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Socio-economic dynamics and crop diversification in south Gujarat: Towards sustainable agriculture and rural development

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Abstract

This study delves into the socio-economic dynamics and agricultural practices in South Gujarat, India, emphasizing the transition from traditional to sustainable agriculture. Employing critical thinking, artificial intelligence, and digital technologies, the research aims to gauge the impact of crop diversification on socio-economic development in the region. A questionnaire survey method was employed, drawing a sample of 240 respondents from 16 villages across eight talukas. The findings reveal significant insights into the socio-economic characteristics of farmers, including gender distribution, credit utilization, caste demographics, age distribution, educational levels, family size, and occupational diversity. Moreover, the study categorizes farmers based on landholding sizes and operational land holdings, shedding light on their cropping systems and irrigation practices. The analysis highlights the prevalence of male-headed households, varied patterns of credit utilization across districts, and a concentration of Scheduled Tribe (ST) farmers in certain regions. Additionally, it underscores the importance of middle-aged farmers in the agriculture sector and the predominance of small and medium landholdings. Using the Simpson diversity index, the research assesses the extent of crop diversification across districts, with Bharuch and Tapi districts exhibiting higher levels compared to Narmada and The Dangs. The study underscores the importance of diversified agriculture in enhancing resilience to pests, diseases, and market fluctuations.

Keywords: Socio-economic, crop, sustainable agriculture, rural development

Introduction

Socio-economic status is paramount consideration for sustainable agriculture in which critical thinking, artificial intelligence and digital technologies are being involved; solutions may be interaction on the basis of questionnaire survey. Some of the prime factors especially socio-economic status, the present status of the society in the developing nations is briskly moving from undeveloped economy to developed economy along with the development of social conditions (Chandna, 2010) [2]. But at all places these changes are not equal. Sustainable agriculture serves as a cornerstone for socio-economic development, particularly in developing nations where agriculture remains the primary livelihood for a significant portion of the population. Majorly the rural areas are very less developed as compared to the urban areas in terms of many aspects like social, economic and cultural. An individual's lifestyle is widely dependent on their economic status. The most critical sector of Indian economy is Agriculture. More than half of the India's population is still dependent on agriculture as it is the only principal source of their income and raw material for a big number of industries. The Crop diversification has great potential as an economic driver inside the agricultural sector. It has also become essential for attaining higher output growth,

expanding farm in-come, creating jobs, conserving precious soil and water resources, consumer preferences for high-value, nutrient-dense foods, rural livelihood, sustainable use of natural resources, and poverty alleviation. It can be influenced by socioeconomic, soil and agronomic, agricultural inputs, productivity, international trade, and climatic factors, all considered in this study (Anuja *et al.*, 2022) [1].

Materials and Methods

Sampling procedure

A multi stage random sampling technique was used for drawing samples for the present study. In the first stage out of seven districts of south Gujarat region, four districts were selected, In the second stage out of total tehsil in the selected districts, two talukas from each district were selected randomly. In the third stage out of total villages in the selected talukas, two villages from each tehsil were selected randomly. In fourth stage a list of cultivators from these villages were prepared across farm categories. Through the random sampling 15 cultivators from each of the selected villages were selected as ultimate sample. Therefore total 240 respondents spread over 16 villages of 8 talukas comprised the ultimate sample for the study. Pre-structured classes were schedule to prepare the

questionnaire for the survey to collect the data covering the objectives of the study. Collected data were analysed by using frequency and percentage. Each student needs to interact with 15 farmers. An interview schedule method to conduct this survey successfully. In we had prepared a questionnaire in which we had to gather all the information about the socio-economic profile of the farmer. Primary data were collected from the respondents using survey method. Data on different aspects was collected through structured schedules. Each of the respondents was approached personally for recording relevant data for the agricultural year 2018-19 to 2021-2022. list of cultivators of each village was prepared. From each village 15 respondents were selected for the study. Total of 240 respondents from South Gujarat region were selected to carry out the present study.

Analytical tools and techniques

- 1. Socio economic characteristics:** Tabular analysis: Tabular analysis involving the computation of means, percentage *etc.* were employed to present the data regarding the socio- economic profile.
- 2. Simpson Index (S.I.):** It is the most suitable index for measuring diversification of crops in a particular geographical region and is calculated by Equation (2):

$$\text{Simpson Index (SI)} = 1 - \sum P_i^2 \quad (2)$$

Where, $P_i = A_i / \sum A_i$ is the proportion of the i^{th} activity in acreage. If SI is near zero, it indicates that the zone or region is near to the specialization in growing of a particular crop and if it is close to one, then the zone is fully diversified in terms of crops.

Results and Discussion

Socio-economic characteristics of sample farmers

The data pertaining to distribution of respondents according to their socio-economic characteristics have been presented in Table 1 to 11. The table is segmented by different socio-economic character further categorized by districts, namely Bharuch, Narmada, Tapi and The Dangs. The details of each of these have been described as under

Head of household

Table 1 provides an overview of the head of household distribution in selected districts of South Gujarat, with a total sample size (N) of 240. The data reveal that male heads of households dominate across all districts, ranging from 86.67% in The Dangs district to 93.33% in Bharuch and Narmada districts. The highest overall percentage of male-headed households is observed in the Bharuch district,

contributing to 93.33% of the total. Females head fewer households across all districts, with the highest percentage in The Dangs district at 13.33%. The overall percentage of female-headed households is 8.75% indicating a lower prevalence compared to male-headed households.

Table 1: Head of household in selected districts of South Gujarat (N=240)

Sr. No.	Particular	Bharuch district	Narmada district	Tapi district	The Dangs district	Total
1.	Male	56 (93.33)	56 (93.33)	55 (91.67)	52 (86.67)	219 (91.25)
2.	Female	4 (6.67)	4 (6.67)	5 (8.33)	8 (13.33)	21 (8.75)

Figures in parentheses indicate the percentage to the total sample

Credit received

Credit received for farming practices in selected districts of South Gujarat presented in table 2 The data illustrates a varied pattern in credit utilization for farming practices across districts. Bharuch has the highest percentage of farmers accessing credit with 75.00%, while the other districts show lower proportions, ranging from 11.66% to 33.33%. Conversely, a significant proportion of farmers in Narmada, Tapi and The Dangs districts report not receiving credit for farming practices. The highest percentage is observed in The Dangs district, where 88.33% of farmers did not receive credit.

Table 2: Credit received for farming practices in selected districts of South Gujarat (N=240)

Sr. No.	Particular	Bharuch district	Narmada district	Tapi district	The Dangs district	Total
1.	Yes	45 (75.00)	20 (33.33)	8 (13.33)	7 (11.66)	80 (33.33)
2.	No	15 (25.00)	40 (66.67)	52 (86.67)	53 (88.33)	160 (66.67)

Figures in parentheses indicate the percentage to the total sample

Caste of farmers in selected district of south Gujarat presented in table 3. The data revealed a significant concentration of Scheduled Tribe (ST) farmers in Tapi and The Dangs districts, with 93.33% and 86.67%, respectively. Bharuch district, however does not have any ST farmers in the sampled population. The highest percentage of Scheduled Caste (SC) farmers was observed in Narmada district, constituting 56.67% of the sampled population. Bharuch district dominates in the Other Backward Class (OBC) category, with 46.67% of the farmers belonging to this caste. The Open category exhibits a more balanced distribution across districts, with Bharuch district having the highest percentage of farmers in this category.

Table 3: Caste of farmers in selected districts of South Gujarat (N=240)

Sr. No.	Particular	Bharuch district	Narmada district	Tapi district	The Dangs district	Total
1.	ST	0 (0.00)	24 (40.00)	56 (93.33)	50 (86.67)	130 (54.17)
2.	SC	0 (0.00)	34 (56.67)	2 (3.33)	10 (13.33)	46 (19.17)
3.	SEBC	28 (46.67)	0 (0.00)	0 (0.00)	0 (0.00)	28 (11.67)
4.	OPEN	32 (53.33)	2 (3.33)	2 (3.33)	0 (0.00)	36 (15)

Figures in parentheses indicate the percentage to the total sample

Age

The age of the sample farmers in all the districts and overall, under study is given from them and the results are presented in Table 4. In Bharuch district, the majority of respondents fall within the middle age group, constituting 51.67% of the total. This indicates a district where farmers in their prime years play a substantial role in agriculture. The young farmers account for 16.67% and the old farmers make up 31.67%. Narmada district, the middle-aged farmers represent 43.33%, closely followed by the old farmers at 36.66% and the young farmers at 20%. This suggests a diverse farming community with significant contributions from both experienced and younger individuals. The old farmers take the lead with 48.33%, followed by the middle-aged group at 30% and the young farmers at 21.67%. Considering the total of all districts, the middle-aged farmers stand out with 48.34%, reflecting the overall trend observed in individual districts. The old farmers follow closely at 33.75%, and the young farmers make up 17.91%. This collective overview emphasizes the importance of the middle-aged demographic in the agriculture sector across

the entire surveyed region.

Table 4: Age of farmers to selected districts of south Gujarat (No. / Farm)

Sr. No.	Particulars	Bharuch district	Narmada district	Tapi district	The Dangs district	Total
1.	Young (up to 35 years)	10 (16.67)	12 (20)	13 (21.67)	8 (13.33)	43 (17.91)
2.	Middle (36 to 50 years)	31 (51.67)	26 (43.33)	29 (48.33)	30 (50)	116 (48.34)
3.	Old (above 50)	19 (31.67)	22 (36.66)	18 (30.00)	22 (36.67)	81 (33.75)

Figures in parentheses indicate the percentage to the total sample

Similar results were obtained by Lahoti and Chole (2010)^[5], Kanat *et al.* (2012)^[4], Sabapara *et al.* (2014)^[8] and De and Bodosa (2014)^[3].

Education: The education level of the sample farmers in all the districts and overall under study were elicited from them and the results are presented in Table 5.

Table 5: Education level of head to selected districts of South Gujarat (No./Farm)

Sr. No.	Particulars	Bharuch district	Narmada district	Tapi district	The Dangs district	Total
1.	Primary or Below (≤ 4)	4 (6.67)	5 (8.33)	8 (13.33)	12 (20.00)	29 (12.08)
2.	High School (std. 5 to 9)	14 (23.33)	15 (25)	24 (40.00)	23 (38.33)	76 (31.67)
3.	SSC (10 th)	18 (30)	5 (8.33)	15 (25.00)	15 (25)	53 (22.08)
4.	Higher Secondary (std. 11 to 12)	14 (23.33)	31 (51.67)	9 (15.00)	7 (11.67)	61 (25.41)
5.	Graduate and above	10 (16.67)	4 (6.67)	4 (6.67)	3 (5.00)	21 (8.75)

Figures in parentheses indicate the percentage to the total sample

The majority of heads of households in Bharuch district have education levels ranging from High School to Higher Secondary. The highest percentage (30.00%) falls under SSC (10th), indicating a significant proportion of farmers with secondary education. Narmada district exhibits a diverse educational distribution, with a notable percentage (51.67%) of farmers having completed higher secondary education. Tapi district stands out with a significant percentage (40.00%) of heads of households having completed education up to high school. The overall picture across the four districts highlights a varied distribution of educational levels among the heads of households. Majority falls into the high school to higher secondary categories, collectively constituting 63.33% of the total population.

Family size

The majority of families in Bharuch district fall under the small and medium categories, constituting 41.67% and 40.00%, respectively (Table 6). Narmada district shows a similar trend with a notable percentage (40.00%) of families categorized as small. The medium category constitutes 50.00% suggesting a higher proportion of moderately-sized families in this district. In Tapi district, the family size distribution was spread across small, medium and large categories. The small and medium categories contributed 45.00% and 46.67% respectively, highlighting a balanced family size distribution. The large category constitutes

18.33% in The Dangs district. Across the total sample of 240 farmers, the majority fall into the small and medium categories, collectively constituting 86.50%.

Table 6: Family size of sampled farmers of south Gujarat (No. /Farm)

Sr. No.	Particulars	Bharuch district	Narmada district	Tapi District	The Dangs district	Total
1.	Small (≤ 4)	25 (41.67)	24 (40.00)	27 (45.00)	21 (35.00)	97 (40.41)
2.	Medium (4 to 8)	24 (40.00)	30 (50.00)	28 (46.67)	28 (46.67)	110 (45.83)
3.	Large (≥ 8)	11 (18.33)	6 (10.00)	5 (8.33)	11 (18.33)	33 (13.75)

Figures in parentheses indicate the percentage to the total sample

Occupation

The Occupation of the sample farmers in all the selected districts is shown in Table 7 farmers of Bharuch district (41.67%) were rely solely on farming. The combination of Farming + non-farm income was notable, representing 18.33% of the respondents. A distinct occupational land emerges in Narmada district, with a notable percentage (41.47%) engaging in Farming + non-farm income. The prevalence of respondents involved in Farming + Animal Husbandry signifies a combination of agricultural and animal-related activities. Tapi district showed a balanced

distribution across various occupations with Farming + nonfarm income contributing the highest percentage (46.67%). A significant number of respondents engage in Farming + Animal Husbandry (11.67%), emphasizing a combination of crop cultivation and animal rearing. The Dangs district exhibits a diverse occupational mix, with

Farming + non-farm leading at 28.33%. The combination of Farming + Animal Husbandry + Wage Labour indicates an approach to livelihoods, with 14.58% of respondents involved in multiple activities. The overall occupational distribution across the four districts reflects a diverse pattern.

Table 7: Occupation of farmers in selected districts of South Gujarat (N=240)

Sr. No.	Particulars	Bharuch district	Narmada district	Tapi district	The Dangs district	Total
1.	Farming only	25 (41.67)	18 (30.00)	18 (30.00)	15 (25.00)	76 (31.66)
2.	Farming+ Animal husbandry	8 (13.33)	9 (15.00)	17 (11.67)	14 (23.33)	48 (20.00)
3.	Farming + non-farm income	6 (18.33)	10 (41.67)	15 (46.67)	13 (28.33)	44 (33.75)
4.	Farming + Animal husbandry + non-farm income	6 (10.00)	9 (15.00)	11 (3.33)	11 (18.33)	28 (11.67)
5.	Farming+ Agriculture wage labour + non-farm income	8 (13.33)	9 (15.00)	8 (13.33)	7 (11.66)	32 (13.33)
6.	Farming + Animal husbandry + Agriculture Wage labour + non-farm income	7 (11.66)	5 (8.33)	7 (11.66)	16 (26.66)	35 (14.58)

Figures in parentheses indicate the percentage to the total sample

There have been supported by Parmar (2006) ^[7], Kanat *et al.* (2012) ^[4] and Sabapara *et al.* (2014) ^[8].

Types of farmers

Table 8 presents a categorization of farmers based on landholding in selected districts of South Gujarat namely Bharuch, Narmada, Tapi and The Dangs. The data

comprising a total of 240 farmers was organized into five categories: Marginal, Small, Medium, Semi-medium and large farmers. Bharuch district has 30% of its farmers classified as semi-medium farmers, followed by Narmada with 3.33%, Tapi with 1.67% and The Dangs with 5.00%. Across all districts, marginal farmers collectively make up 14.58% of the total sampled population.

Table 8: Categories wise distribution of sample farmers in South Gujarat (N= 240)

Sr. No.	Particulars	Bharuch district	Narmada district	Tapi District	The Dangs district	Total
1.	Marginal farmers (< 1.0 ha land)	4 (6.67)	23 (38.33)	43 (71.67)	30 (50.00)	100 (41.67)
2.	Small farmers (1.0 to 2.0 ha land)	7 (11.67)	22 (36.67)	9 (15.00)	23 (38.33)	61 (25.41)
3.	Medium farmers (2.0 to 4.0 ha land)	15 (25.00)	10 (16.67)	7 (11.67)	3 (5.00)	35 (14.58)
4.	Semi-medium farmers (4.0 to 10.0 ha land)	18 (30.00)	2 (3.33)	1 (1.67)	3 (5.00)	24 (10.00)
5.	Large farmers (> 10.0 ha land)	16 (26.67)	3 (5)	0 (0.00)	1 (1.67)	20 (8.33)

Figures in parentheses indicate the percentage to the total sample

Tapi district has the highest percentage of small farmers (71.67%), while Bharuch has the lowest (6.67%). Small farmers constitute 6.67% of the total sampled population. Bharuch has the highest percentage of medium farmers (25.00%) followed by Narmada (16.67%), The Dangs (11.67%) and Tapi (11.67%). Medium farmers together account for 14.58% of the total sampled population. Bharuch district has the highest percentage of large farmers (26.67%), while Narmada and The Dangs have 5.00% and 1.67%, respectively. Large farmers constitute 8.33% of the total sampled population. The majority of farmers fall into the marginal and small categories, indicating a prevalence of smaller landholdings in the selected districts. Tapi district stands out with a high percentage of marginal and small farmers, suggesting a concentration of smaller landholdings in this region. Bharuch district, on the other hand, exhibits a more diverse distribution across all categories.

The present finding gets support from research reported by Naseri *et al.* (2013) ^[6], Sabapara *et al.* (2014) ^[8] and De and Bodosa (2014) ^[3].

Operational land holding

The table 9 provides insights into the operational land holdings of farmers in selected districts of South Gujarat, specifically Bharuch, Narmada, Tapi and The Dangs. The data are presented in hectares per farm and was further categorized based on ownership (Own or Leased) and irrigation status (Irrigated or Unirrigated). Bharuch district has the highest average own + irrigated land holding per farm at 1.71 hectares, contributing to 32.81% of the total operational land in the district. The Dangs district follows closely with 1.54 hectares, constituting a significant portion of 62.86% of the operational land. Tapi district has the lowest average in this category at 1.06 hectares,

representing 36.25% of the operational land. Bharuch district again leads with an average own + unirrigated land holding of 1.41 hectares, contributing to 27.23% of the total operational land in the district. Narmada district has the lowest percentage in this category (22.60%), with an average of 0.80 hectares per farm. Tapi district has 0.86 hectares on average, making up 29.43% of the operational land.

Table 9: Operational land holding of selected farmers of South Gujarat (ha. /Farm)

Sr. No.	Particulars	Bharuch district	Narmada district	Tapi district	The Dangs district	Total
1.	Own + irrigated land	1.71 (32.81)	1.56 (22.60)	1.06 (36.25)	1.54 (62.86)	5.87 (79.08)
2.	Own + unirrigated land	1.41 (27.23)	0.80 (44.29)	0.86 (29.43)	0.91 (37.14)	3.98 (12.13)
3.	Leased + irrigated land	2.08 (39.95)	1.17 (33.09)	1 (34.31)	-	4.25 (8.78)
4.	Leased + Unirrigated land	-	-	-	-	-
5.	Total average land	5.21	3.52	2.91	2.46	14.1

Figures in parentheses indicate the percentage to the operational holdings

Cropping system: The analysis of cropping systems in selected districts of south Gujarat, as presented in Table 10. The results revealed that monocropping was particularly prominent in Narmada and The Dangs districts, constituting 25.28% and 20.31%, respectively. This concentration on a single crop, with average values of 1.38 ha and 0.81 ha per farm. On the other hand, multiple cropping strategies, such as intercropping dominate in The Dangs district representing 45.31% of the cropping system area and average 1.81 ha per farm. This approach reflects a diversified and resilient farming system that can adapt to environmental and market fluctuations. Bharuch district stands out for mixed cropping with a value of 33.64% suggesting a comprehensive integration of different crops to optimize resource utilization. Tapi district relies significantly on ratoon cropping contributing 41.51% to the cropping system area with an average of 2.34 ha per farm.

Table 10: Cropping system in selected districts of south Gujarat (ha./Farm)

Sr. No.	Particulars	Bharuch district	Narmada district	Tapi district	The Dangs district	Total
1.	Monocropping	0.36 (6.79)	1.38 (25.28)	0.78 (13.75)	0.81 (20.31)	3.32 (16.34)
2.	Multiple cropping					
(A)	Crop rotation	1.68 (32.13)	1.48 (27.32)	0.74 (13.01)	0.80 (20.12)	4.71 (23.16)
(B)	Intercropping	1.43 (27.41)	0.90 (16.46)	1.32 (23.51)	1.81 (45.31)	5.47 (26.92)
3.	Mixed cropping	1.76 (33.64)	1.68 (30.93)	0.46 (8.21)	0.57 (14.24)	4.47 (22.03)
4.	Ratoon cropping	0.00 (0.00)	0.00 (0.00)	2.34 (41.51)	0.00 (0.00)	2.35 (11.54)
	Total= 1+2+3+4	5.23 (100)	5.44 (100)	5.65 (100)	4.00 (100)	20.33 (100)

Figures in parentheses indicate the percentage to the cropping system area

Irrigation

The analysis of distribution of irrigation land in selected districts of south Gujarat, as presented in Table 11. Focused on various sources such as Open well, Tube well, Cannel and River. In Bharuch district the average irrigation land per farm for Open well is 0.88 hectares constitute 26.68% of the total area, while Tube well contributes 29.08% with an average of 0.95 hectares per farm. Cannel irrigation in Bharuch stands at 0.65 hectares per farm (19.70%) and River irrigation was 0.81 hectares per farm (24.53%). Narmada district show a substantial contribution from River irrigation accounted for 36.28% with an average of 1.68 hectares per farm. Tube well and Cannel also play significant roles with 0.99 hectares per farm (21.52%) and 0.95 hectares per farm (20.60%) respectively. Tapi district exhibits a diverse pattern with Cannel irrigation being the predominant source constitute 31.74% (1.03 hectares per farm) while open well and Tube well contribute 17.80% (0.57 hectares per farm) and 23.94% (0.78 hectares per farm) respectively. In The Dangs district, Open well was the primary source, covered 31.58% (0.75 hectares per farm), followed by Tube well at 33.98% (0.81 hectares per farm). The overall average irrigation land per farm for the surveyed districts was 13.59 hectares, with River irrigation being the most significant contributor at 30.76%. This variation in irrigation sources underscores the diverse agricultural practices and water resource utilization strategies across the districts.

Table 11: Irrigation land in selected districts of south Gujarat (ha. /Farm)

Sr. No.	Particulars	Bharuch district	Narmada district	Tapi District	The Dangs district	Total
1.	Open well	0.88 (26.68)	1.00 (21.58)	0.57 (17.80)	0.75 (31.58)	3.22 (23.68)
2.	Tube well	0.95 (29.08)	0.99 (21.52)	0.78 (23.94)	0.81 (33.98)	3.55 (26.14)
3.	Canal	0.65 (19.70)	0.95 (20.60)	1.03 (31.74)	0.00 (0.00)	2.64 (19.41)
4.	River	0.81 (24.53)	1.68 (36.28)	0.86 (26.50)	0.82 (34.43)	4.18 (30.76)
5.	Sum of average irrigated land	3.29 (100)	4.64 (100)	3.25 (100)	2.39 (100)	13.59 (100)

Figures in parentheses indicate the percentage to the total irrigation area

Nature and Extent of crop diversification at household level:

An attempt was made to analyze the extent of crop diversification by using primary data collected from 240 sample farmers from all four district of study area. To know the extent of diversification Simpson index used. At farm household level, level of crop diversification using different indices for Bharuch, Narmada, Tapi and The Dangs district are analysed. At household's level index.

Table 12: Crop diversification in south Gujarat through Simpson index

Sr. No.	Bharuch district	Narmada district	Tapi district	The Dangs district	Total
1.	0.94	0.89	0.93	0.83	0.89

The Simpson diversity index provides valuable insights into crop diversification across South Gujarat's districts. With Bharuch and Tapi districts leading with Simpson index values of 0.94 and 0.93 respectively, and Narmada district close behind at 0.89, the region showcases a notable degree of crop diversity. In contrast, The Dangs district trails slightly with a Simpson index of 0.83, indicating comparatively lower crop diversification. These findings suggest that farmers in South Gujarat are cultivating a wide range of crops, potentially enhancing resilience to pests, diseases, and market fluctuations. However, a deeper examination of the specific crops grown and the underlying drivers influencing diversification patterns is essential. Factors such as agro-climatic conditions, land availability, and market demand play pivotal roles in shaping farmers' choices. Further analysis and discussion should focus on understanding these drivers, assessing the sustainability of current cropping systems, and formulating policies to support and promote diversified agriculture. Such efforts are crucial for ensuring the long-term resilience and prosperity of South Gujarat's agricultural sector.

Conclusion

Over all, the detailed examination of agricultural dynamics in South Gujarat, as outlined in the provided data, showed that the prevalence of male-headed households, particularly in Bharuch prompts inquiries into gender dynamics within decision-making processes. The disparity in credit access across districts underscores the need for investigating the availability and accessibility of financial resources for farmers. Caste distribution reveals distinct challenges and opportunities for Scheduled Tribe farmers in Tapi and The Dangs, while the age distribution emphasizes the significance of middle-aged farmers impacting the region's agricultural sustainability. Varied educational levels and family sizes showed potential disparities and their implications for farming practices. Occupational diversity across districts highlights the importance of interventions based on local economic activities. Landholding patterns and operational land holdings showed on the structure and efficiency of farming. Finally, an exploration of cropping systems and irrigation sources unveils potential opportunities for diversification and resource optimization. Collectively, these characteristics showed aimed at fostering sustainable agricultural development in South Gujarat and average 0.89 diversification observed in four districts of south Gujarat.

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