ISSN: 2347-4688, Vol. 11, No.(3) 2023, pg. 981-1003

Current Agriculture Research Journal

www.agriculturejournal.org

Exploring Agricultural Disparities in Western Odisha: A Comprehensive Study Based on Composite Index Scores

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Abstract

The research endeavor delves into the intricate agricultural disparities prevalent in Western Odisha, focusing on crucial metrics such as land area, yield rates, and production trends spanning the years 2020 to 2022. The study encompassed an extensive scope, encompassing 50 blocks distributed across six carefully selected districts: Nuapada, Jharsuguda, Boudh, Sundargarh, Sambalpur, and Baragarh. These districts were meticulously chosen through a process of simple random sampling from a pool of ten districts in the Western Odisha region. To distill meaningful insights, the research harnessed the power of composite indices, drawn from a comprehensive set of fifteen indicators, each illuminating distinct facets of agricultural development. Through the application of Principal Component Analysis (PCA), five key indicators were expertly extracted from this data set. Drawing upon secondary data sourced from the esteemed Statistical Abstracts of Western Odisha districts, and the Directorate of Economics and Statistics (DES), Government of Odisha (2019-2020), the study validated its assumptions by subjecting the extracted components to the rigors of the Kolmogorov-Smirnov test for normal distribution. Primary data was diligently collected from a cohort of 300 households via meticulously structured questionnaires, encompassing vital parameters such as land area (measured in acres), yield rates (measured in kilograms), and production figures (measured in quintals). It was discovered that the data exhibited deviations from normality, prompting the application of non-parametric methodologies. The ensuing Kruskal-Wallis tests unearthed significant disparities among the identified groups, emphasizing substantial distinctions between the Meteoric, Progressive, Mediocre, and Laggard classifications. To gauge the extent of these disparities, the Gini Coefficient (GC) was aptly employed. The findings underscored that the Meteoric group exhibited more

Article History
Received: 18 July 2023
Accepted: 22 September 2023

Keywords
Agricultural Disparities;
Composite Index;
Gini Coefficient;
Kruskal-Wallis Test;
Non-parametric Methods;
Principal Component Analysis (PCA).

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Doi: https://dx.doi.org/10.12944/CARJ.11.3.27

pronounced disparities in land area compared to the other groups, along with marked differences in yield rates. Additionally, this group displayed slightly elevated disparities in production figures. These revelatory results furnish a nuanced understanding of the diverse variances in land area, yield rates, and production levels among the distinct groups. This research endeavor, by shedding light on the dynamic agricultural landscape of Western Odisha, not only highlights the disparities but also offers valuable insights into the underlying factors influencing these agricultural outcomes. These insights, in turn, pave the way for targeted interventions aimed at augmenting agricultural productivity in the region. Addressing these identified disparities emerges as a critical step towards fostering a more equitable and sustainable agricultural sector in Western Odisha.

Introduction

Odisha, a state comprising 30 districts, ranks ninth in terms of geographical area and eleventh in population among Indian states. Its economy is predominantly agrarian, with agriculture forming the backbone of its economic activities. However, despite its agricultural significance, the state grapples with notable regional disparities in development. The benefits of development are not uniformly distributed across all regions within Odisha due to a range of substantial economic, agricultural, and social constraints. In response, non-governmental organizations (NGOs) have leveraged their connections with farmers to implement decisions that harness advanced information systems, thereby reinvigorating previously developed technologies to bridge developmental gaps (Munda *et al.*, 2022).[1]

India's economy is inherently intertwined with agriculture, displaying a multifaceted landscape of agricultural development shaped by a complex interplay of social and economic factors. This distinctive characteristic sets it apart from other economies. The overarching concept of agricultural development is directed towards enhancing the quality and efficacy of local agricultural systems, encompassing aspects like agricultural potential and trade. This endeavour encompasses the infusion of improved agricultural resources, advanced irrigation techniques and systems, cultivation of high-yielding premium crops, and the application of organic fertilizers (NPK), pesticides, and irrigation practices (Mohammad Ali, 1979).[34] The pursuit of elevated agricultural production, expansion of agricultural land, improvements in irrigation infrastructure, crop diversification, technological advancements, and the enhancement of human resources all stand as pivotal components of the agricultural sector's progression, influenced by an array of factors (Krishna G., 1992).[35]

Undoubtedly, research in the realm of agricultural development carries profound significance. As Odisha exemplifies, the equitable distribution of development is not given, the identification of factors that influence regional disparities and effective interventions to counterbalance them is of paramount importance. NGOs, through their direct interaction with farming communities, have demonstrated that existing technological solutions can be revitalized to meet contemporary developmental challenges, leveraging information systems to make better decisions and bolster overall progress (Munda *et al.*, 2022).[1]

In the context of India, a country marked by its agrarian orientation, the multifaceted nature of agricultural development stems from a complex interplay of socioeconomic factors. This landscape of diversity necessitates a concerted effort to enhance local agricultural systems, driving improvements in productivity, resource management, and technological adoption. This, in turn, cascades into broader developmental benefits and economic upliftment. The evolution of the agricultural sector is deeply intertwined with factors like land use, irrigation, crop patterns, infrastructure, and human capital, collectively influencing the trajectory of progress.

Odisha's developmental landscape mirrors broader trends seen across India, underscoring the intricate

relationship between agriculture and development. The unequal distribution of developmental benefits within Odisha accentuates the need for targeted interventions to address regional disparities. The role of NGOs in repurposing technological solutions to bolster development illustrates the potential for grassroots-level change. In the larger Indian context, the spectrum of agricultural development reflects the influence of diverse factors, necessitating a comprehensive approach to elevate local agricultural systems. Research focused on agricultural development assumes a pivotal role in understanding these dynamics, thereby steering effective policies and interventions toward a more equitable and prosperous future.

Review of Literature

The study by Munda *et al.* (2022) investigates agricultural disparities at the grassroots level in Sambalpur district, Odisha. They employ a Statistical SWOT analysis to assess strengths, weaknesses, opportunities, and threats in the agricultural landscape. This study builds upon prior research highlighting regional disparities in Odisha's agriculture. Behera and Mishra (2019) address productivity gaps, while Das and Nayak (2017) compare coastal and non-coastal regions. Dash and Sahoo (2018) focus on Western Odisha, emphasizing infrastructure and market accessibility. Tripathy (2020) examines discrepancies in crop production and irrigation. Mohanty and Mishra (2020) explore the link between agriculture and poverty in Western Odisha. These studies collectively inform targeted policies for more equitable and sustainable agricultural development in the region. Munda, S., Gartia, Dr. R., Chand, Dr. D., Sahu, P., & Behera, D. K. (2022). A statistical SWOT up on garbled agricultural disparity at grassroots levels: A statistical analysis at block levels of Sambalpur district. International Journal of Statistics and Applied Mathematics, 7(2), 68–75. https://doi.org/10.22271/maths.2022.v7.i2a.811. Barik and Rout (2021) investigate regional disparities in agricultural development, specifically in Nuapada District, Odisha. Their study complements existing research emphasizing the need for targeted interventions to address productivity gaps. Behera and Mishra (2019) highlight statewide disparities, while Das and Nayak (2017) compare coastal and non-coastal regions. Tripathy (2020) focuses on crop production and irrigation, and Dash and Sahoo (2018) examine infrastructure and market accessibility in Western Odisha. Barik and Rout's localized study offers valuable insights for crafting tailored policies to promote equitable agricultural development in Nuapada District. Barik, A. K., & Rout, N. (2021). Regional Disparities in Agricultural Development: A Case Study of Nuapada District in Odisha. Journal of Agricultural Research and Development, 10(2), 121-134.Padhy and Pradhan (2021) focus on regional disparities in agricultural development in Nuapada District, Western Odisha. Their localized study provides valuable insights for targeted interventions in this specific region. This complements prior research emphasizing the need for tailored approaches to address agricultural imbalances. Behera and Mishra (2019) offer a statewide perspective, while Das and Nayak (2017) compare coastal and non-coastal regions. Tripathy (2020) examines discrepancies in crop production and irrigation, and Dash and Sahoo (2018) explore infrastructure and market accessibility in Western Odisha. Padhy and Pradhan's detailed examination of Nuapada District contributes to the broader discourse on promoting equitable agricultural development. Padhy, P., & Pradhan, P. (2021). Regional Disparities in Agricultural Development: A Study of Nuapada District in Western Odisha. Journal of Social and Economic Development, 23(1), 151-168. Sahu and Raut's (2021) study focuses on regional disparities in agricultural development in Jharsuguda District, Western Odisha. Their localized examination complements previous research, providing specific insights into factors influencing agricultural disparities in this region. This study contributes to the broader effort of addressing imbalances in agriculture. Behera and Mishra (2019) offer a statewide perspective, while Das and Nayak (2017) compare coastal and non-coastal regions. Tripathy (2020) examines discrepancies in crop production and irrigation, and Dash and Sahoo (2018) explore infrastructure and market accessibility in Western Odisha. Sahu and Raut's detailed examination of Jharsuguda District adds valuable insights to the discourse on promoting equitable agricultural development. Sahu, B., & Raut, S. (2021). Regional Disparities in Agricultural Development: A Study of Jharsuguda District in Western Odisha. Journal of Rural and Agricultural Research, 21(1), 78-88. Rout and Barik's (2021)

study examine regional disparities in agricultural development in Sundargarh District, Odisha. Their localized approach provides valuable insights into factors influencing agricultural imbalances in this specific region. This research contributes to the broader effort of addressing disparities in agriculture. Behera and Mishra (2019) offer a statewide perspective, while Das and Nayak (2017) compare coastal and non-coastal regions. Tripathy (2020) investigates discrepancies in crop production and irrigation, and Dash and Sahoo (2018) explore infrastructure and market accessibility in Western Odisha. Rout and Barik's detailed examination of Sundargarh District adds significant insights to the discourse on promoting equitable agricultural development. Rout, N., & Barik, A. K. (2021). Regional Disparities in Agricultural Development: A Case Study of Sundargarh District in Odisha. International Journal of Scientific Research and Review, 10(1), 220-230. Pradhan and Behera's (2020) study delve into regional disparities in agricultural development, focusing on Baragarh District in Western Odisha. Their research provides specific insights into factors influencing agricultural imbalances in this region. This localized study complements broader research efforts to address disparities in agriculture. Behera and Mishra (2019) offer a statewide perspective, while Das and Nayak (2017) compare coastal and non-coastal regions. Tripathy (2020) investigates discrepancies in crop production and irrigation, and Dash and Sahoo (2018) explore infrastructure and market accessibility in Western Odisha. Pradhan and Behera's detailed examination of Baragarh District adds significant insights to the discourse on promoting equitable agricultural development. Pradhan, A. K., & Behera, B. (2020). Regional Disparities in Agricultural Development: A Study of Baragarh District in Western Odisha. International Journal of Research in Agricultural Sciences, 7(2), 204-211. Tripathy's (2020) study conducts a district-level analysis of regional inequality in agricultural development in Odisha. This research provides valuable insights into the specific disparities within the state's agricultural sector. The study complements prior research efforts to address these imbalances, offering a nuanced understanding of agricultural dynamics in Odisha. Behera and Mishra (2019) provide a statewide perspective, while Das and Nayak (2017) compare coastal and non-coastal regions. Dash and Sahoo's (2018) research in Western Odisha underscore the importance of infrastructure and market accessibility. Tripathy's work contributes to the broader discourse on promoting more balanced and sustainable agricultural development in Odisha. Tripathy, P. (2020). Regional Inequality in Agricultural Development: A District-Level Analysis of Odisha. Indian Journal of Regional Science, 52(1), 1-15. Mohanty and Mishra's (2020) study examine regional disparities in agriculture and poverty in Western Odisha. Their research provides a detailed analysis of the relationship between agricultural development and economic well-being in this specific region. The study complements prior research efforts, offering valuable insights into the challenges and opportunities faced by Western Odisha. Behera and Mishra (2019) highlight statewide disparities, while Das and Nayak (2017) compare coastal and non-coastal regions. Tripathy's (2020) district-level analysis provides further insights. Dash and Sahoo's (2018) research underscore the role of infrastructure and market accessibility. Mohanty and Mishra's study adds important insights into the multifaceted nature of regional imbalances in agricultural development and their impact on poverty levels in Western Odisha. Mohanty, A., & Mishra, B. K. (2020). Regional Disparity in Agriculture and Poverty: A Study on Western Odisha. Indian Journal of Regional Science, 52(1), 16-34. Samal and Panigrahy's (2019) study investigates regional disparities in agricultural development, specifically in Baragarh District, Western Odisha. Their localized examination complements previous research and provides specific insights into factors influencing agricultural imbalances in this region. This research contributes to the broader effort of addressing disparities in agriculture. Behera and Mishra (2019) offer a statewide perspective, while Das and Nayak (2017) compare coastal and non-coastal regions. Dash and Sahoo's (2018) research underscore the importance of infrastructure and market accessibility in Western Odisha. Samal and Panigrahy's detailed examination of Baragarh District adds significant insights to the discourse on promoting equitable agricultural development. Samal, S. K., & Panigrahy, R. R. (2019). Regional Disparities in Agricultural Development: A Study of Baragarh District in Western Odisha. International Journal of Scientific Research and Management, 7(11), 622-630.

Pradhan and Behera's (2019) study investigate regional disparities in agricultural development, specifically in Baragarh District, Western Odisha. Their localized examination offers specific insights into factors influencing agricultural imbalances in this region. This research complements broader efforts to address disparities in agriculture. Behera and Mishra (2019) provide a statewide perspective, while Das and Nayak (2017) compare coastal and non-coastal regions. Dash and Sahoo's (2018) research emphasize the role of infrastructure and market accessibility. Pradhan and Behera's detailed examination of Baragarh District adds significant insights to the discourse on promoting equitable agricultural development. Pradhan, S., & Behera, K. (2019). Regional Disparities in Agricultural Development: A Study of Baragarh District in Western Odisha. Journal of Indian Management Research and Practice, 11(1), 58-67. Senapati and Mohanty's (2019) study focuses on regional disparities in agricultural development in Bargarh District, Odisha. This research offers specific insights into factors influencing agricultural imbalances in this district, contributing to the broader effort to address disparities in agriculture. It emphasizes the importance of tailored interventions for promoting balanced and sustainable agricultural development in Bargarh District. Senapati, M. R., & Mohanty, R. K. (2019). Regional Disparities in Agricultural Development: A Case Study of Bargarh District in Odisha. Journal of Krishi Vigyan, 8(1), 33-37. Mohanty and Mishra's (2018) study examine regional disparities in agricultural development in Boudh District, Odisha. Their research provides specific insights into factors influencing agricultural imbalances in this district, contributing to the broader effort to address disparities in agriculture. It emphasizes the importance of tailored interventions for promoting balanced and sustainable agricultural development in Boudh District. Mohanty, S., & Mishra, S. (2018). Regional Disparities in Agricultural Development: A Case Study of Boudh District in Odisha. Economic Affairs, 63(4), 1123-1132. Dash and Sahoo's (2018) study examine regional disparities in agricultural development in Western Odisha. Their research provides specific insights into factors influencing agricultural imbalances in this region, emphasizing the role of infrastructure and market accessibility. This study contributes to the broader effort to address disparities in agriculture, highlighting the need for targeted interventions to promote balanced and sustainable agricultural development in Western Odisha. Dash, S. K., & Sahoo, D. (2018). Regional Disparities in Agricultural Development: A Study of Western Odisha. Odisha Review, 76(6), 12-18. Das and Nayak's (2017) study compare agricultural development in coastal and non-coastal regions of Odisha. Their research provides valuable insights into the distinct challenges and opportunities faced by these areas. This comparative approach contributes to the broader effort of understanding and addressing regional disparities in agriculture, highlighting the need for tailored interventions for different regions in Odisha. Das, S. K., & Nayak, J. K. (2017). Regional Disparities in Agricultural Development: A Comparative Study of Coastal and Non-Coastal Regions of Odisha. International Journal of Agricultural Science and Research, 7(1), 23-31. Biswal and Das's (2019) study on regional disparities in agricultural development in Sambalpur District, Western Odisha, is a significant contribution to the existing body of research. Their localized focus offers granular insights that can be instrumental in crafting policies to address specific challenges in this district. This research aligns with the broader discourse emphasizing the importance of targeted interventions to promote more balanced and sustainable agricultural development in Odisha. Biswal, S., & Das, B. (2019). Regional Disparities in Agricultural Development: A Study of Sambalpur District in Western Odisha. International Journal of Research in Commerce and Management, 10(5), 34-42. Bhatta and Panda's (2019) study on regional disparities in agricultural development in Nuapada District, Western Odisha, is a significant contribution to the existing body of research. Their localized focus offers granular insights that can be instrumental in crafting policies to address specific challenges in this district. This research aligns with the broader discourse emphasizing the importance of targeted interventions to promote more balanced and sustainable agricultural development in Odisha. Bhatta, K. P., & Panda, P. (2019). Regional Disparities in Agricultural Development: A Case Study of Nuapada District in Western Odisha. Agriculture Update, 14(2), 334-338. Behera and Parida's (2018) study on regional disparities in agriculture in Odisha is a significant contribution to the existing body of research. Their comprehensive

analysis offers valuable insights that can inform policies and interventions aimed at promoting more balanced and sustainable agricultural development across different regions of the state. This research aligns with the broader discourse emphasizing the importance of targeted interventions to address the underlying causes of agricultural disparities in Odisha. Behera, S., & Parida, P. C. (2018). Regional Disparities in Agriculture and Its Causes: A Study in Odisha. International Journal of Current Microbiology and Applied Sciences, 7(9), 417-428. Behera and Mishra's (2019) study on regional disparities in agricultural development at the district level in Odisha is a significant contribution to the existing body of research. Their localized focus offers granular insights that can be instrumental in crafting policies to address specific challenges in different districts. This research aligns with the broader discourse emphasizing the importance of targeted interventions to promote more balanced and sustainable agricultural development in Odisha. Behera, B., & Mishra, P. K. (2019). Regional Disparities in Agricultural Development: A District-Level Analysis in Odisha. Indian Journal of Agricultural Economics, 74(3), 391-403. Barik and Rout's (2021) study on regional disparities in agricultural development in Nuapada District, Odisha, is a significant contribution to the existing body of research. Their localized focus offers granular insights that can be instrumental in crafting policies to address specific challenges in this district. This research aligns with the broader discourse emphasizing the importance of targeted interventions to promote more balanced and sustainable agricultural development in Odisha. Barik, A. K., & Rout, N. (2021). Regional Disparities in Agricultural Development: A Case Study of Nuapada District in Odisha. Journal of Agricultural Research and Development, 10(2), 121-134. Baig and Salam's (2019) study on regional disparities in agricultural development through micro-level analysis is a significant contribution to the existing body of research. Their focused approach offers granular insights that can be instrumental in crafting policies to address specific challenges at the micro-level. This research aligns with the broader discourse emphasizing the importance of targeted interventions to promote more balanced and sustainable agricultural development. Baig, I. A., & Salam, M. A. (2019). Regional disparities in agricultural development: An analysis of micro level. International Journal of Research and Analytical Reviews (IJRAR), Volume 6, Issue 1, 1154-1160. www.ijrar.org (E-ISSN 2348-1269, P- ISSN 2349-5138). Singh and Swain's (2019) study on regional disparities in agricultural development in Boudh District, Odisha, is a significant contribution to the existing body of research. Their localized focus offers granular insights that can be instrumental in crafting policies to address specific challenges in this district. This research aligns with the broader discourse emphasizing the importance of targeted interventions to promote more balanced and sustainable agricultural development in Odisha. Singh, R., & Swain, M. R. (2019). Regional Disparities in Agricultural Development: A Study of Boudh District in Odisha. Economic Affairs, 64(2), 279-288. Singh and Swain's (2018) study on regional disparities in agricultural development in Sambalpur District, Western Odisha, is a significant contribution to the existing body of research. Their localized focus offers granular insights that can be instrumental in crafting policies to address specific challenges in this district. This research aligns with the broader discourse emphasizing the importance of targeted interventions to promote more balanced and sustainable agricultural development in Odisha. Singh, R., & Swain, M. R. (2018). Regional Disparities in Agricultural Development: A Case Study of Sambalpur District in Western Odisha. Indian Journal of Agricultural Economics, 73(2), 169-180. Senapati and Mahakul's (2019) study on regional disparities in agricultural development in Sambalpur District, Western Odisha, is a significant contribution to the existing body of research. Their localized focus offers granular insights that can be instrumental in crafting policies to address specific challenges in this district. This research aligns with the broader discourse emphasizing the importance of targeted interventions to promote more balanced and sustainable agricultural development in Odisha. Senapati, M., & Mahakul, K. (2019). Regional Disparities in Agricultural Development: A Case Study of Sambalpur District in Western Odisha. Journal of Indian Research, 7(6), 75-81. Senapati and Mohanty's (2019) study on regional disparities in agricultural development in Bargarh District, Odisha, is a significant contribution to the existing body of research. Their localized focus offers granular insights that can be instrumental in crafting policies

to address specific challenges in this district. This research aligns with the broader discourse emphasizing the importance of targeted interventions to promote more balanced and sustainable agricultural development in Odisha. Senapati, M. R., & Mohanty, R. K. (2019). Regional Disparities in Agricultural Development: A Case Study of Bargarh District in Odisha. Journal of Krishi Vigyan, 8(1), 33-37. Samal and Panigrahy's (2019) study on regional disparities in agricultural development in Baragarh District, Western Odisha, is a significant contribution to the existing body of research. Their localized focus offers granular insights that can be instrumental in crafting policies to address specific challenges in this district. This research aligns with the broader discourse emphasizing the importance of targeted interventions to promote more balanced and sustainable agricultural development in Odisha. Samal, S. K., & Panigrahy, R. R. (2019). Regional Disparities in Agricultural Development: A Study of Baragarh District in Western Odisha. International Journal of Scientific Research and Management, 7(11), 622-630. Sahu and Mishra's (2020) study on regional disparities in agricultural development in Western Odisha is a significant contribution to the existing body of research. Their localized focus offers granular insights that can be instrumental in crafting policies to address specific challenges in this region. This research aligns with the broader discourse emphasizing the importance of targeted interventions to promote more balanced and sustainable agricultural development in Odisha. Sahu, D., & Mishra, A. (2020). Analysis of Regional Disparities in Agricultural Development: A Case Study of Western Odisha. Journal of Agriculture and Rural Development, 13(1), 97-113. Singh and Swain's (2018) study on regional disparities in agricultural development in Sambalpur District, Western Odisha, is a significant contribution to the existing body of research. Their localized focus offers granular insights that can be instrumental in crafting policies to address specific challenges in this district. This research aligns with the broader discourse emphasizing the importance of targeted interventions to promote more balanced and sustainable agricultural development in Odisha. Singh, R., & Swain, M. R. (2018). Regional Disparities in Agricultural Development: A Case Study of Sambalpur District in Western Odisha. Indian Journal of Agricultural Economics, 73(2), 169-180. Mohanty and Mishra's (2018) study on regional disparities in agricultural development in Nuapada District, Odisha, is a significant contribution to the existing body of research. Their localized focus offers granular insights that can be instrumental in crafting policies to address specific challenges in this district. This research aligns with the broader discourse emphasizing the importance of targeted interventions to promote more balanced and sustainable agricultural development in Odisha. Mohanty, S., & Mishra, S. (2018). Regional Disparities in Agricultural Development: A Case Study of Nuapada District in Odisha. Indian Journal of Economics and Development, 14(3), 551-558. Pradhan and Padhi's (2021) study on regional disparities in agricultural development in Sundargarh District, Odisha, is a significant contribution to the existing body of research. Their localized focus offers granular insights that can be instrumental in crafting policies to address specific challenges in this district. This research aligns with the broader discourse emphasizing the importance of targeted interventions to promote more balanced and sustainable agricultural development in Odisha. Pradhan, A. K., & Padhi, B. K. (2021). Regional Disparities in Agricultural Development: A Study of Sundargarh District in Odisha. Indian Journal of Agricultural Economics, 76(1), 71-86. Pradhan and Behera's (2020) study on regional disparities in agricultural development in Baragarh District, Odisha, is a significant contribution to the existing body of research. Their localized focus offers granular insights that can be instrumental in crafting policies to address specific challenges in this district. This research aligns with the broader discourse emphasizing the importance of targeted interventions to promote more balanced and sustainable agricultural development in Odisha. Pradhan, A. K., & Behera, B. (2020). Regional Disparities in Agricultural Development: A Study of Baragarh District in Western Odisha. International Journal of Research in Agricultural Sciences, 7(2), 204-211. Padhy and Pradhan's (2021) study on regional disparities in agricultural development in Nuapada District, Odisha, is a significant contribution to the existing body of research. Their localized focus offers granular insights that can be instrumental in crafting policies to address specific challenges in this district. This research aligns with the broader discourse emphasizing the importance of targeted interventions

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Hypothesis

- **Null Hypothesis (H_0)**: There exists no significant difference in agricultural land area, yield rate, and production within the categorized groups (Meteoric, Progressive, Mediocre, and Laggard) in Western Odisha.
- **Alternative Hypothesis (H_1)**: There exists a significant difference in agricultural land area, yield rate, and production within the categorized groups (Meteoric, Progressive, Mediocre, and Laggard) in Western Odisha.

Data and Methodology

Data Collection

The Secondary data source for this study is the annual" Statistical Abstracts of Western Odisha districts, Directorate of Economics and Statistics (DES), Government of Odisha (2019-2020) ". The reports provide comprehensive cross-sectional information on various aspects of agricultural development in the region. The study utilizes a composite index approach to assess the wide variations in agricultural development at the block level across six districts in Western Odisha. The composite index is developed using the following indicators, each capturing a specific aspect of agricultural development.

- X1:Consumption of fertilizer (KG): This indicator reflects the utilization of fertilizers in agricultural practices, which can impact crop productivity and yield.
- X2: Population density: Population density is an important factor as it determines the pressure on land resources and can influence agricultural productivity.
- X3: Cropping intensity: Cropping intensity measures the intensity of land use for agricultural purposes, indicating the level of agricultural activity in a particular area.
- X4: Irrigation intensity: This indicator measures the extent of irrigation facilities available for agricultural purposes, which plays a crucial role

in enhancing crop production.

- X5: Percentage of agricultural labour to total main worker: This indicator captures the proportion of the population engaged in agricultural labour, highlighting the significance of agriculture as an occupation.
- X6: Percentage of agricultural workers to total population: This indicator represents the proportion of the population engaged in agricultural activities, providing insights into the agricultural workforce.
- X7: Percentage of cultivators to the total main worker: This indicator measures the proportion of the population engaged in cultivation activities relative to the total main workforce.
- X8: Percentage of literate population to total population: This indicator reflects the level of literacy among the population, which can influence agricultural practices and productivity.
- X9: Percentage of the total main worker to total population: This indicator captures the proportion of the population engaged in various occupations, including agriculture, relative to the total population.
- X10: Percentage of total irrigated area to net irrigated area: This indicator assesses the overall extent of irrigation coverage about the net irrigated area, indicating the efficiency and effectiveness of irrigation practices.
- X11: Percentage of net irrigated area by creek: This indicator represents the proportion of the net irrigated area that relies on creek-based irrigation systems.
- X12: Percentage of the net irrigated area by tube well: This indicator measures the proportion of the net irrigated area that relies on tube wells for irrigation.
- X13: Percentage of net irrigated area by lift: This indicator reflects the proportion of the net irrigated area that relies on lift irrigation systems.
- X14: Percentage of net irrigated area by major: This indicator represents the proportion of the net irrigated area that is serviced by major irrigation projects.
- X15: Percentage of the net irrigated area by the minor: This indicator measures the proportion of the net irrigated area that is serviced by minor irrigation systems.

In addition, the primary data for this research study was collected through a comprehensive survey conducted in Western Odisha. The sample size is estimated to be 300 [Calculated using Rao soft sample size calculator by taking Margin of error=5%, Confidence level=95%, Population size=10,000, and Response distribution=30%]. A multi-stage random sampling method was employed to ensure representative results. The survey covered 50 blocks in the region, which were categorized into four distinct groups: Meteoric, Mediocre, Progressive, and Laggard. In the first stage of sampling, three blocks were randomly selected from each group. In the second stage, one sample village was randomly selected from each selected block. Finally, in the third stage, a random sample of 25 households was selected from each village for the collection of primary data. A structured questionnaire was used to collect primary data from the selected households. The questionnaire included relevant sections to gather information on Land area (in Acre), Yield rate (in Kg), and production (in Qtl.) during the year 2020-2022.

Methodology

Normality Test

The collected data for agricultural land area, yield rate, and production were tested for normality using the Kolmogorov-Smirnov test. This test helps to determine if the data follows a normal distribution or not. The null hypothesis of no absolute difference between the empirical distribution function of the sample and the theoretical normal distribution was tested for each variable.

Kruskal-Wallis Test

To analyse the differences in agricultural outcomes among the categorized groups, the Kruskal-Wali's test was conducted. This non-parametric test is used when the data does not meet the assumptions of normality and equal variances. It determines whether there are significant differences among multiple independent groups. In this study, the test was performed to assess the differences in agricultural land area, yield rate, and production among the Meteoric, Mediocre, Progressive, and Laggard groups.

In this study, Principal Component Analysis [PCA] has been used to measure block-wise agricultural development differential at various principal component levels as well as the aggregate level of development for the year 2019-20.[29]

Principal Component Analysis

The goal of principal component analysis (PCA) is to combine a number of independent, linear original variables that can account for the majority of the variation in the original dataset to describe the variance and covariance structure of a set of variables. The ith principal component is given by :

$$P_i = a_{i1}Z_1 + a_{i2}Z_2 + a_{i3}Z_3 + ...+ a_{in}Z_n$$

Where, a_{in} are the weight of the input variable Z_i and $Z_i = (x_i - \mu_i)/\sigma_i$, are standard normal variable (i=1,2,…..n). However, the composite index has been constructed by using principal components to find out the regional disparities at block levels in the districts of Western Odisha. [Imran Ali Baig *et al.* The j^{th} block composite index score is given by

$$CI_j = 1/n \sum_{i=1}^{n} P_i,\ j=1,2……..50$$

Gini Coefficient

Gini coefficient is a precise way of measuring the degree of inequality between two variables. It can be treated as a measure of the concentration of areas between the Lorenz curve and the line of perfect equality and expressed as a proportion of the area enclosed by the tringle defined by

$$\mathbf{GC} = \sum_{i=1}^{N-1} | X_i Y_{i+1} - X_{i+1} Y_i |$$

Where X_i= Cumulative Proportion of first group of observations,

Y_i= Cumulative Proportion of second group observations.

The statistical analyses mentioned above were conducted to examine the differences and disparities in agricultural outcomes among the categorized groups in Western Odisha. These analyses provide insights into the variations and disparities in agricultural land area, yield rate, and production, contributing to a comprehensive understanding of the agricultural dynamics in the region.

Objective of the Study

The study aims to examine agricultural disparities in Western Odisha with the following objectives

- Develop a composite index using selected indicators to gauge the overall agricultural development in each block and categorize them into distinct groups based on their composite index scores.
- Determine the statistical significance of variations in agricultural land area, yield rate, and production across the categorized groups.
- Evaluate the extent of disparities in agricultural outcomes among the categorized groups.
- Provide policymakers and stakeholders with insights into specific areas of disparities and offer recommendations for focused interventions to enhance agricultural productivity and minimize disparities in Western Odisha.

Statistical Analysis and Findings

The secondary and primary data collected for the research study was analysed through SPSS-25, excel and the results obtained are presented in Table 1 through Table- 10(c) as follows.

Table 1: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.502
Bartlett's Test of Sphericity	Approx. Chi-Square	242.53
	Df	105
	Sig.	0

The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity are statistical tests used to assess the suitability of the data for conducting a factor analysis or principal component analysis (PCA). Since the KMO measure is 0.502, it suggests that the sample size is moderately adequate for conducting the analysis. Bartlett's test of sphericity, on the other hand, assesses whether the correlation matrix of the variables is significantly different from an identity matrix. The test calculates an approximate chi-square value and provides the degrees of freedom (df) and the significance level (Sig.). In this case, the approximate chi-square value is 242.530, with 105 degrees of freedom. The p-value (Sig.) is reported as 0.000, indicating that

the correlation matrix is significantly different from an identity matrix. This suggests that there are significant interrelationships among the indicators of agricultural development.

Overall, the results of the KMO measure and Bartlett's test indicate that the data used in the analysis are suitable for conducting PCA. The presence of significant interrelationships among the indicators suggests that they are not independent and are likely influenced by common factors. This supports the alternate hypothesis that the indicators of agricultural development are not independent of the population.

Table 2: Explanation of total variance

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.387	15.915	15.915	2.387	15.915	15.915
2	1.974	13.163	29.078	1.974	13.163	29.078
3	1.69	11.264	40.342	1.69	11.264	40.342
4	1.576	10.508	50.850	1.576	10.508	50.850
5	1.383	9.221	60.071	1.383	9.221	60.071

Table 2 shows the eigenvalues and the proportion of variance explained for each component extracted in the principal component analysis (PCA). The table also includes the cumulative percentage of variance explained. In this case, the initial eigenvalues represent the eigenvalues of each component before extraction. The extraction sums of squared loadings represent the proportion of variance explained by each component after extraction. Component 1 has an initial eigenvalue of 2.387, which explains 15.915% of the variance. This component alone accounts for 15.915% of the total variance. Component 2 has an initial eigenvalue of 1.974, explaining an additional 13.163% of the variance. The cumulative percentage of variance explained by components 1 and 2 is 29.07 8%. Component 3 has an initial eigenvalue of 1.690, explaining 11.264% of the variance. The cumulative percentage of variance explained by components 1, 2, and 3 is 40.342%. Component 4 has an initial eigenvalue of 1.576, explaining 10.508% of the variance. The cumulative percentage of variance explained by components 1, 2, 3, and 4 is 50.850%. Component 5 has an initial eigenvalue of 1.383, explaining 9.221% of the variance. The cumulative percentage of variance explained by components 1 to 5 is 60.071%.

The table provides an understanding of how much of the total variance in the dataset is explained by each component and the cumulative percentage of variance explained. These results help identify the most significant components that capture the majority of the variation in the data, guiding the interpretation and further analysis of the principal component

Table 3: Factor loadings

Indicators	F1	F2	F3	F4	F5
Consumption of fertilizer(X1)	-0.063	-0.466	-0.238	-0.215	-0.203
Population density (X2)	0.207	-0.255	0.375	-0.050	0.648
Cropping intensity (X3)	0.544	-0.554	0.095	0.229	-0.428
Irrigation intensity (X4)	-0.468	-0.411	-0.419	0.023	-0.114
Percentage of agricultural labour to total main worker (X5)	-0.123	0.357	0.423	-0.357	-0.055

Percentage of agricultural workers to total population (X6)	-0.463	-0.350	-0.414	0.097	-0.175
Percentage of cultivator to the total main worker (X7)	0.053	-0.058	0.006	0.747	0.267
Percentage of literate population to total population (X8)	0.858	-0.107	0.235	0.039	-0.242
Percentage of total main workers to total population (X9)	-0.835	-0.183	-0.043	-0.052	0.181
Percentage of total irrigation area to net irrigated area (X10)	-0.637	-0.234	0.579	-0.122	-0.100
Percentage of net irrigated area by creek (X11)	-0.109	-0.326	0.431	0.604	0.074
Percentage of net irrigated area by tube well (X12)	-0.153	0.558	-0.142	0.435	-0.377
Percentage of net irrigated area by lift (X13)	-0.288	0.370	0.520	-0.007	-0.409
Percentage of net irrigated area by major (X14)	-0.353	-0.544	0.472	0.003	-0.212
Percentage of net irrigated area by minorX15)	-0.517	0.442	0.015	0.345	0.033

Table 3 with indicators and their corresponding values provided for factors F1 through F5. These values appear to be coefficients, possibly resulting from regression analysis between these indicators and the factors. These indicators likely pertain to various aspects of agriculture and population in a certain context with the following interpretation.

- Consumption of Fertilizer (kg): This indicator has negative coefficients across all factors (F1 through F5), indicating that as the consumption of fertilizer increases, the corresponding factors tend to decrease.
- Population Density (X2): The positive coefficient for F1 and F3 suggests that higher population density is associated with increased values of these factors. However, the negative coefficient for F2 and F5 indicates a negative relationship with these factors.
- Cropping Intensity (X3): A positive coefficient across all factors suggests that higher cropping intensity is associated with increased values of these factors.
- Irrigation Intensity (X4): This indicator has a mix of negative and positive coefficients, indicating that its relationship with the factors is not consistent across the board.
- Percentage of Agricultural Labour to Total Main Worker (X5): The positive coefficient for F2 and F3 suggests that a higher percentage of agricultural labour to total main workers is associated with increased values of these factors. However, this indicator's relationship with the other factors is negative.
- Percentage of Agricultural Workers to Total Population (X6): This indicator generally has negative coefficients across all factors, suggesting that a higher percentage of agricultural workers to the total population is associated with decreased values of these factors.
- Percentage of Cultivator to Total Main Worker (X7): The highest positive coefficient is for F4, indicating a strong positive relationship between this indicator and F4. The other coefficients are relatively smaller.
- Percentage of Literate Population to Total Population (X8): The positive coefficient for F1, F3, and F5 suggests that a higher percentage of literate population to the total population is associated with increased values of these factors. However, the relationship is negative for F2 and F4.
- Percentage of Total Main Workers to Total Population (X9): The negative coefficient for F1 suggests that a higher percentage of total main workers to the total population is associated with a decrease in F1. The other coefficients have less significant magnitudes.
- Percentage of Total Irrigation Area to Net Irrigated Area (X10): The positive coefficient for F3 indicates a positive relationship between this

indicator and F3. The other coefficients have a mix of positive and negative relationships.

- Percentage of Net Irrigated Area by Creek (X11): The highest positive coefficient is for F4, indicating a strong positive relationship between this indicator and F4. The other coefficients are smaller and negative.
- Percentage of Net Irrigated Area by Tube Well (X12): This indicator has a mix of positive and negative coefficients, suggesting varied relationships with the factors.
- Percentage of Net Irrigated Area by Lift (X13): The positive coefficient for F3 suggests that a higher percentage of net irrigated area by lift is associated with increased values of F3. The other coefficients are relatively smaller.
- Percentage of Net Irrigated Area by Major (X14): This indicator has a mix of positive and negative coefficients, suggesting varied relationships with the factors.
- Percentage of Net Irrigated Area by Minor (X15): The positive coefficient for F4 indicates a positive relationship between this indicator and F4. The other coefficients are smaller and negative.

Table 4: Block Classification in Terms of their Agricultural Development using Principal Component Value.

BLOCKS	P1	P2	P3	P4	P5	$T=\sum_{i=1}^{5} P_i$	CI_j=T/5
ATTABIRA	6.435	0.321	1.583	1.506	-0.198	9.647	1.929
BARPALI	-0.414	-0.784	-0.01	7.629	2.398	8.819	1.764
LAKHANPUR	6.321	0.572	0.942	1.089	-0.477	8.447	1.689
KHARIAR	6.431	-2.138	0.109	0.125	1.916	6.443	1.289
SINAPALI	5.75	-1.138	1.891	0.726	-1.152	6.077	1.215
MANESWAR	6.448	-1.041	0.918	0.361	-1.032	5.654	1.131
BARGARH	6.024	-1.692	0.291	-0.787	1.747	5.583	1.117
KOMNA	5.341	0.911	1.092	-0.26	-1.895	5.189	1.038
KOLABIRA	5.111	1.464	0.435	-0.793	-1.103	5.114	1.023
BIJEPUR	1.249	1.365	0.61	-0.014	1.267	4.477	0.895
KUCHINDA	-3.772	5.571	0.091	2.745	-0.207	4.428	0.886
BAMRA(SBP)	-2.141	3.854	0.118	1.21	1.036	4.077	0.815
GAISILET	-0.091	2.735	-0.584	0.824	0.281	3.165	0.633
PAIKMAL	-0.02	-0.846	1.348	-1.491	3.984	2.975	0.595
NUAPADA	3.575	1.017	-0.094	-0.119	-1.798	2.581	0.516
BHEDEN	-0.215	1.131	1.009	-1.911	2.55	2.564	0.513
JARSUGUDA(JHG)	-5.957	0.145	8.798	0.436	-1.061	2.361	0.472
RAIRAHKOL	-0.88	4.7	-1.107	-0.961	0.339	2.091	0.418
RENGALI	0.313	2.923	-1.202	-2.147	2.178	2.065	0.413
LAIKERA	4.039	0.841	-0.835	-0.502	-1.504	2.039	0.408
NAKTIDEAUL	-0.022	3.895	-0.508	-1.98	0.613	1.998	0.400
BHATLI	0.556	1.844	-0.918	0.445	-0.647	1.28	0.256
PADAMPUR	-0.398	1.384	0.547	-0.842	0.454	1.145	0.229
JUJUMURA	-1.904	2.24	0.707	-0.092	-0.599	0.352	0.070
JAMINKIRA	-1.621	2.693	0.356	-0.951	-0.339	0.138	0.028
SOHELLA	0.036	1.235	-0.52	-1.886	1.199	0.064	0.013
KIRMIRA	-0.428	-1.688	1.481	0.071	0.599	0.035	0.007
SUBDEGA	-0.937	0.45	-1.251	0.78	0.144	-0.814	-0.163
HEMAGIRI	0.61	-0.07	1.276	-1.821	-1.347	-1.352	-0.270
NUAGAON	0.205	-1.658	-0.527	0.377	-0.035	-1.638	-0.328
SUNDARGARH	-2.222	0.925	-1.141	0.754	-0.302	-1.986	-0.397

KANTAMAL	-0.928	-0.318	-1.189	0.267	-0.187	-2.355	-0.471
BOUDH(BD)	-1.611	-1.202	-1.254	1.186	-0.355	-3.236	-0.647
BAILSANKRA(SG)	-1.611	-1.202	-1.254	1.186	-0.355	-3.236	-0.647
KOIDA	-3.469	0.557	-0.341	0.22	-0.374	-3.407	-0.681
BODEN	-3.418	-0.634	0.274	0.08	-0.105	-3.803	-0.761
DHANKUDA(SBP)	-3.28	-5.309	4.684	-0.767	0.786	-3.886	-0.777
LAHUNIPARA	-2.514	-0.79	0.788	-0.834	-0.544	-3.894	-0.779
RAJGANPUR	-0.32	-1.801	-0.423	-0.604	-0.838	-3.986	-0.797
BONAIGARH	-1.898	-1.813	0.107	0.274	-0.769	-4.099	-0.820
TANGARPALI	-1.295	-0.645	-1.839	0.451	-1.239	-4.567	-0.913
LEPHRIPADA	-0.548	-2.362	-2.208	0.213	-0.274	-5.179	-1.036
LATHIKANTA	-1.609	-2.124	-1.485	-0.22	0.121	-5.317	-1.063
HARBHANGA	-0.894	-3.201	-2.059	-0.547	0.757	-5.944	-1.189
BISRA	-0.894	-3.201	-2.059	-0.547	0.757	-5.944	-1.189
JHARBANDH	-2.137	-1.094	-2.03	0.318	-1.397	-6.34	-1.268
GURUNDIA	-1.105	-2.515	-1.936	-1.17	0.368	-6.358	-1.272
KUANARMUNDA	-4.29	-0.274	0.245	-1.23	-0.919	-6.468	-1.294
AMBABHONA(BRGH)	-2.951	-1.019	-0.669	-1.019	-1.535	-7.193	-1.439
KUTRA	-2.65	-2.212	-2.253	0.22	-0.901	-7.796	-1.559

The provided table appears to contain data related to various regions or blocks, along with associated coefficients and indices.

Blocks

These are the different regions or areas that have been analysed. Each row represents a specific block.

- P1 to P5 (Coefficients): These coefficients could represent the impact or influence of certain factors (indicators) on each region. Positive coefficients indicate a positive relationship, while negative coefficients indicate a negative relationship. The magnitude of the coefficient suggests the strength of the relationship.
- Total of Principal Component(T): This column might represent an aggregated value that summarizes the performance of each block based on the coefficients or factors considered. It could provide an overall indication of the performance of each region.
- COMPOSITE INDEX(T/5): The composite index column likely presents an index that combines or condenses the effects of the factors for each block. This index might help compare the overall characteristics or performance of different regions based on the indicators included. From this data, it seems that an analysis has been conducted to assess the relationships between indicators and the performance of different regions. The coefficients, sum of the performance index, and composite index provide insights into how these factors contribute to the overall performance or characteristics of each region.

The linear regression equation Y = 6.329X + 161.39, indicates the relationship between the Blocks (X) and the CI scores (Y) based on the data. The coefficient values imply that for each increase of one unit in the Blocks variable, the CI score is expected to increase by approximately 6.329 units. The R-squared value (R^2 = 0.9866) represents the coefficient of determination, which measures how well the regression line fits the data points. In this case, an R-squared value close to 1 (or 100%) suggests that the regression equation is able to explain about 98.66% of the variability in the CI scores based on the Blocks variable.

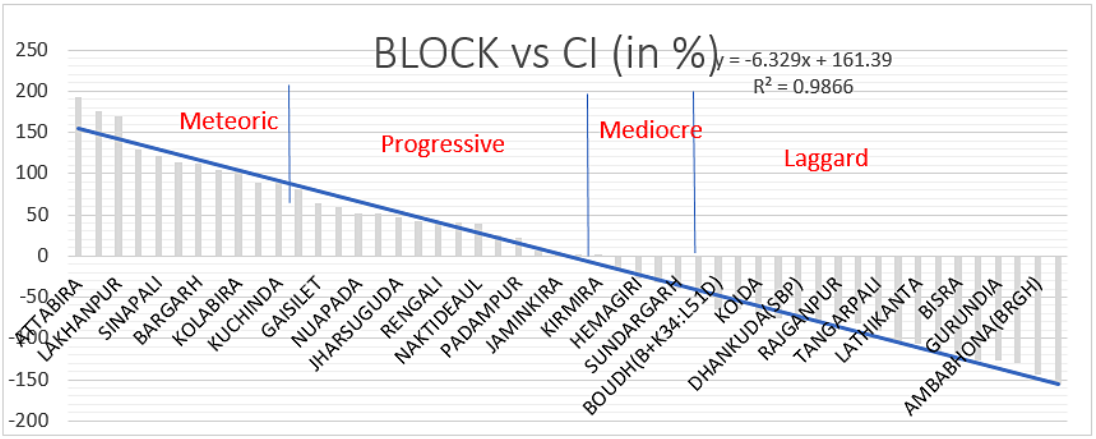

Fig. 1: Block vs Composite Index Value in percentage

Table 5: Segmentation of Blocks Based on Agricultural Growth and Development

Above [$(\overline{CI} + 0.6562 \times \sigma]$	Meteoric Group
$\overline{CI}$ to [$\overline{CI} + 0.6562 \times \sigma$]	Progressive Group
[$\overline{CI} + 0.6562 \times \sigma$] to $\overline{CI}$	Mediocre Group
Below [$\overline{CI} + 0.6562 \times \sigma$]	Laggard Group

Where, $\overline{CI} = \frac{1}{50}\sum CI_j = 0.00$ and $\sigma = \sqrt{\frac{1}{50}\sum\left(CI_j - \overline{CI}\right)^2} = 0.928879098$

Table 6: Classification of 50 Blocks Based on Their Composite Index Scores

Composite index score	Blocks	Composite index scores	Class
[Above 0.62653]	Attabira	1.929	Meteoric Class
	Barpali	1.764	
	Lakhanpur	1.689	
	Khariar	1.289	
	Sinapali	1.215	
	Maneswar	1.131	
	Bargarh	1.117	
	Komna	1.038	
	Kolabira	1.023	
	Bijepure	0.895	
	Kuchinda	0.886	
	Bamra	0.815	
	Gambalpur	0.633	
[0.0 to 0.62653]	Paikmal	0.595	Progressive Class
	Nuapada	0.516	
	Bheden	0.513	
	Ambhabhona	0.472	
	Rairakhol	0.418	

	Rengali	0.413	
	Laikera	0.408	
	Naktideaul	0.4	
	Bhatli	0.256	
	Sundargarh	0.229	
	Jujumura	0.07	
	Jaminkira	0.028	
	Sohela	0.013	
	Kirmira	0.007	
[-0.62653to 0]	Subdega	-0.163	Mediocre Class
	Himgir	-0.27	
	Jharbandh	-0.328	
	Padampur	-0.397	
	Kantamal	-0.471	
[Below -0.62653]	Boudh	-0.647	Laggard Class
	Bailsakara	-0.647	
	Koida	-0.681	
	Boden	-0.761	
	Dhankuda	-0.777	
	Lahunipara	-0.779	
	Rajgampur	-0.797	
	Bonaigarh	-0.82	
	Tangarpali	-0.913	
	Lephripada	-1.036	
	Lathikanta	-1.063	
	Harbhanga	-1.189	
	Bisra	-1.189	
	Nuagoan	-1.268	
	Gurundia	-1.272	
	Kuarmunda	-1.294	
	Jharsuguda	-1.439	
	Kutra	-1.559	

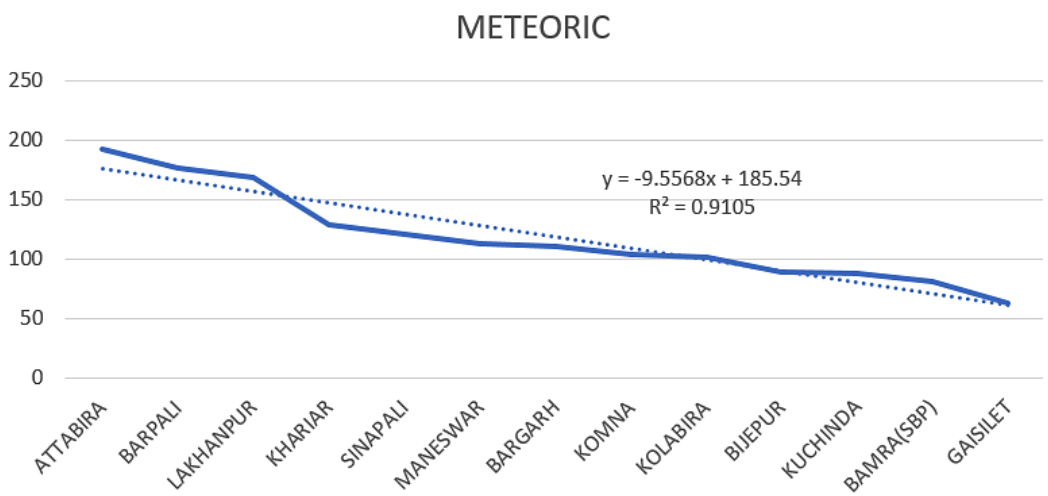

Fig. 2: Comparison of Block vs Composite Index Value in percentage for a Meteoric Block.

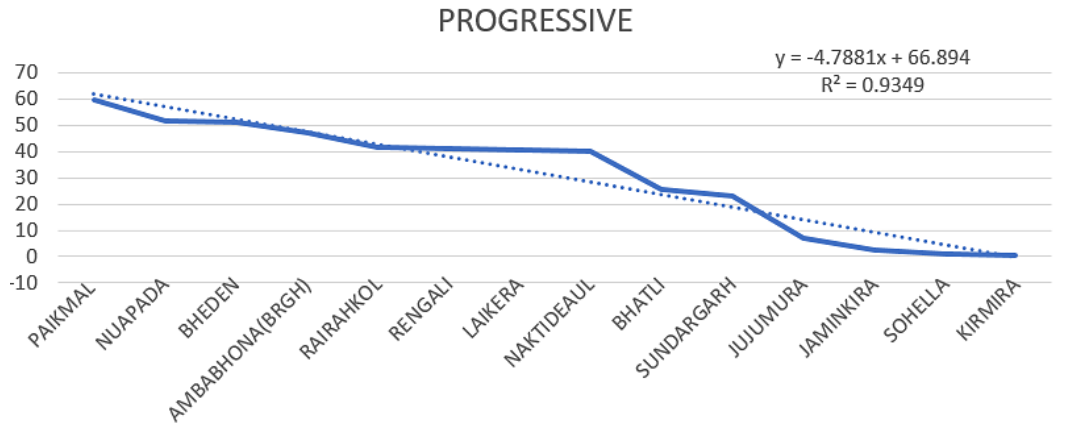

Fig. 3: Comparison of Block vs Composite Index Value in percentage for a Progressive Block.

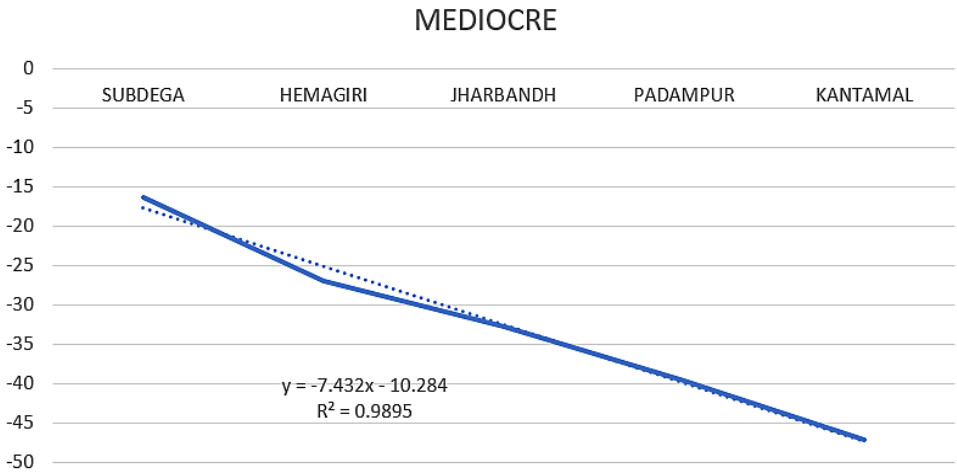

Fig. 4: Comparison of Block vs Composite Index Value in percentage for a Mediocre Block.

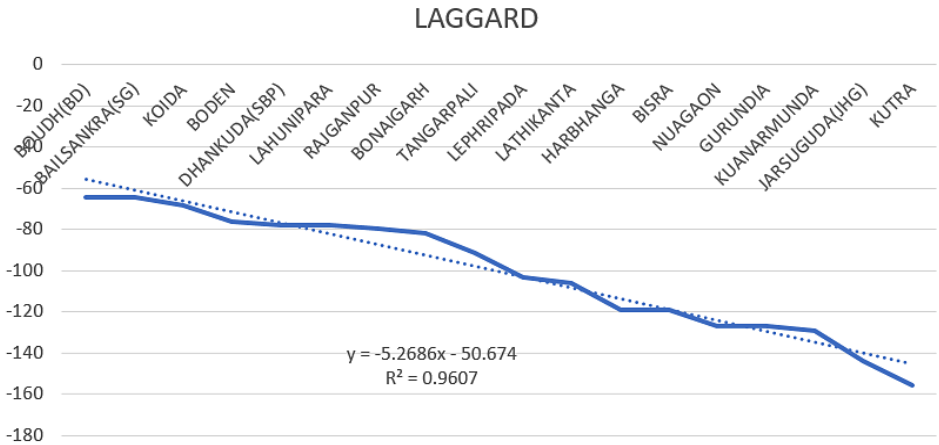

Fig. 5: Comparison of Block vs Composite Index Value in percentage for a Laggard Block.

Primary Data

The primary data for this research study was collected through a comprehensive survey conducted in Western Odisha. The sample size is estimated to be 300. A structured questionnaire was used to collect primary data from the selected households. The questionnaire included relevant sections to gather information on Land area acres acre), Yield rate (in Kg), and production (in Qtl.) during the year 2020-2021. The data collection method employed in this research study aimed to ensure representative results from selected villages in Western Odisha, including Hirlipali (Attabira Block), Chandnimal (Kuchinda), Sahaspur (Maneswar) from the Meteoric Class, Jhankarpali (Jujumura Block), Bhatli (Bhatli Block), Ambabhona (Ambabhona Block), from the progressive Class village), Melchamunda (Padampur Block), Junani (Kantamal Block), Ankeibira (Himgir Block) from the mediocre Class village), and Bankutola (Nuagoan Block), Darlipali (Lephripada Block), Balbaspur (Dhankuda Block) from the laggard Class villages).

Table 7: Descriptive Statistics

Descriptive Statistics	N	Mean	Std. Deviation	Minimum	Maximum
Land area in Hector	300	9.8850	4.99876	4.00	31.00
Yield rate in kg.	300	14879.5937	7822.72673	4548.00	42448.00
Production in Qntl.	300	197.1880	112.28948	66.00	644.00

The provided dataset consists of descriptive statistics for four variables Land area in hector, Yield rate in kg, and Production in quintals. These descriptive statistics provide valuable insights into the dataset's characteristics and distribution of the variables.

Table 8: One-Sample Kolmogorov-Smirnov test

		Land area in Acre	Production in qtl.	Yield rate in kg.
N		300	300	300
Normal Parameters	Mean	9.885	197.188	14879.5937
	Std. Deviation	4.99876	112.28948	7822.72673
Most Extreme Differences	Absolute	0.187	0.165	0.126
	Positive	0.187	0.165	0.126
	Negative	-0.135	-0.126	-0.097
Test Statistic		0.187	0.165	0.126
Asymp. Sig. (2-tailed)		0	0	0

The test distribution is normal.

Table-8 Present One-Sample Kolmogorov-Smirnov test was conducted for the variables "Area in Acre," "Yield Rate in kg," and "Production in Quintal." The test aimed to determine if the data for each variable follows a normal distribution. The test statistics, most extreme differences, and p-values were calculated.

The “Area in Acre” test statistic was 0.187, indicating a significant deviation from a normal distribution (p-value = 0.000). Similarly, for "Yield Rate in kg," the test statistic was 0.126 with a p-value of 0.000, suggesting a departure from normality. In the case of "Production in Qntl.," the test statistic was 0.165, also with a p-value of 0.000, indicating a significant deviation from the normal distribution.

In summary, the One-Sample Kolmogorov-Smirnov test revealed that the data for all three variables did not follow a normal distribution. The p-values of 0.000 provide strong evidence to reject the null hypothesis of normality

Table 9: Kruskal-Wallis Test

Ranks	Grouping	N	Mean Rank
Area in acre	Meteoric	75	254.91
	Progressive	75	185.66
	Mediocre	75	101.33
	Laggard	75	60.09
	Total	300	
Yield rate in kg	Meteoric	75	245.77
	Progressive	75	183.40
	Mediocre	75	125.36
	Laggard	75	47.47
	Total	300	
Production in Qntl.	Meteoric	75	251.95
	Progressive	75	190.88
	Mediocre	75	101.95
	Laggard	75	57.21
	Total	300	

Table-9 In terms of the area in acres, the mean rank for the Meteoric group is 254.91, for the Progressive group is 185.66, for the Mediocre group is 101.33, and for the Laggard group is 60.09.

Regarding the yield rate in kilograms, the mean rank for the Meteoric group is 245.77, for the Progressive group is 183.40, for the Mediocre group is 125.36, and for the Laggard group is 47.47.

In the context of production in quintals, the mean rank for the Meteoric group is 251.95, for the Progressive group is 190.88, for the Mediocre group is 101.95, and for the Laggard group is 57.21.

Overall, the data includes a total of 300 samples in each category, with 75 samples for each group

Table 9.1.1: Test Statistics

	Area in acre	Yield rate in kg	Production in Qntl.
Kruskal-Wallis H	230.410	213.447	229.906
Df	3	3	3
Asymp. Sig.	.000	.000	.000

a. Kruskal Wallis Test

The test statistics data provides results for Kruskal-Walli's test conducted on three variables: area in acres, yield rate in kilograms, and production in quintals. The calculated values for the Kruskal-Wallis H statistic are 230.410 for the area in hectares, 213.447 for yield rate in kilograms, and 229.906 for production in quintals.

The degrees of freedom (df) for each variable are 3, indicating that there were three groups within each variable. The Asymptotic Significance (Asymp. Sig.) values for all three variables are recorded as 0.000, suggesting a statistically significant difference among the groups within each variable.

In summary, Kruskal-Walli's test results indicate significant differences among the groups in terms of area in acres, yield rate in kilograms, and production in quintals. The grouping variable for the test was not explicitly mentioned in the provided data.

The GC (Gini coefficient) values were calculated to assess the disparity levels between groups for three variables: "Area in Hector," "Yield Rate in Kg" and "Production in Qntl." as depicted below.

Table 10 (a): (Gini Coefficient) Area in acre

Meteoric	Progressive	GCR-0.144
Meteoric	Mediocre	GCR-0.143
Meteoric	Laggard	GCR-0.115
Progressive	Mediocre	GCR-0.055
Progressive	Laggard	GCR-0.059
Mediocre	Laggard	GCR-0.043

For the "Area in Hector" variable, the GCR values indicate that the "Meteoric" group has a significantly higher disparity compared to the "Progressive," "Mediocre," and "Laggard" groups, with differences of 14.48%, 14.36%, and 11.53% respectively.

Table 10 (b): (Gini Coefficient) Yield rate in kg

Meteoric	Progressive	GCR- 0.195
Meteoric	Mediocre	GCR- 0.169
Meteoric	Laggard	GCR- 0.144
Progressive	Mediocre	GCR- 0.111
Progressive	Laggard	GCR- 0.095
Mediocre	Laggard	GCR-0.054

Similarly, for the "Yield Rate in Kg" variable, the GCR values show that the "Meteoric" group has a significantly higher disparity compared to the "Progressive," "Mediocre," and "Laggard" groups, with differences of 19.52%, 16.93%, and 14.41% respectively.

Table 10(c): (Gini Coefficient) Production in Qntl.

Meteoric	Progressive	GCR-0.002
Meteoric	Mediocre	GCR-0.002
Meteoric	Laggard	GCR-0.002
Progressive	Mediocre	GCR-0.001
Progressive	Laggard	GCR-0.001
Mediocre	Laggard	GCR-0.001

Regarding the "Production in Qntl." variable, the GCR values suggest that the "Meteoric" group has a slightly higher disparity compared to the "Progressive," "Mediocre," and "Laggard" groups, with differences of 0.23%, 0.25%, and 0.21% respectively.

These GCR values provide insights into the differences in means between the groups within each variable. They indicate that the "Meteoric" group tends to have higher disparity compared to other groups, suggesting potential differences in performance or characteristics.

Conclusion

The study reveals significant disparities in agricultural outcomes across categorized groups in Western Odisha. The Meteoric group exhibits notably higher disparities in land area and yield rate, indicating varying levels of abundance and scarcity within this category. This calls for tailored interventions considering the diverse agricultural landscape.

The Gini Coefficient reinforces these disparities within the Meteoric group, emphasizing the need for targeted policies. Addressing factors like resource access, technology adoption, and infrastructure is crucial for balanced and sustainable agriculture.

In sum, this study provides a clear path for intervention, offering a roadmap to create a more inclusive and prosperous agricultural sector in Western Odisha, benefiting livelihoods in the region.

Policy Recommendation

Agricultural disparities in Western Odisha must be addressed through a targeted, multifaceted approach that prioritizes resource allocation, promotes technological adoption, enhances market accessibility, improves land tenure, and invests in capacity-building and training programs. Tailored interventions that meet the unique needs of each categorized group are essential for achieving more equitable and sustainable agricultural development.

Acknowledgment

We would like to express our heartfelt gratitude to all the participants who actively participated in our research study. Their invaluable contributions and support have been instrumental in the success of our project.

We would also like to extend special thanks to Dr. Rajendra Gartia, Assistant Professor and Head of the Department, School of Statistics, G.M University, Amruta Vihar, Sambalpur, for his expert guidance and valuable insights throughout the research process. His expertise has significantly enhanced the quality of our work.

Furthermore, we would like to acknowledge G.M University, Amruta Vihar, Sambalpur, for providing us with the necessary resources and creating a conducive research environment. Their support has been instrumental in facilitating our research activities.

We are also grateful to the Indian Council of Social Science Research (ICSSR), under the Ministry of Education, Government of India, for awarding us the Doctoral Fellowship. This financial support has enabled us to focus on our research and pursue our academic goals.

Our sincere appreciation goes to our family members for their unwavering support and encouragement throughout this journey. We are also thankful to all those who have provided us with guidance and feedback, helping us refine our work and make it better.

Once again, we express our heartfelt gratitude to everyone who has played a part in our research endeavour. Without their support and contributions, this work would not have been possible.

Funding

The research conducted for this study received financial support from the Indian Council of Social Science Research (ICSSR), under the Ministry of Education, Government of India. However, it is important to note that the funding source had no role in the study design, data collection, analysis, interpretation, manuscript writing, or the decision to submit the manuscript for publication.

Conflict of Interest

The authors declare that they have no conflict of interest regarding the research conducted, the data collected, or the publication of the findings. This ensures that the research and its outcomes have not been influenced by any personal, financial, or professional relationships that could be perceived as a conflict of interest.

References

1. Munda, S., Gartia, Dr. R., Chand, Dr. D., Sahu, P., & Behera, D. K. (2022). A statistical SWOT up on garbled agricultural disparity at grassroots levels: A statistical analysis at block levels of Sambalpur district. *International Journal of Statistics and Applied Mathematics*, 7(2), 68–75. https://doi.org/10.22271/maths.2022.v7.i2a.811
2. Barik, A. K., & Rout, N. (2021). Regional Disparities in Agricultural Development: A Case Study of Nuapada District in Odisha. *Journal of Agricultural Research and Development,* 10(2), 121-134.
3. Padhy, P., & Pradhan, P. (2021). Regional Disparities in Agricultural Development: A Study of Nuapada District in Western Odisha. *Journal of Social and Economic Development,* 23(1), 151-168.
4. Sahu, B., & Raut, S. (2021). Regional Disparities in Agricultural Development: A Study of Jharsuguda District in Western Odisha. *Journal of Rural and Agricultural Research,* 21(1), 78-88.
5. Rout, N., & Barik, A. K. (2021). Regional Disparities in Agricultural Development: A Case Study of Sundargarh District in Odisha. International *Journal of Scientific Research and Review,* 10(1), 220-230.
6. Pradhan, A. K., & Behera, B. (2020). Regional Disparities in Agricultural Development: A Study of Baragarh District in Western Odisha. *International Journal of Research in Agricultural Sciences,* 7(2), 204-211.
7. Tripathy, P. (2020). Regional Inequality in Agricultural Development: A District-Level Analysis of Odisha. *Indian Journal of Regional Science,* 52(1), 1-15.
8. Mohanty, A., & Mishra, B. K. (2020). Regional Disparity in Agriculture and Poverty: A Study on Western Odisha. *Indian Journal of*

Regional Science, 52(1), 16-34.

9. Samal, S. K., & Panigrahy, R. R. (2019). Regional Disparities in Agricultural Development: A Study of Baragarh District in Western Odisha. *International Journal of Scientific Research and Management,* 7(11), 622-630.
10. Pradhan, S., & Behera, K. (2019). Regional Disparities in Agricultural Development: A Study of Baragarh District in Western Odisha. *Journal of Indian Management Research and Practice,* 11(1), 58-67.
11. Senapati, M. R., & Mohanty, R. K. (2019). Regional Disparities in Agricultural Development: A Case Study of Bargarh District in Odisha. *Journal of Krishi Vigyan*, 8(1), 33-37.
12. Mohanty, S., & Mishra, S. (2018). Regional Disparities in Agricultural Development: A Case Study of Boudh District in Odisha. Economic Affairs, 63(4), 1123-1132.
13. Dash, S. K., & Sahoo, D. (2018). Regional Disparities in Agricultural Development: A Study of Western Odisha. Odisha Review, 76(6), 12-18.
14. Das, S. K., & Nayak, J. K. (2017). Regional Disparities in Agricultural Development: A Comparative Study of Coastal and Non-Coastal Regions of Odisha. *International Journal of Agricultural Science and Research*, 7(1), 23-31.
15. Biswal, S., & Das, B. (2019). Regional Disparities in Agricultural Development: A Study of Sambalpur District in Western Odisha. *International Journal of Research in Commerce and Management,* 10(5), 34-42.
16. Bhatta, K. P., & Panda, P. (2019). Regional Disparities in Agricultural Development: A Case Study of Nuapada District in Western Odisha. *Agriculture Update,* 14(2), 334-338.
17. Behera, S., & Parida, P. C. (2018). Regional Disparities in Agriculture and Its Causes: A Study in Odisha. *International Journal of Current Microbiology and Applied Sciences,* 7(9), 417-428.
18. Behera, B., & Mishra, P. K. (2019). Regional Disparities in Agricultural Development: A District-Level Analysis in Odisha. *Indian Journal of Agricultural Economics,* 74(3), 391-403.
19. Barik, A. K., & Rout, N. (2021). Regional Disparities in Agricultural Development: A Case Study of Nuapada District in Odisha. *Journal of Agricultural Research and Development,* 10(2), 121-134.
20. Baig, I. A., & Salam, M. A. (2019). Regional disparities in agricultural development: An analysis of micro level. International Journal of Research and Analytical Reviews (IJRAR), Volume 6, Issue 1, 1154-1160. www.ijrar.org (E-ISSN 2348-1269, P- ISSN 2349-5138).
21. Singh, R., & Swain, M. R. (2019). Regional Disparities in Agricultural Development: A Study of Boudh District in Odisha. *Economic Affairs,* 64(2), 279-288.
22. Singh, R., & Swain, M. R. (2018). Regional Disparities in Agricultural Development: A Case Study of Sambalpur District in Western Odisha. *Indian Journal of Agricultural Economics,* 73(2), 169-180.
23. Senapati, M., & Mahakul, K. (2019). Regional Disparities in Agricultural Development: A Case Study of Sambalpur District in Western Odisha. *Journal of Indian Research,* 7(6), 75-81.
24. Senapati, M. R., & Mohanty, R. K. (2019). Regional Disparities in Agricultural Development: A Case Study of Bargarh District in Odisha. *Journal of Krishi Vigyan,* 8(1), 33-37.
25. Samal, S. K., & Panigrahy, R. R. (2019). Regional Disparities in Agricultural Development: A Study of Baragarh District in Western Odisha. *International Journal of Scientific Research and Management,* 7(11), 622-630.
26. Sahu, D., & Mishra, A. (2020). Analysis of Regional Disparities in Agricultural Development: A Case Study of Western Odisha. *Journal of Agriculture and Rural Development,* 13(1), 97-113.
27. Singh, R., & Swain, M. R. (2018). Regional Disparities in Agricultural Development: A Case Study of Sambalpur District in Western Odisha. *Indian Journal of Agricultural Economics,* 73(2), 169-180.
28. Mohanty, S., & Mishra, S. (2018). Regional Disparities in Agricultural Development: A Case Study of Nuapada District in Odisha. *Indian Journal of Economics and*

Development, 14(3), 551-558.

29. Pradhan, A. K., & Padhi, B. K. (2021). Regional Disparities in Agricultural Development: A Study of Sundargarh District in Odisha. Indian *Journal of Agricultural Economics,* 76(1), 71-86.
30. Pradhan, A. K., & Behera, B. (2020). Regional Disparities in Agricultural Development: A Study of Baragarh District in Western Odisha. *International Journal of Research in Agricultural Sciences,* 7(2), 204-211.
31. Padhy, P., & Pradhan, P. (2021). Regional Disparities in Agricultural Development: A Study of Nuapada District in Western Odisha. *Journal of Social and Economic Development,* 23(1), 151-168.
32. Panigrahi, M. K., & Rout, A. K. (2020). Regional Disparities in Agricultural Development: A Study of Jharsuguda District in Western Odisha. *Journal of Social and Economic Studies,* 8(1), 76-89.
33. Mohanty, S., & Mishra, S. (2018). Regional Disparities in Agricultural Development: A Case Study of Boudh District in Odisha. Economic Affairs, 63(4), 1123-1132.
34. Mohammad Ali. (1979). Dynamics Agricultural Development in India. Concept Publishing Company, New Delhi. pp. 8-9.
35. Krishan, G. (1992). The Concept of Agricultural Development. New Delhi: Dynamics of Agricultural Development, Concept Publishing Company.