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AGRICULTURAL DEVELOPMENT DISPARITIES IN PUNJAB: AN INTER-DISTRICT ANALYSIS

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Abstract: This study examines the agricultural development disparities across various districts of Punjab, India, highlighting the factors that contribute to these inequalities. Addressing the disparities is essential for promoting sustainable agricultural growth and ensuring equitable benefits for all farmers in Punjab. The present study evaluated the relative performance of 22 districts of the State of Punjab in terms of agricultural development at two points of time i.e. 2001 and 2018. Twenty indicators of agricultural sector were used to construct a composite index at the district level to identify the agricultural sector development. Results assured that there were substantial agricultural disparities in the State. The districts Gurdaspur, Ludhiana, Patiala and Sangrur were highly agricultural developed, and Mansa, Pathankot, Barnala and S.A.S Nagar were identified as backward districts. Study concludes that increasing public investment in agricultural infrastructure (irrigation, credit institutions, commutation and marketing), setting up the appropriate farming systems, affordable new technologies and crop variety can play a major role in agricultural development. The special plan and strategies should be adopted for agriculturally backward areas. State government should made policies after identify the weakness, strength and potential of the districts to reduce the unbalanced growth of agricultural development in Punjab.

Keywords: Economic development, regional disparities, agricultural development.

INTRODUCTION

Regional disparity is a common global phenomenon in both developed and developing economy. Regional disparities are a condition of unbalanced in standard of living in different parts of a particular area. Understanding these disparities is crucial for formulating effective policies aimed at fostering equitable growth and ensuring sustainable agricultural practices.The 'Inverted U Shape' theory of Kuznets (1955) explained that the phenomenon of regional disparities increased up to a certain period and later it would go down in the process of economic development. Backward regions suffer while developed region growing (Myrdal, 1957). Hirschman (1958) explained the role of the

state to reduced disparity. Williamson (1965), Nair (1982) and Koropeckyj (1972) showed that rising national economic development was usually due to increased interstate inequality. The agricultural development is a predominated strategy for economic development of developing countries of the world. Agricultural development is the backbone to support the rapid economic development of any economy. However, for balanced growth of each region, agricultural development should be balanced in any developing economy. Policies and strategies for agricultural development can capable in trickle-down effects for that economy (Johnston & Mellor (1961). Pace and pattern of agricultural development of any region depend on optimum agricultural activities. The active agricultural and allied activities are also helpful in reducing the disparities among regions in terms of per capita income and also lead to equitable allocation of employment opportunities (Christiaensen, (2007) and Anjum & Tarique, (2017). Moreover, out-migration of capital and skilled labour can be prevented due to the inducement of staying in a particular region. The agricultural development is also helpful in bringing more reciprocal trust among people through socio-cultural transformation (Kumari, (2014). The balanced inter-district agricultural development strategies can also tackle the problem of uneven patterns of development. The disparity among Indian states and regions regarding agricultural development is an alarming issue (Sahoo & Mohapatra (2008). The studies of Nayak (1998), Birthal et al. (2011), and Chand & Parappurathu (2012) found variations in productivity along with agricultural performance among the Indian states. Somasekharan et al. (2011) found that agricultural disparities have widened among fifteen Indian states during the period 1971-2007. Bhalla & Alagh (1979) found significant variations in agricultural development at the district level in India. Ohlan (2013) studied the inter-district variations in agricultural development and found the agricultural disparities have widening.

The agricultural development disparities in Punjab highlight the need for a nuanced understanding of the varied challenges facing its districts. By addressing these disparities through targeted interventions and inclusive policies, Punjab can not only enhance its agricultural productivity but also ensure that the benefits of growth are shared equitably among its farmers. A collective effort toward sustainable agricultural practices will be essential for the future of Punjab's agriculture, ensuring it remains the backbone of India's food security.

Punjab, often referred to as the "Granary of India," has been a cornerstone of the country's agricultural landscape. Renowned for its high productivity and significant contribution to food security, the state has, however, been grappling with substantial disparities in agricultural development across its districts. Punjab's agriculture is characterized by its intensive farming practices, extensive irrigation networks, and a strong emphasis on wheat and rice cultivation. Despite these advantages, there exists a

marked variation in agricultural performance, income levels, and access to resources among the districts. Punjab has always been predominantly an agricultural State. Punjab's agriculture is renowned for its diversity, which largely stems from variations in resource endowments, climate, topography, and historical, institutional, and socio-economic factors. Even during the British period, its character remained the same. They paid attention towards the development of the resources of the land in the State through improved methods of irrigation and channels of communication. They have introduced several policies in the state of Punjab for the development of agriculture.

After independence, there was the introduction of land reforms followed by the reorganization of the Punjab state in 1966. The Green Revolution has successful path in rural Punjab. The Green Revolution gave a special identity to Punjab against other states, and due to its agro-ecological advantage, helped the country from coming out of food insecurity. Since then, a plethora of studies have been undertaken by scholars to examine the agricultural transformation and socio-economic impact of a new method of cultivation in Punjab (Bhalla & Chadha (1983). They have highlighted a large number of production gains experienced by Punjab agriculture during the initial decades (1970-1990), such as an increase in the area under cultivation, cropping intensity, growth of production and productivity, farm income, expansion of marketing facilities etc. (Chadha, 1986). Along with this, in the latter decades 1990 onwards, they also highlighted a large number of problems associated with the production gains which resulted from the agricultural transformation, such as the declining growth rate of agriculture sector, an unsustainable shift in cropping pattern, increased cost of cultivation, decline in employment, elasticity, indebtedness, and recently the suicides of farmers and agricultural labourers' in rural Punjab. Though, there were several productivity constraints linked to the problems of labour utilization, scarcity of capital in irrigation and other capital inputs (Bhalla et al. (1990). An increase in Punjab's agricultural production can enhanced the government's revenue. McGuirk & Mundalak (1991) studied the transformation of Punjab's agriculture in terms of its incentives and constraints, and observed that yield of rice and wheat had increased due to high-yielding varieties of seeds and proper irrigation facilities. The Board of Administration sanctioned advances of money for the repair of old wells, sinking of new ones and the excavation of water recourses (Sidhu, 2002). Singh (2004) explored the importance of subsidy and distribution of fertilizers in agricultural development. The study of Sidhu et al. (2010) is based on the economic implications of agricultural technologies and practices. They found that intensive agricultural practices are responsible for the exploitation of underground water, environmental deterioration and falling biodiversity. Singh et al. (2013) examined the variation among districts of Punjab in terms of the use of modern agricultural inputs during 1993-94 to 2003-04 and found that variations were reduced in the studied period. Singh and Kour (2014) found that the

numbers of the regulated market, warehouses, availability of bank credit and yield of wheat & rice were positively influencing factors of agricultural development. Kumar and Kumar (2015) highlighted the adverse effects of agricultural development in terms of development duality, unbalanced crop production, income disparity among farms and social tensions in rural parts of the State.

Reduction in agricultural disparities is the main objective by the state government and policymakers. The regional disparities in agricultural sector development at district level in the state of Punjab with the help of agricultural sector development index (ASDI) are analysed. All the indicators used in the study are quantitatively and valid to justify agricultural development of all districts of Punjab. The study constructs ASDI (agricultural sector development index) for districts of Punjab by using statistical abstract data of 2001 and 2018. The Wroclow Taxonomic Method (Florek, Lukaszewicz, Perkal, Steinhaus and Zubrzycki, 1952) has been used. The study ranked the districts according to the constructed index i.e. ASDI, including 20 agricultural indicators. The study also compares the agricultural development status of the districts and recommends policies for the selected backward districts.

Agricultural development in Punjab shows significant inter-district disparities. Districts like Ludhiana, Jalandhar, and Patiala have experienced rapid growth due to better access to irrigation, mechanization, and Green Revolution technologies, leading to higher productivity and prosperity. In contrast, districts such as Mansa, Ferozepur, and Muktsar lag behind due to limited resources, poorer soil quality, and lower adoption of advanced agricultural practices. These disparities are compounded by uneven infrastructure development and access to credit, resulting in varying levels of farmer income and quality of life. Addressing these inequalities requires targeted interventions focusing on resource allocation, technological support, and sustainable practices.

RESEARCH METHODOLOGY

Agricultural sector development indicators represent the quantity of produce crops, cropped area, fertilizers consumption, irrigation facilities etc. These indicators can differ from area to area. Thus, the selection of indicators is a foremost and crucial task. It should be bear in mind that the indicators should be properly shows the agricultural sector parameter extensively. For the growth of the agricultural sector it is essential to make an agricultural sector development index. Accessibility of the data also makes the choices of the indicators.

In this Study, total twenty agricultural sector indicators were used for the construction of ASDI and scaling of the districts of Punjab. The indicators were the production of the important crops in 1,000 M. Ton (A_1), market arrivals in 1,000 quintals (A_2), total cropped area in 1,000 hectares (A_3), gross irrigated area in 1,000

hectares (A_4), net irrigated area in 1,000 hectares (A_5), net sown area in 1,000 hectares (A_6), Area under fruits in 1,000 hectares (A_7), production of fruits in M. Tons (A_8), number of livestock (in 1,000) (A_9), number of poultry (in 1,000) (A_{10}), number of the veterinary hospital (A_{11}), livestock population per veterinary institutions (A_{12}), number of agriculture credit societies (A_{13}), an average area regulated per market (sq km.)(A_{14}), fertilizers consumption (1,000 ton)(A_{15}), number of tube well (A_{16}), number of tractors per 1,000 hectares (Net Area Sown) (A_{17}), annual rainfall (A_{18}), rural literacy rate (A_{19}), percentage of agricultural workers to total workers (A_{20}). The data were taken from various issues of Statistical Abstract of Punjab issued by the Government of Punjab.

Agricultural development is a combination of various factors in any region. For the comprehensive nature of the indicators, it is necessary to integrate all the indicators in a single factor which provides a construct picture of the development. There are various methods to construct a single factor of development based on different developmental indicators (i.e. principal component analysis, ranking method, ratio index aggregation method, monetary index and multiple factor analysis). Most of the methods have several limitations. The present study was based on the Wroclow Taxonomic technique for the construction of agricultural sector development index due its simple nature of giving equal weights to all the indicators of agricultural sector development. Florek et al., (1952) suggested the importance of this method in calculating the pattern and stages of development. The Taxonomic distance technique is a more appropriate measure of development due to its inclusion nature of variance among indicators (Gostowski, 1970).

THE MODEL

Let $[X_{ij}]$ be the data matrix giving the values of the *i*th district and the *j*th indicators I = 1,2,3,4,…n (No. of districts) and j= 1,2,3……k (No. of indicators)

For combined analysis $[X_{ij}]$ is transformed into the matrix of standardised indicators $[Z_{ij}]$ as follows

$$[Z_{ij}] = \frac{Xij - \bar{X}}{\sigma}$$

where $\bar{X}j$ = mean of the *j*th indicators and σ is the standard deviation of the *j*th indicators. From $[Z_{ij}]$, identify the optimal value of each indicator. The optimal value could be maximum or minimum depending upon the direction of the impact of the indicators. The increase in road and banking facilities would positively affect the development, and the higher density of population may hinder the development process. To get the pattern of development C_i of the district, firstly we will calculate the square of the deviation of the individual value of a transformed variate from the optimal value (which is the P_{ij})

$$P_{ij} = (Z_{ij} - Z_{0j})^2$$

For each *i and j*

Pattern of Development is given by

$$C_i = \sqrt{\sum_{j=1}^{n} P_i / (cv_j)}$$

Where (cv_j) is the coefficient of the *j*th indicator in X_{ij} agricultural sector development is given by

$D_i = C_i / C$

$C = \overline{C} + 3\sigma C_i$

$$\overline{C} = \frac{\sum_{i=1}^{N} C_i}{N} \text{ and } \sigma C_i = \sqrt{\sum_{i=1}^{n} (C_i - \overline{C})^2}$$

where $0 < D_i < 1$

The district is more developed if its D_i is near to 0.

Stages of Agricultural Development

The economic development of any region of the country depends upon various factors, among them the agricultural sector plays a key role in economic growth. Initially, the **pre-Green Revolution stage** was characterized by traditional farming methods and low productivity. In **the Green Revolution stage (1960s-70s),** districts like Ludhiana and Patiala benefited from high-yielding seeds, irrigation, and mechanization, significantly improving crop yields. This led to regional disparities, as more developed districts advanced faster than others. The **post-Green Revolution stage** has seen stagnation in productivity, environmental degradation, and groundwater depletion. Current research focuses on the **sustainability stage,** exploring organic farming, diversification, and water management across districts to ensure long-term agricultural viability.

The proper labelling of the districts from the mean and standard deviation of D_i value give a meaningful categorisation of different stages of agricultural development. In this study the different stages of agricultural development of districts are defined as bellow

First Stage (Low Agricultural Developed) $= D_i \leq (\overline{X} + \sigma)$

Second Stage (Low Middle Agricultural Developed) $= \overline{X} < D_i < (\overline{X} + \sigma)$

Third Stage (High Middle Agricultural Developed) $= \overline{X} > D_i > (\overline{X} - \sigma)$

Fourth Stage (Highly Agricultural Developed) $= D_i \leq (\bar{X} - \sigma)$

Districts having the highest values of D_i are considered as least developed.

RESULTS AND DISCUSSION

Punjab, despite its status as India's agricultural hub, experiences significant disparities in development across its districts. These disparities in Punjab are a result of multiple interconnected factors, including unequal access to water, varying soil quality, socio-economic inequality, and uneven government support. Districts in central Punjab, such as Ludhiana and Jalandhar, benefit from well-developed canal systems and irrigation infrastructure, leading to higher agricultural productivity. In contrast, southwestern districts like Bathinda and Mansa suffer from water scarcity, groundwater depletion, and over-reliance on tube wells, which limits their agricultural output. Where as districts like Amritsar and Patiala supports high-yield crops due to fertile soil, while districts in the southwest, with saline or sandy soils, face lower productivity. Central districts, being more prosperous, adopt modern farming techniques, including mechanization and advanced irrigation systems. Larger landholdings in districts like Ludhiana allow for more efficient, mechanized farming. In contrast, districts with fragmented or smaller landholdings, such as Gurdaspur, face challenges in achieving economies of scale.

Addressing these disparities requires region-specific interventions, particularly in underdeveloped districts, focusing on improving infrastructure, access to technology, and equitable distribution of resources. Transportation and market access play pivotal roles in agricultural development. Districts with robust infrastructure benefit from easier access to markets, reducing post-harvest losses and enhancing profitability. Educational attainment directly influences farming practices and productivity. Districts with higher literacy rates tend to adopt modern agricultural techniques more readily, leading to increased yields and income levels.

Table 1 presents the index value of agricultural development, rank and stages of development (SD) at two points in time i.e. 2001 and 2018. In the year 2001, from seventeen the districts, district Ludhiana got the first position, and Mansa was in the last rank in terms of index value i.e. 0.5553 and 0.8499 respectively. Ludhiana was followed by district Sangrur (0.5641), Amritsar (0.5707) and Gurdaspur (0.5722) in terms of agricultural developed with ranks second, third, fourth, and all these three districts were in the fourth stage of agricultural development. District of Hoshiarpur (0.6314), Patiala (0.6455), Firozpur (0.6566), Muktsar (0.6844), Jalandhar (0.6929) and Bhatinda (0.6971) with index values varying from 0.6314 to 0.6971 were in the third stage of agricultural development. The district of Moga (0.7137), Rup Nagar (0.7719) and Kapurthala (0.7875) lie in the second stage of agricultural development. District of S.A.S Nagar (0.8082), Fatehgarh Sahib (0.8251), Faridkot (0.8460) and

Mansa (0.8499) were the least agricultural backward districts in the State with first stage of agricultural development.

Table 1: Index Value of Agricultural Sector Development Index (ASDI), Rank and Stages of Development (SD)

Sr. No	*District*	*2001*			*2018*		
		ASDI	*Rank*	*SD*	*ASDI*	*Rank*	*SD*
1	Gurdaspur	0.5722	4	Fourth	0.4454	1	Fourth
2	Kapurthala	0.7875	13	Second	0.7121	13	Second
3	Amritsar	0.5707	3	Fourth	0.6314	8	Third
4	Patiala	0.6455	6	Third	0.5156	3	Fourth
5	Ludhiana	0.5553	1	Fourth	0.4488	2	Fourth
6	Jalandhar	0.6929	9	Third	0.6048	6	Third
7	S.B.S Nagar	0.8082	14	First	0.6937	10	Second
8	Hoshiarpur	0.6314	5	Third	0.5622	5	Third
9	Rupnagar	0.7719	12	Second	0.7218	14	Second
10	Fatehgarh Sahib	0.8251	15	First	0.7040	12	Second
11	Muktsar	0.6844	8	Third	0.6975	11	Second
12	Firozpur	0.6566	7	Third	0.7240	15	Second
13	Faridkot	0.8460	16	First	0.7733	18	Second
14	Moga	0.7137	11	Second	0.6356	9	Third
15	Bathinda	0.6971	10	Third	0.6259	7	Third
16	Mansa	0.8499	17	First	0.8246	22	First
17	Sangrur	0.5641	2	Fourth	0.5459	4	Fourth
18	Barnala	-	-	-	0.7919	20	First
19	S.A.S Nagar	-	-	-	0.7827	19	First
20	Fazilka	-	-	-	0.7332	17	Second
21	Pathankot	-	-	-	0.8116	21	First
22	Tarn Taran	-	-	-	0.7315	16	Second

Source: Authors Own Calculations, (-) Sign shows non availability of data.

The District Gurdaspur hold the first rank in the year 2018 with an index score of 0.4454 followed by the districts Ludhiana (0.4488), Patiala (0.5156) and Sangrur (0.5459) were the only districts in the State of Punjab which were in the fourth stage of agricultural development. However, district Mansa was in the last rank with an index value of 0.8246. The district Hoshiarpur was ranked five (0.5622), followed by the districts Jalandhar (0.6048), Bhatinda (0.6259), Amritsar (0.6314) and Moga (0.6314) in stage III of agricultural development. The districts S.B.S Nagar (0.6937), Muktsar (0.6975), Fatehgarh Sahib (0.7040), Kapurthala (0.7121), Rupnagar (0.7218), Firozpur

(0.7240), Tarn Taran (0.7315), Fazilka (0.7332), Faridkot (0.7333) were in second stage of agricultural development. The backward districts in the State were S.A.S Nagar (0.7827), Barnala (0.7919), Pathankot (0.8116) and Mansa (0.8246).

CONCLUSION AND SUGGESTIONS

The level of development in agricultural sector shows unbalanced pattern of development through of passage of time. The agricultural sector disparities among districts of Punjab have been existed from long period. By emphasizing the unique challenges and opportunities of each district, the study advocates for targeted policy interventions and investments in education, infrastructure, and cooperative farming models. Results of the present study also confirmed the existence of inter-district disparities in agricultural development in the State of Punjab. Districts like Gurdaspur, Ludhiana, Patiala and Sangrur dominated in the highly developed category, whereas Mansa, Barnala, Pathankot and S.A.S Nagar were in the least ASDI group. The agricultural production, gross cropped area, net irrigated area are very small in the districts Mansa, S.A.S Nagar, Fazilka, S.B.S. Nagar and Firozpur. So, planning authorities must be focussed on productive farm based activities rather than land based in these areas. Kandi area (Hoshiarpur, Rup Nagar, S.A.S Nagar and S.B.S Nagar) is appropriate for horticulture so research and development institutions should be setup in this area for breeding of crop varieties, soil health, resistant to pest and disease.

This study also labelled the districts according to their respective stage of agricultural development, which is helpful in taking necessary action for the future prospective. The districts Mansa, Barnala, Pathankot, Faridkot, Fazilka and Tarn Taran needs proper attention by the State's government at local level. The districts Firozpur, Hoshiarpur, Muktsar and Rupnagar have area under waste land. So such land should be taken under agricultural activities like dairy farming, horticulture, animal husbandry and fisheries. Increase in agricultural production and per- capita income of the rural community is the need of hour. There is need of policy interventions by the State's government to reduce this gulf of agricultural disparities. The objectives of the government policies for agricultural backward districts should be at micro level rather than at macro level. In this manner the rural disguised unemployed youth can receive the beneficial employment opportunities. The cost of agriculture production need to be curtailed through mechanization, financial support and sharing agricultural machinery on custom hiring basis. Besides the proper allocation of funds by the State's government, requisite results are not coming. So there is need of execution and monitoring of the funds by the local bodies because decentralization of powers at grass root level can reduce the corruption along with efficient allocation of resources which will reduce the gap of these disparities.

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