South India Journal of Social Sciences, September'24, Vol. 22 - No. 3
ISSN : 0972-8945 (Print) | 3048-6165 (Online)

ASSESSING THE LEVEL OF AGRICULTURAL DEVELOPMENT AMONG THE HILL STATES OF INDIA

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Introduction

The development of frontier states has been a major area of concern and a prime agenda for the policymakers of the Indian state. The hilly states of India, which serve as the Northern and Eastern frontiers of the state are beset with problems that can be traced back from Independence. They are scourged by issues of immigration of people from the mainland, limited resources and inequitable access to the poor indigenous people, overexploitation of the environment, and failure of the policymakers to take effective measures to change the economic landscapes, by implementing developmental agenda-taking the regional issues into consideration. While the impact of industrialization is little to be seen in these parts of the country, the Agricultural sector accounts for a significant fraction of the economic activity of these regions. It would not be wrong to say that they serve as the backbone of the local economies, with over 50% of value-added coming from this sector. The sheer size of this sector implies that any changes affecting the agricultural sector also have large aggregate effects. Thus, it becomes logically relevant that an analysis of agricultural productivity becomes important, especially because agricultural growth has significant effects on macro variables, including economic growth.

The study covers the 10 hilly and mountainous states from both mainland India and Northeast India. Jammu and Kashmir, Himachal Pradesh and Uttarakhand in mainland India, and Arunachal Pradesh, Nagaland, Manipur, Meghalaya, Mizoram, Tripura, and Sikkim in Northeast India. Land use is very important in agricultural studies. The productivity levels are dependent on the land use pattern of a region. Chand, R., Lakshmi Prasanna, P. A., & Singh, A. (2011) in their study investigates the relationship between farm size and productivity in India and challenge the conventional belief that larger farms are more productive. They have found that Smallholders often have higher land productivity than larger farms but, provided there is adequate policy support for smallholder farmers(Chand et al., 2011). This observation holds promise in the case of the hilly states provided the appropriate policy

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frameworks are set in place.

Subsequently, the role of infrastructure in agricultural production is an important element in securing productivity. Basavaraja, H.(2007), has concluded that investment in scientific storage facilities, such as warehouses and silos, can mitigate losses and improve food grain management(Basavaraja, 2007). This holds valid in the case of the horticultural produce of the hilly states that are highly perishable. Another aspect is the transportation infrastructure,which holds much weight in these hilly states. Badiane, O., & Shively, G.(1998) in their paper observe that improved transportation infrastructure not only reduces transaction costs and enhances access to markets, but regions with better road networks have higher levels of agricultural productivity, also investments in rural roads are particularly helpful for smallholder farmers(Badiane, et al.,1998).

Considering the difficult terrain and soil types of the hilly regions, which are deficient in many key nutrients, the use of fertilizers becomes an important component. However, the adoption of expensive fertilizers can become a burden for many marginal farmers in these hilly states. S. Gulati and A. Banerjee (2009) observe that fertilizer subsidies have played a crucial role in increasing fertilizer consumption and enhancing agricultural productivity and recommend targeting subsidies to small and marginal farmers and promoting the use of eco-friendly fertilizers(Gulati & Banerjee, 2009).

In India's Second Green Revolution initiatives, the hilly regions of India, particularly Northeast India, due to their distinct agro-climatic locations have been identified as the hub of horticultural production. Dwelling on this issue S. Kumar & P. Sharma (2008) observes that horticulture has significantly contributed to income generation, especially for small and marginal farmers in India, and has created substantial employment opportunities in both rural and urban areas. Exports of horticultural products have increased, contributing to much-valued foreign exchange earnings and trade balance improvement for the country as a whole(Kumar & Sharma, 2008).

In assessing the levels of agricultural productivity, one of the key indicators used is the level of cropping intensity. Nath and Saikia (2020) have used Cropping intensity as a measure of productivity implying the insensitivity of agricultural activity considering the scarce availability of good arable land in Assam, which holds weight in other hilly states of India(Saikia & Nath, 2020). Here, the Z-score standardization method has been employed for standardizing the variables.

The agricultural productivity of a few selected crops like oilseeds and food crops has been studied to highlight the current status of agriculture in these states. Oilseed cultivation has contributed to agricultural diversification, reducing dependency on traditional cereals.

This sector has provided alternative income sources for farmers, enhancing rural livelihoods(Sahu & Panda, 2014). So, for a comprehensive development of the hilly states, the adoption of oilseed cultivation can be easily implemented, by encouraging crop rotation with oilseeds and integrating oilseeds into existing farming systems.

Finally, the paper studies issues relating to the labour sector in these areas by assessing the average monthly income of farmers and the average daily wage rate of agricultural labourers. Agriculture being a labour-intensive activity, these components hold the key for agricultural development in these hilly areas, where infrastructural disparities and the mechanization process is slow.

Study Area & Background

The main objectives of the paper are-

a) To compare the different indexes of agriculture over the hill states of mainland India.

b) To assess the overall disparity in terms of development in the agriculture sector.

The area considered for this study is the hill states of mainland India comprising the states viz. Arunachal Pradesh, Himachal Pradesh, Jammu & Kashmir, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Tripura and Uttarakhand. The hill states of India are the most deprived states of the country due to their physiography, and socio-economic and socio-cultural diversity. Besides, political factors also played a vital role in the development of different sectors. The population of the hill states of mainland India is composed of mainly tribals with different races, ethnicities, and religions and is quite low in numbers. In terms of physiography, the states of north India except Jammu and Kashmir fall under the Himalayan sections of Lesser Himalaya and Shiwaliks where the average elevation is quite high and is also quite rugged in comparison to the northeastern states like Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura which fall under the Patkai-Purvanchal range. After the syntaxial bend of the Himalayas in the northeastern corner of Arunachal Pradesh, the mountain started to decline in its elevation southwards(Khullar, 2006, pp.53-95).

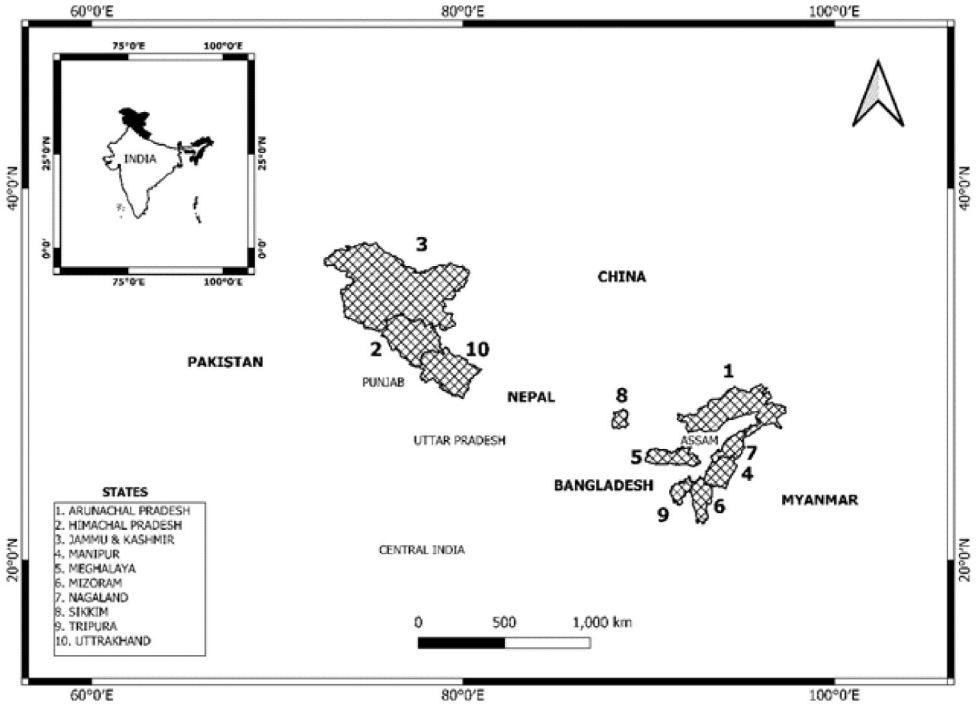

Figure 1: Study Area Map (Hill states of India)

The hills states of India fall under two different types of soil- Mountain soil and Red Soil. The entire hill states of north India including Sikkim covered by Mountain soil while Red soil covers the hill states of Northeast India. Exceptionally the northwest Indo-China bordering area of Arunachal Pradesh has some sort of Mountain soil. The mountain soils are deficient in potash, phosphorus, nitrogen, lime and require fertilizer input for agriculture while the latter is also the same but rich in potash (Khullar, 2006, pp. 197-203). Soil erosion remains at its peak due to its physiography.The entire states are rich in vegetation which has also been reflected in its soil content as the soils are humus-rich. Though the main occupation of those states is agriculture but certain inputs are required for it to support agriculture and people.

Materials and Methods

The study is conducted based on secondary data collected from various authentic sources. The reports of various state governments and central government ministries are deeply studied and data has been gathered. The database period is from 2019 to 2022. The collected data has been modified as per the requirements and demands of the study. Relevant literature on the field has been studied from the various research papers published in different journals and doctoral theses. In certain states, in some variables, a lack of data

has been faced due to the non-reporting of facts by both govt. and non-govt. agencies to the state as well as to the various ministries of the central government. There, average data of the existing states has been assigned. In case of any doubt about the data, it has been verified in other sources too for a two-way confirmation. Some variables are excluded due to a lack of data but have significant relevance in the study.

The study involves a comparative research method where quantitative data of different variables related to the study has been compared over space i.e., states. The entire study starts with identifying variables fit for the study for which relevant literature has been studied. Collection of data took place in the second stage and certain data was modified as per the requirement and later on, it was clubbed under three different indexes. The indexes are considered based on their importance in the agricultural growth. The indexes are calculated by standardizing the variables which is done using the 'Z-Score Standardization' statistical technique. The formula used to standardize each variable is:

$$Z= (x_i-\bar{x})/\sigma$$

where,

z= Z Scores
x_i= Value of each variable
$\bar{x}$= Mean of each variable
σ= Standard Deviation of each variable

After giving weightage to the variables, a composite score has been derived which finally gives a picture of the disparity in the agricultural sector of the said states. The results are displayed using various diagrams and choropleth maps for better understanding to general viewers.

Analysis and Discussion

Description of the indexes:

1. Index of Infrastructure related to agriculture: This index will give us an idea of the existing infrastructure facility that is required for agricultural activity in the selected states. This index is prepared using various infrastructure-related variables and is as follows:

a) Storage capacity (In '00000 Metric Tonnes)
b) Net irrigated area (In '000 Hect.)
c) Electricity used for agricultural purposes (In Gwh)
d) Road density (per sq.km)
e) Railway density (per sq.km)

Table 1: Indicators reflecting the infrastructure facilities

States	A1 (a)	A2 (b)	A3 (c)	A4 (d)	A5 (e)
Arunachal Pradesh	0.4	62	0.01	0.6599	0.00014
Himachal Pradesh	0.88	117	0.83	1.315359	0.0056
Jammu & Kashmir	2.22	319	3.69	0.54012	0.00134
Manipur	0.63	69	0.98	1.450665	0.00058
Meghalaya	0.26	106	0.01	1.794908	0.0004
Mizoram	0.32	16	0	0.770836	9.5E-05
Nagaland	0.58	122	0	2.284275	0.00151
Sikkim	0.11	14	0	1.716742	0
Tripura	0.48	90	3.72	4.300829	0.02526
Uttarakhand	2.13	322	3.43	1.285025	0.00647

Source: Agricultural Statistics at a Glance, 2022, MOA & FW, Govt. of India, New Delhi.
Central Electricity Authority, New Delhi, India
National Horticulture Board (NHB), Haryana, India
Basic Road Statistics, 2018-19, MORTH, Govt, of India, New Delhi
Reserve Bank of India, (https://rbi.gov.in), New Delhi

In the field of agricultural productivity, the role of storage capacity is very significant for Post-Harvest Management by minimizing the losses by protecting crops from pests, diseases, and adverse weather conditions. But also ensuring that the quality of the produce is maintained, which is crucial for both marketability and consumption. In terms of the hilly states, we see that the northern Indian hilly states fare better in terms of storage capacity owing to their dominant horticultural practices.

The total Net Irrigated Area has a strong correlation with higher agricultural productivity, as irrigation typically enhances crop yields compared to rain-fed farming. If we see the data, we can see that J&K, and Uttarakhand have very robust irrigation systems, 5 out of the 7 hilly states of Northeast have very few areas under irrigation. Nagaland with 122,000 hectares is the best performer which can be attributed to its shift from traditional to modern agricultural practices, mainly food crops like rice, which is a staple food,this is followed by Meghalaya with 106,000 hectares and is more in focussed on horticultural and other cash crop.

Electricity is a crucial component in the farm mechanization process, which not only enhances productivity and reduces labour costs, but also indirectly contributes to improving the quality and marketability of agricultural produce. Among the hilly states, Uttarakhand

and J&K fare exceptionally well owing to their hydropower capacity, whereas in Tripura, the majority of the electricity comes from natural gas sources. The condition of other Northeastern states is very poor, which should be a matter of concern for planners.

High road density has a positive correlation with agricultural productivity and the overall development of rural areas.They contribute to the timely access to agricultural inputs and other extension services which are very essential to these hilly regions. They also contribute to the efficient movement of the produce (chiefly horticultural items) and improved market reach and access. Hilly geographical barriers have made the task of developing road networks difficult in states like J&K, Arunachal Pradesh and Mizoram. Tripura followed by Nagaland have made some progress in recent times, with initiatives by the Central Government to enhance road connectivity. The development of the Tourism sector in Meghalaya, Sikkim and Uttarakhand has contributed directly to the proliferation of road connectivity in these hilly states- but much more still needs to be done in regard to surfaced roads, to see their positive impact on agricultural productivity.

Railway services are perhaps the most cost-effective logistical service providers for the mainland and hilly areas of India. They have a significant role in expanding the market access as well as provisioning of inputs for agriculture. Almost all the hilly states suffer from a severe lacuna of access to railway services. In Tripura, an initiative to promote international trade called the Agartala-Akhaura railway project is being sanctioned with Bangladesh, which promises to change the agricultural scenario in the Northeast. But apart from that other Northeastern hilly states have very poor access to Railway services. Geographical barriers of terrain have hindered the progress of railways in almost all the hilly states of India.

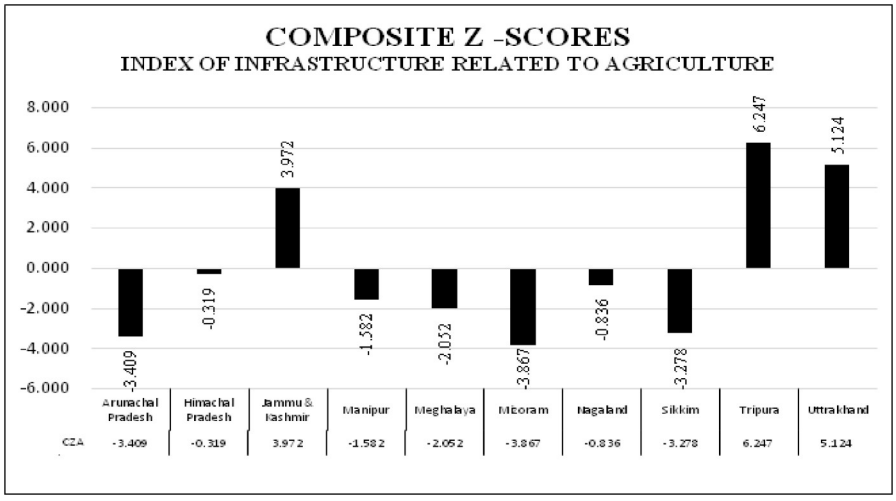

Figure 2: Composite index of Infrastructure development

From the scores shown in the above figure, it is visible to us that the infrastructure facilities are well-developed in the states of Jammu & Kashmir, Tripura, and Uttarakhand.

However, the other states lack certain infrastructural facilities that are very crucial for the growth ofthe agriculture sector. It is record lowest in Arunachal Pradesh followed by Mizoram and Sikkim where it is below -3.

2. Index of Agro-based input-output: The Agro-based input-output index is a combined index of variables especially those variables that are directly involved with agricultural productivity. Any anomaly in these variables may drastically affect productivity. The variables under this index are:

a) Net Sown area to Gross Cropped area (In %)
b) Cropping Intensity (In %)
c) Fertilizer Consumption (In '000 Tones)
d) Average Land Holdings (In Hect.)
e) Yield of all types of food grains (Kg/Hect.)
f) Yield of all types of oil seeds (Kg/Hect.)
g) Yield of Sugarcane (Kg/Hect.)
h) Yield of all types of Horticulture crops (Kg/Hect.)

Table 2: Variables reflecting state wise agricultural productivity

States	P1 (a)	P2 (b)	P3 (c)	P4 (d)	P5 (e)	P6 (f)	P7 (g)	P8 (h)
Arunachal Pradesh	75.0798722	135.7	0	3.35	1646	1049	21589	4277.026
Himachal Pradesh	55.265902	170.9	55.99	0.95	2112	719	15447	8042.86
Jammu & Kashmir	62.8717077	151.1	120.07	0.59	1894	643	2223	8849.367
Manipur	70.575693	100	12.38	1.14	2448	862	56561	9934.981
Meghalaya	82.5242718	122.2	0	1.29	2570	1062	3000	7140.593
Mizoram	78.4946237	142.5	1.26	1.25	1736	1169	31198	4492.623
Nagaland	73.7044146	137.7	0.24	4.87	1664	1055	45520	9170.792
Sikkim	52.739726	181.9	0	1.27	1676	925	0	3498.057
Tripura	51.9348269	190.8	19.36	0.49	2767	863	56486	13112.16
Uttarakhand	58.9648799	160.6	135.93	0.85	2474	970	80000	6036.978

Source: Agricultural Statistics at a Glance, 2022, MOA & FW, Govt. of India, New Delhi.

The Net Sown Area refers to the total area of land on which crops are actually sown and harvested during a single agricultural year, in this regard almost all the hilly states have net sown area above the national average (42.57%). This factor can be attributed to wide prevalence of terrace cultivation and efficient land use. Also, a contributory factor is the

practice of multiple cropping through agroforestry and mixed farming practices, which are commonly seen in almost all Northeastern states.

The relationship between Net sown area to gross cropped area throws a valuable light on the cropping intensity prevalent in the region. Cropping Intensity being the ratio of the Gross Cropped Area to the Net Sown Area, expressed as a percentage. Almost all the hill states fare high due to their efficient land use like cultivation of crops on hill slopes, and since Farmers in hilly areas often have smaller landholdings, the land is put to intensive use, and every available piece of land is used for cultivation to maximize productivity. With the sole exception of Manipur (100%) and Meghalaya (122%), almost all the hilly states under study have cropping intensity figures above the national average (135%).

Almost all the primary northeastern hilly states have very poor levels of fertilizer consumption compared to the national average. Only Uttarakhand (over 135,000tonnes) and J&K (120,000 tonnes) compare favourably in this aspect. Low consumption of fertilizers has contributed to the high cost of cultivation and poor quality of produce, which has created obstacles tothe adoption of commercial cultivation in these states.

The average land holding per person, while on one hand demonstrates the levels of land fragmentation and the prevailing socio-economic conditions of a place, on the other hand it is also an indicator of the economic viability of agriculture as a whole. It helps measure the efficiency and productivity of agriculture practiced in the region and the extent to which mechanization and modernity will be adopted in agricultural practices. Only Arunachal and Nagaland show moderately high levels of fragmentation, compared to the other hilly states under study, which is mainly due to the vast presence of uncultivable land (hilly terrain) compared to the gross cropped area in these two states.

Foodgrain production is the backbone of the agriculture sector in a region. In the context of these hilly states, the topography and population are the twin factors that determine the extent of foodgrain production. Tripura which has over 1/4th of its land dedicated to agriculture has the highest yield of foodgrains, followed closely by other hilly states. Intensive cultivation practices through terrace farming and traditional water harvesting methods have contributed to the maintenance of healthy yields.

Oilseeds are an essential component of commercial agricultural practices in a region. India is the fourth largest oilseeds producer in the world, having 20.8% of the total area under cultivation globally. The importance of oilseeds to the economy is multivariate and it serves an important role in many other allied industries. Many northeastern states have focused on developing this sector, particularly in the production of Rapeseed and Mustard. The Mizoram government has even ventured in the Palm oil sector and the Mizoram Oil

Palm (Regulation of Production & Processing) Act, was passed way back in 2004 for developing Oil Palm cultivation, which has delivered good results (Khawlhring & Lalbiakthangi, 2019).

The productivity of sugarcane varies based on topography and soil conditions. It requires quite a high amount of rainfall for its growth and all the hill states support that cultivation but the extent of production varies. The sugarcane industry is India's second largest industry after textile giving ample opportunities to farmers as well as skilled and unskilled workers. In India, about 5 million farmers are sugarcane cultivators and 0.5 million workers are engaged in its processing factories(nfsm.gov.in).Except for Jammu & Kashmir, Meghalaya and Sikkim, a good yield per hectare of sugarcane is observed among the other states. The yield is highest in Uttarakhand i.e., about 80000 kg/hectare followed by Tripura and Manipur.

A major strength of the hilly states lies in the horticultural sector. Geographical locations have rendered diversity in the overall basket of horticultural products. Tripura which has a yield of 12112 kg/hect. produces a host of tropical fruits like pineapple,jackfruit, banana, orange, mango (Amrapalli) etc. On the other hand, Manipur (9934.981 kg/ha) which has 52% of its agricultural practices confined to the Manipur valley, produces a wide range of Kharif (Summer) and Rabi (Winter) vegetables besides Plantation crops like Litchi,Lemon, Passion fruit, Peach, Pear, Plum etc. Similarly, the northern hilly states of Jammu and Kashmir and Himachal Pradesh boast of a variety of crops like apples, almonds, walnuts, pears, cherries and apricots (in the temperate areas) and mango, citrus, litchi, papaya, guava etc. in (subtropical areas).

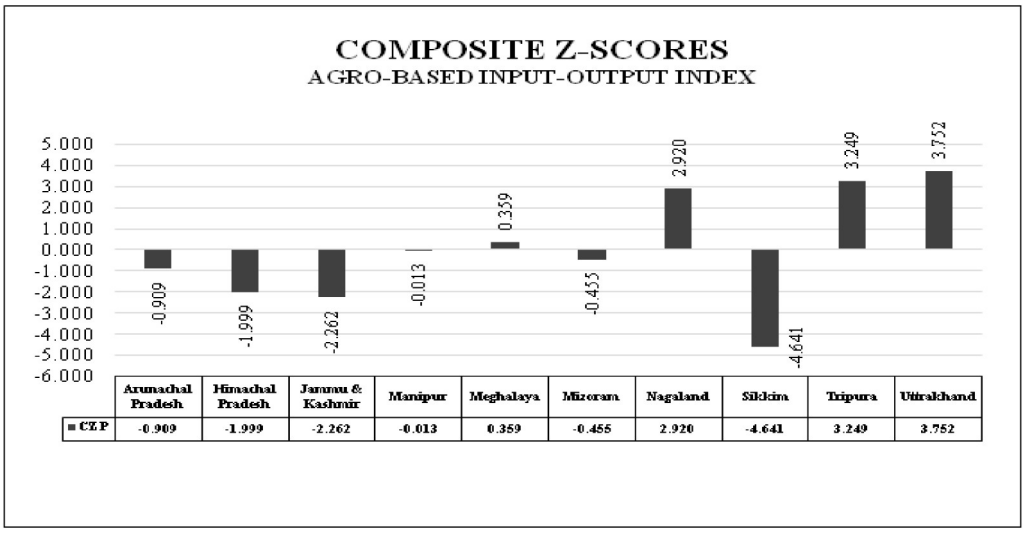

Figure 3: Composite scores of agro-based input-output variables

In terms of the overall agro-based input and output variables, high productivity is measured in Uttarakhand, Tripura, and Nagaland. While it is lowest in the states of Sikkim followed by Jammu and Kashmir, etc. It is interesting to see that Uttarakhand, Jammu & Kashmir despite of their hilliness, performs well in agriculture in terms of agriculture. It is not being seen in this index only but is also been seen in some other indexes too.

3. Index of economic Input: This index signifies those financial supports that is provided by the economic sector of the country for a region's agricultural development. A combined index is prepared using the following variables to measure the disparity in terms of economic input to the selected states.

a) Average Daily Wage rate of Agricultural laborers (In Rs.)

b) Average Monthly Income of Farmers (In Rs.)

c) Area Insured under PMFSY & RWBCIS (In '00000 Hect.)

d) Agricultural households to rural households (In %)

Table 3: Variables visualizing economic inputs in the agriculture sector.

States	E1 (a)	E2 (b)	E3 (c)	E4 (d)
Arunachal Pradesh	0	19225	0	69.1
Himachal Pradesh	473.3	12153	77.06	69.2
Jammu & Kashmir	550.4	18918	3.25	74.4
Manipur	0	11227	0.36	64.6
Meghalaya	381	29348	0.03	73.5
Mizoram	233	17964	0	74.2
Nagaland	0	9877	0	79.9
Sikkim	0	12447	0.01	66.3
Tripura	303.6	9918	1.48	41.4
Uttarakhand	0	13552	55.31	67.4

Source: Reserve Bank of India Publication, New Delhi, India.

Department of Agriculture & Farmers Welfare, Govt, Of India, New Delhi.

NABARD, Mumbai, India.

Rural Development Department, Govt. of Mizoram.

Pradhan Mantri Fasal Bima Yojana (PMFBY) & Restructured Weather Based Crop Insurance Scheme (RWBCIS) are both agricultural insurance schemes, where PMFBY is a yield index-based scheme and RWBCIS, a weather index-based scheme. The dataset clearly shows that only 2 hilly states of Himachal Pradesh and Uttarakhand have taken the benefits of the scheme, whereas almost all the hilly states of Northeast have been left out

of the schemes. The major reason behind this has been the reluctance of Insurance companies to build their base in these States, as the administrative costs are high. Another factor is that there is dearth of proper land records and also the historic agricultural yield data is not readily available, particularly at the Block and panchayat levels. In the same vein, the lack of weather forecasting infrastructure has hindered the penetration of the weather-based insurance scheme like RWBCIS in these states.

Almost all the hilly states show a predominant share of agricultural sector in the overall occupational pattern of the people, over and above the national average (around 45%). Nagaland has around 80% of its rural household that are agrarian in nature- this owing to its agriculture and other cottage and agro-based industries that comprises its main economy. Similarly in J&K almost 72% of the population (2011 Census) reside in rural areas and are engaged in the agricultural sector. This trend is almost uniformly seen in almost all the hilly states.

According to the Net state domestic product (NSDP) percapita figures (2020-21),Sikkim ranks highest among the hilly states under the study at Rs 415,045, followed by Arunachal Pradesh at Rs 181,537. The dominant impact of tourism and mining sectors in these two states has created a positive impact on the state's economy. However, on the agricultural income front both these states come in 6th (Sikkim) and 2nd (Arunachal Pradesh) position. Meghalaya which has around 38% of its land for cash crops, like Maize and other horticultural products has been able to provide its farmers with a steady income and ranks 1st in the list of hilly states under the study.

Agriculture in itself is a labour-intensive activity, especially during planting and harvesting seasons. In hilly regions, the availability of seasonal labour can significantly influence productivity. However, as the data shows in almost 4 out of 7 North-eastern hilly states, the daily wage rates are not available. Factors such as poor transportation facilities coupled with concerns about safety and other ethnic issues have discouraged the movement of migrant laborers from the plains to these states. On the other side of the spectrum, J&K and Himachal Pradesh with Rs 550.4 & Rs 473.3 respectively rank much above the national average of Rs 328.18 (2020-21), highlighting the value of their commercial agricultural sector.

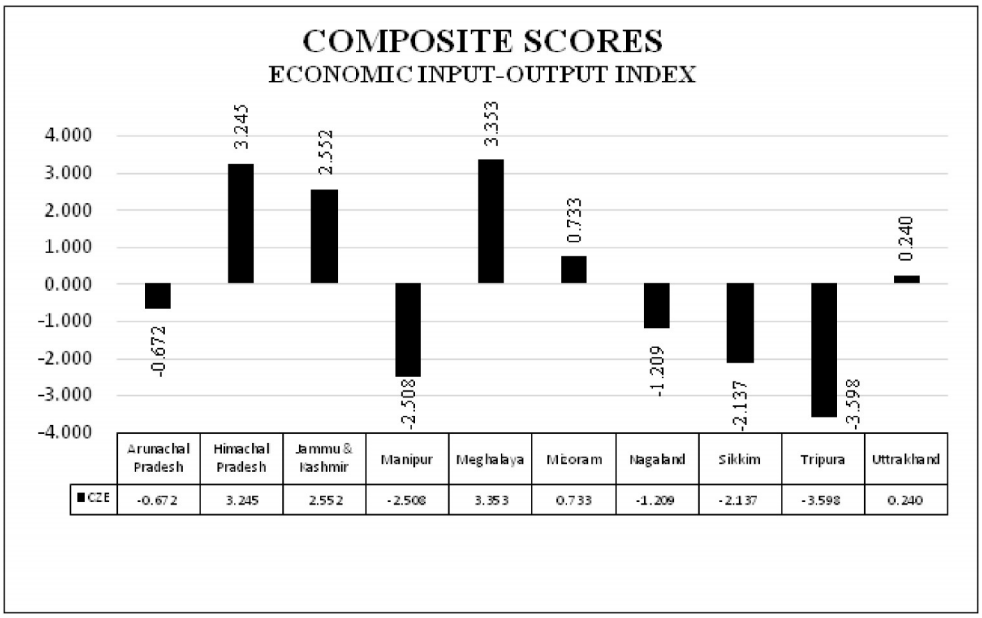

Figure 4: Combined index of variables depicting the inputs from the economic side to the agricultural sector.

The composite z scores of variables related to economic inputs in agriculture reflect the high allocation of funds in the agriculture sector to states like Himachal Pradesh, Jammu & Kashmir, Meghalaya, and Uttarakhand and Meghalaya has the highest. The allocation of economic inputs to agriculture is very low in Tripura followed by Manipur and Sikkim. A large gap is observed from the results shown above.

Conclusion

Hill areas due to their physiographic condition, have always been deprived of developmental activities. Here, no other economic sector performs in a much better way than that of the plains. The major population of those regions relies on agriculture as their socio-economic condition is not well developed and they lack technological skills. They perform traditional farming which is not very profitable and they can't prosper economically from that production. To prosper economically, agriculture should be profitable and it should be done scientifically and also special attention to them is highly required.

After summing the composite z-score indexes, the disparity in the agriculture sector over the hill states is visible to us. The final result shows that states like Jammu & Kashmir, Uttarakhand and Tripura with a composite z-score index value ranging from 2.7 to 9.1 are agriculturally developed while Himachal Pradesh, Meghalaya, Nagaland, and Mizoram ranging from -3.7 to 2.7 are moderately developed states. The less developed states are Sikkim, Arunachal Pradesh and Manipur with composite z-score index values of -10.1 to -3.7.

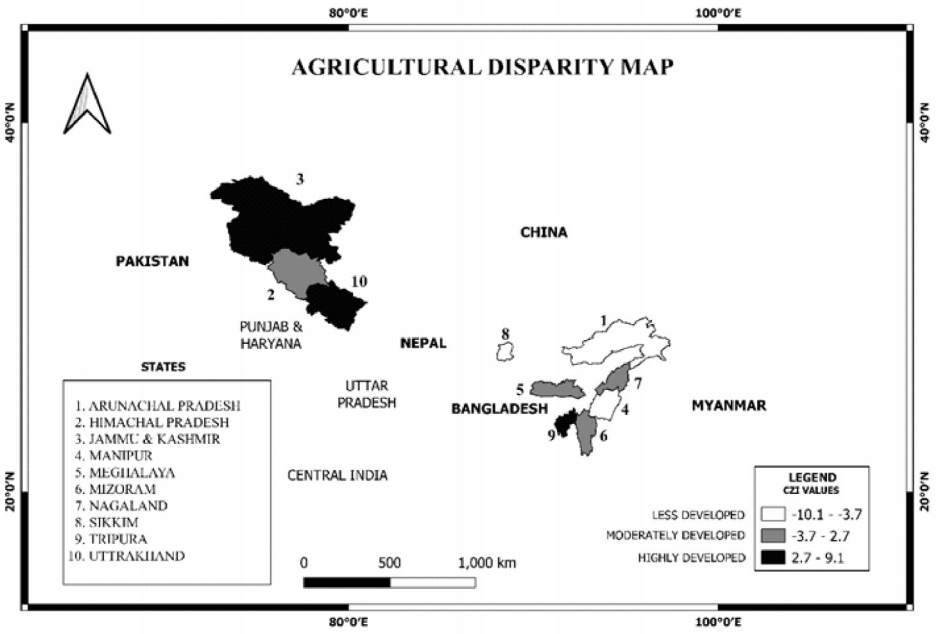

Figure 5: Choropleth map reflecting the agricultural disparity

From the results, it is also been visible that the less developed states are only the northeastern states while the rest are in a considerable stage. So more developmental activities related to agriculture need to be implemented in the northeastern states as well as in the other states. There is great potential in the agriculture sector in northeast Indian states which needs to be utilized and it will also help the farmers as it is the main occupation of the population living in those regions.

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