrastructural facilities, the tehsils with moderate composite index in 1971 experienced a change in the level of composite index in 1981 and there was none in this category (Fig. 3). In 1991, tehsils namely Dharamshala, Kangra and Jaisinghpur (Kangra), Amb (Una), Dharampur, Kotli and Aut (Mandi), Arki (Solan) and tehsil Ghumarwin (Bilaspur) exhibited a decrease in the physical infrastructure due to rise in population base. While tehsil Jawali (Kangra), Chachyot (Mandi), Rakkar (Kangra) and Kandaghat (Solan) exhibited moderate composite index due to improvement in the expansion and availability of physical infrastructure due to reduced geographic size (Fig. 4). Likewise, Fig. 5 portrays that moderate development in physical infrastructure doesn't form any clear and contiguous geographic pattern in 2001 and is highly uneven and pocketed in a few tehsils namely Jawali (Kangra), Dharampur (Mandi), Shimla Rural and Kumarsain (Shimla) and Poanta Sahib (Sirmaur).

I. Areas with Low Composite Index in Physical Infrastructural Development

The study reveals that there has been a decrease in the proportion of tehsils with low level of physical infrastructural development during the study period (Fig. 2 to 5). The share of such tehsils has fluctuated from about 12% in 1971 to 4% in 2001. In 1971, eastern and western part of district Kangra, Bhattiyat tehsil (Chamba), Nirmand (Kullu) and Theog (Mahasu) registered low level of physical infrastructure (Fig. 2). In 1981, tehsils Nurpur, Indora and Khundiyan (Kangra), Lad Bharol (Mandi), Arki and

Table 2 Study Area: Distribution of Tehsils by Level of Development in Overall Physical Infrastructure 1971 – 2001

Dist.	*No. of Tehsils and Sub-tehsils*				*Overall Physical Composite Index*			
	1971	*1981*	*1991*	*2001*	*1971*	*1981*	*1991*	*2001*
Chamba	Churah	Churah	Churah	Churah	-7.07	-8.91	-5.22	-10.30
	Chamba	Saluni	Saluni	Saluni	-1.26	-0.09	-0.92	-5.21
	Bhattiyat	Chamba	Chamba	Bhalai	0.02	-2.39	-2.24	-5.03
		Bhattiyat	Bhattiyat	Dalhousie		-0.43	0.64	2.52
		Sihunta	Bhalai	Bhattiyat		-1.51	0.28	-3.32
			Sihunta	Sihunta			-1.75	-4.30
				Chamba				-2.52
ST	3	5	6	7	-8.31	-13.33	-9.22	-28.16
Kangra	Nurpur	Nurpur	Nurpur	Nurpur	0.13	0.12	-0.11	0.87
	Kangra	Indora	Indora	Indora	3.55	0.98	-0.35	0.03
	Palampur	Kangra	Fatehpur	Fatehpur	0.82	3.31	-0.44	-1.26
	Dera Gopipur	Dera Gopipur	Jawali	Jawali	2.75	-2.21	1.53	1.72
	Hamirpur	Khundian	Harchakian	Harchakian	6.90	0.42	-0.01	-1.01
	Amb	Lambagraon	Dharmsala	Shahpur	3.78	5.91	1.70	2.42
	Barsar	Palampur	Kangra	Dharmsala	1.81	-7.42	1.85	5.86
	Una	Fatehpur	Baroh	Kangra	5.72	5.39	-0.71	8.06
			Dera Gopipur	Baroh			-0.25	-0.98
			Jaswan	Dera Gopipur			-2.29	2.05
			Rakkar	Jaswan			1.35	-1.55
			Khundian	Rakkar			-0.40	3.99
			Thural	Khundian			3.62	-2.47
			Dhira	Thural			0.60	4.07
			Jai Singhpur	Dhira			1.87	3.12
			Palampur	Jai Singhpur			3.39	7.44
			Baijnath	Palampur			2.19	7.72
			Multhan	Baijnath			-20.33	6.20
				Multhan				-17.92
ST	8	8	18	19	25.47	6.50	-6.76	28.38
Una		Amb	Amb	Amb		2.84	1.64	5.25
		Haroli	Haroli	Bharwain		5.74	3.40	1.16
		Una	Una	Haroli		5.92	4.92	3.46
		Bangana	Bangana	Una		-1.54	-1.14	8.29
			Bangana					0.21
ST		4	4	5		12.96	8.82	18.36
Hamirpur		Nadaun	Nadaun	Nadaun		7.60	3.50	9.68
		Tira Sujanpur	Tira Sujanpur	Tira Sujanpur		4.79	2.02	5.07
		Hamirpur	Hamirpur	Hamirpur		7.78	3.59	11.37
		Barsar	Barsar	Barsar		6.78	2.68	7.90
		Bhoranj	Bhoranj	Bijhri		10.52	4.70	5.57
				Bhoranj				11.09
ST		5	5	6		37.48	16.49	50.67

Table 2 Study Area: Distribution of Tehsils by Level of Development in Overall Physical Infrastructure 1971 – 2001

Dist.	*No. of Tehsils and Sub-tehsils*				*Overall Physical Composite Index*			
	1971	*1981*	*1991*	*2001*	*1971*	*1981*	*1991*	*2001*
Bilaspur	Ghumarwin	Ghumarwin	Ghumarwin	Ghumarwin	1.74	4.20	1.88	6.66
	Bilaspur	Bilaspur	Bilaspur	Bilaspur	-1.03	3.87	2.78	8.65
		Naina Devi	Naina Devi	Naina Devi		-2.30	-1.85	-5.50
			Jhandutta	Jhandutta			0.71	5.78
ST	2	3	4	4	0.71	5.77	3.52	15.59
Kullu	Kullu	Kullu	Kullu	Kullu	-5.00	-5.51	-5.96	-2.88
	Banjar	Banjar	Banjar	Banjar	-5.49	-9.56	-8.45	-10.03
	Ani	Ani	Ani	Ani	2.84	-1.69	-1.70	-5.06
	Nirmand	Nirmand	Nirmand	Nirmand	0.10	-3.24	-3.49	-3.93
		Sainj	Sainj				-6.13	-7.76
				Manali				-1.63
ST	4	4	5	6	-7.55	-19.99	-25.72	-31.31
Mandi	JoginderNagar	JoginderNagar	Padhar	Padhar	-0.50	0.70	-2.10	-4.84
	Mandi Sadar	Lad Bharol	Jogindarnagar	Jogindarnagar	2.49	2.45	3.07	4.58
	Sarkaghat	Sandhol	Lad Bharol	Lad Bharol	4.12	3.74	2.19	1.74
	Chachyot	Sarkaghat	Sandhol	Sandhol	-2.77	4.50	4.87	4.87
	Sunder Nagar	Mandi	Dharmpur	Dharmpur	2.97	2.93	1.65	1.59
	Karsog	Sunder Nagar	Kotli	Kotli	-2.42	4.14	1.85	2.09
		Chachyot	Sarkaghat	Sarkaghat		-0.30	4.00	4.58
		Chachyot	Baldwara	Baldwara		-0.46	5.90	4.01
		Bali Chowki	SundarNagar	SundarNagar		-1.39	4.30	5.35
		Karsog	Mandi	Mandi		-1.01	2.41	4.28
		Aut	Aut				1.08	-1.56
			Bali Chowki	Bali Chowki			-1.02	-4.87
		Thunag	Thunag				-0.47	-4.11
		Chachyot	Chachyot				1.51	-1.81
		Nihri	Nihri				-3.14	-7.83
		Karsog	Karsog				-0.47	-2.46
ST	6	10	16	16	3.89	15.31	25.64	5.61
Solan		Arki	Arki	Arki		0.15	0.17	2.84
		Ramshahr	Ramshahr	Ramshahr		-2.17	-0.28	-2.94
		Nalagarah	Nalagarah	Nalagarah		0.42	1.76	3.42
		Kasauli	Kasauli	Kasauli		2.43	5.10	8.75
		Solan	Solan	Solan		3.12	3.97	10.85
		Kandaghat	Kandaghat	Kandaghat		-2.36	1.77	2.29
			Krishangarh	Krishangarh			-0.15	0.12
ST		6	7	7		1.59	12.34	25.33

Table 2 Study Area: Distribution of Tehsils by Level of Development in Overall Physical Infrastructure 1971 – 2001

Dist.	*No. of Tehsils and Sub-tehsils*				*Overall Physical Composite Index*			
	1971	*1981*	*1991*	*2001*	*1971*	*1981*	*1991*	*2001*
Shimla	Shimla	Seoni	Rampur	Rampur	10.86	-1.65	-3.14	-4.43
	Kandaghat	Shimla	Nankhari	Nankhari	-5.27	5.25	-0.67	-4.99
	Nalagarah	Theog	Kumharsain	Kumharsain	-4.89	-1.05	0.79	1.95
		Kumharsain	Seoni	Seoni		-0.52	-0.79	-3.23
		Rampur	Shimla Rural	Shimla Rural		-7.68	0.55	1.35
		Nankhari	Shimla Urban	Shimla Urban		-1.03	29.67	30.42
		Rohru	Junga	Junga		-8.75	-1.51	-5.53
		Jubbal	Theog	Theog		-3.57	-0.88	-3.30
		Kotkhai	Chaupal	Chaupal		-2.19	-3.50	-7.35
		Chaupal	Cheta	Cheta		-6.64	-3.30	-10.74
		Nerua	Nerua	Nerua		-5.53	-4.13	-9.37
			Jubbal	Jubbal			-1.88	-3.20
			Kotkhai	Kotkhai			0.38	2.28
			Tikar	Tikar			-0.29	-3.09
			Rohru	Rohru			-0.54	-0.62
			Chirgaon	Chirgaon			-5.19	-11.43
			Dodra Kwar	Dodra Kwar			-14.60	-19.96
ST	3	11	17	17	0.70	-33.36	-9.04	-51.25
Sirmaur	Rajgarah	Rajgarah	Rajgarh	Rajgarh	-4.44	-3.92	-1.76	-2.49
	Pachhad	Pachhad	Pachhad	Pachhad	-4.53	-3.81	-1.00	-2.90
	Nahan	Nahan	Nahan	Nahan	-2.09	-1.41	-1.88	2.31
	Renuka	Renuka	Renuka	Renuka	-4.81	-3.16	-2.42	-7.19
	Shilai	Shilai	Shalai	Shalai	-1.75	-1.13	-1.59	-4.29
	Poanta Sahib	Poanta Sahib	Paonta Sahib	Paonta Sahib	-2.47	0.51	0.13	1.03
			Nohra	Nohra			-2.94	-7.20
			Dadahu	Dadahu			-0.17	-2.12
			Kamrau	Kamrau			-1.12	-4.66
			Pajota	Ronhat			-3.32	-5.71
ST	6	6	10	10	-20.09	-12.93	-16.07	-33.23
Mahasu	Arki				2.83			
	Seoni				1.41			
	Kumharsain				3.90			
	Rampur				-3.39			
	Rohru				-5.72			
	Jubbal				-1.15			
	Kotkhai				2.18			
	Theog				0.88			
	Kasumpti				3.99			
	Solan				5.08			
	Chaupal				-4.82			
ST	11				5.19			

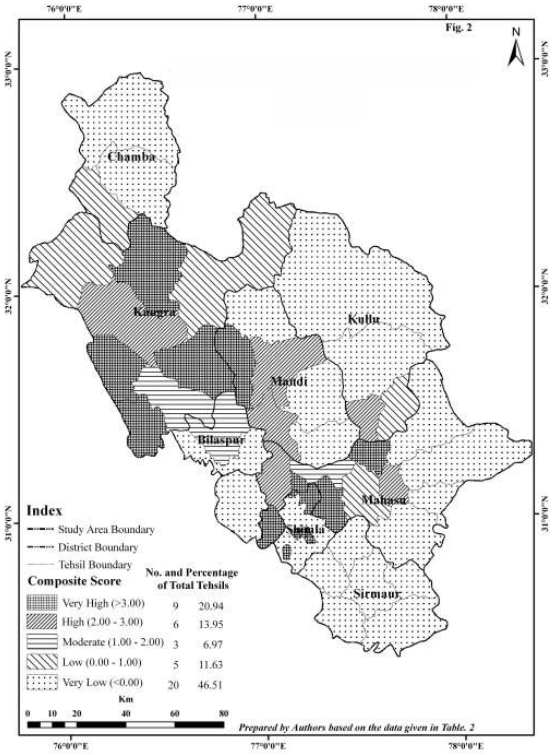

Fig.:2 Tribal Region of Himachal Pradesh Level of Physical Infrastructural Development 1971 (Data by Tehsils)

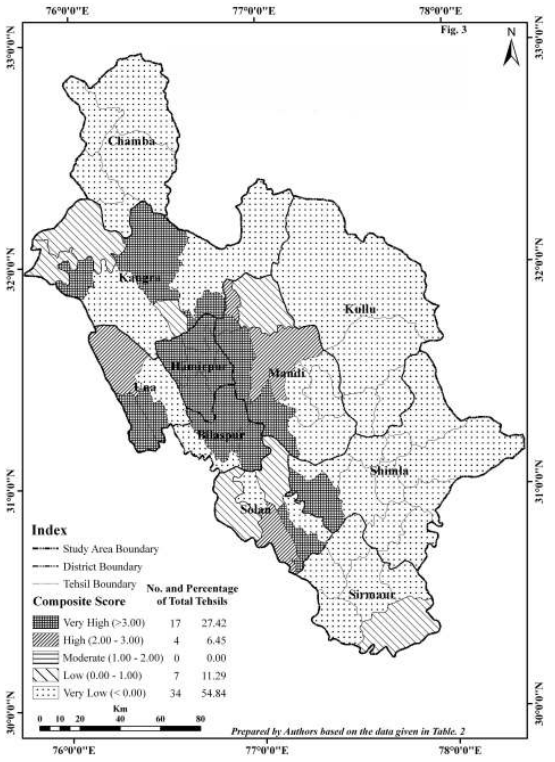

Fig.:3 Non-Tribal Region of Himachal Pradesh Level of Physical Infrastructural Development 1981 (Data by Tehsils)

Nalagarh (Solan) and Poanta Sahib (Sirmaur) were categorized in low level of physical infrastructure (Fig. 3). In 1991, tehsil Bhattiyat and Bhalai (Chamba), Dhira (Kangra), Jhandutta (Bilaspur), Arki (Solan), Shimla Rural, Kumarsain and Kotkhai of Shimla district were observed grappling with low level of physical infrastructure (Fig. 4). The tehsils with low level of development in physical infrastructure in 2001 can be observed in the form of pockets. These pockets have been found in western Kangra district covering Nurpur and Indora tehsils, north-eastern and south-eastern Una district and central part of district Solan i.e. tehsil Krishangarh (Fig. 5). It is noted here that a decline in share of tehsils in low category of physical infrastructure is not mainly due to improvement in sectoral facilities. It is also due to increase in population and inadequate infrastructure and roll back to very low category of sectoral development.

II. Areas with Very Low Composite Index in Physical Infrastructural Development

The study reveals that areas with very low composite index of physical infrastructural development (Fig. 2 to 5) comprised of about 47% tehsil in 1971 which rose to about 55% tehsils in 1981, slightly declined to about 53% in 1991 and 49% in 2001. It infers that development in physical infrastructure has been highly uneven and irregular over both time and space. The spatial distribution of tehsils with very low category has dominated the picture of physical infrastructural development in the study

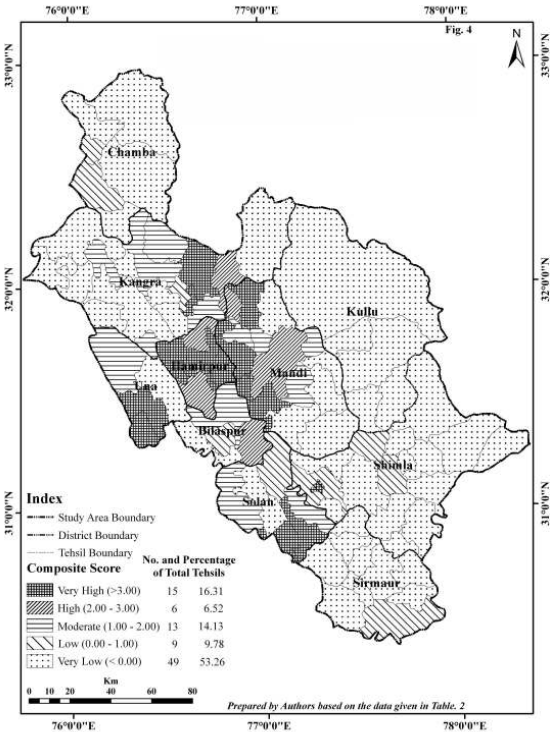

Fig.:4 Non-Tribal Region of Himachal Pradesh Level of Physical Infrastructural Development 1991 (Data by Tehsils)

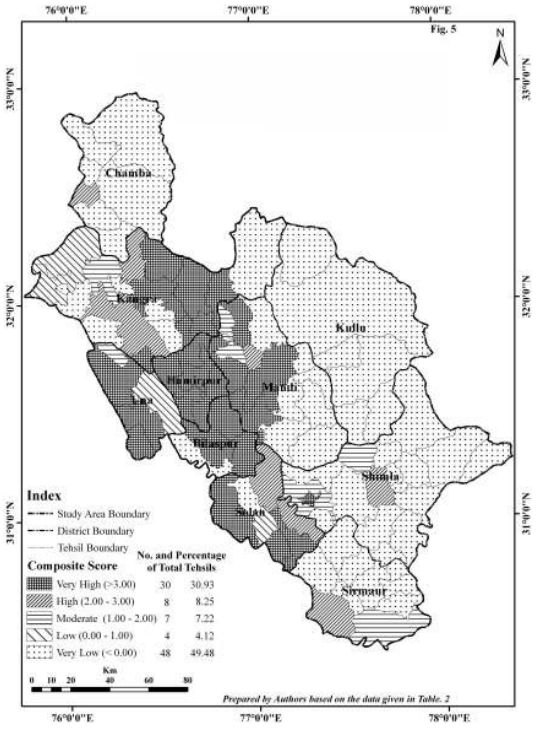

Fig.:5 Non-Tribal Region of Himachal Pradesh Level of Physical Infrastructural Development 2001 (Data by Tehsils)

area since 1971 till the begining of 21st century. The spatial concentration of tehsils with very low development was very common during early 1980s and 1990s. It extended over north, east and south of the study area mainly the mid Himalayan belt along with a few patches in the Shiwalik range. It included all the tehsils of district Chamba, Kullu, Shimla (except tehsil Shimla) and Sirmaur (except Poanta Sahib) and Palampur and Deragopipur (Kangra), Bangana (Una), Naina Devi (Bilaspur), Ramshahr and Kandaghat (Solan) and about 4 tehsils of district Mandi (Fig. 2 and 3). The spatial distribution of tehsils with very low composite score in 1991 remained almost same in the areas with hilly terrain. However, it witnessed slight increase in the plain areas due to the effect of growing population and increasing population pressure (Fig.4). In 2001, the concentration of tehsils with very low development reduced marginally as some of the areas in the Shiwalik belt experienced improvement in physical infrastructure. The spatial pattern of very low infrastructural development almost resembled the similar pattern as that of 1991 except few areas in the low altitude areas (Fig. 5).

Concluding Remarks

It has been observed that there has not been even and planned development in physical infrastructure over both time and space in the study area. It has been investigated that the increase in physical infrastructure has also not been satisfactory with respect to growing population and its requirements. Notably, there has been improvement at the component level in transport sector but still there is need of

strengthening of transport infrastructure considering both the relatively higher population pressure in the low altitude areas and relatively excessive control of topography in the higher altitude areas. It may also be inferred here that undoubtedly there has been development in communication facilities and services but these facilities have been highly inadequate till 2011 and calls for proper expansion with special focus in higher altitude areas where terrain exercises more influence on the availability of communication infrastructure. The study reveals that except the number of electrified households, the power infrastructure of the study region has been lagging behind and falls short of supporting domestic, commercial, industrial and agricultural requirements of energy. The trends in agricultural facilities and associated provisions reveals almost insignificant rise in agricultural institutions in a society where agriculture is the main source of livelihood. It is a matter of great concern to the agricultural planners. The information on sanitation provisions also presents a glooming picture and reveals that there is a long way to achieve 100% safe and hygienic sanitation facilities and open defecation society.On the whole, more than 50% of the tehsils have been facing shortage of provision of physical infrastructural facilities and services during last three decades of 20th century. The share of tehsils with high level (both very high and high together) of physical infrastructural development has also been fluctuating throughout the reference periods. There were 45% such tehsils in 1971 which surprisingly decreased to about 34% in 1981. This share further declined to 23% in 1991 but increased upto 39% by the beginning of 21st century. Therefore, it has been investigated that all the sectoral indicators namely transport, power, communication, agriculture and sanitation together have not developed upto the mark and as per prescribed government norms. The overall status of physical infrastructural development is not satisfactory in the lower part of the study area due to insufficient and inadequate support infrastructure and huge growing population. The upper part of the study region comprising of Chamba, Kullu, Shimla, Sirmaur districts and eastern and northern part of Mandi remains almost highly backward in physical infrastructure due to difficult topography. The need is therefore to apply a region specific approach to overcome the growing gap between the availability of physical infrastructure and the population served by it.

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