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Spatial Pattern and Regional Disparities of Dairy Development Cooperative Societies and membership in Kolhapur District

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Abstract

Dairy cooperatives constitute a vital component of rural economic development in Maharashtra. The present study examines the spatial distribution and regional disparities of Dairy Development Cooperative Societies (DDCS) in Kolhapur district for the year 2024–2025. The district has a total of 6,238 dairy cooperative societies distributed across 12 tahsils. Using quantitative tools such as Cooperative Density Index (CDI), Location Quotient (LQ), and Pearson's correlation analysis, the study identifies spatial specialization and institutional concentration patterns. The findings reveal that Karvir, Radhanagari, Kagal, and Panhala tahsils exhibit high cooperative specialization ($LQ > 1$), whereas Gaganbavda and Hatkanangale show low concentration. A moderate positive correlation ($r = 0.61$) exists between the number of societies and membership strength. The study highlights spatial imbalance and emphasizes the need for region-specific policy interventions to ensure balanced dairy development.

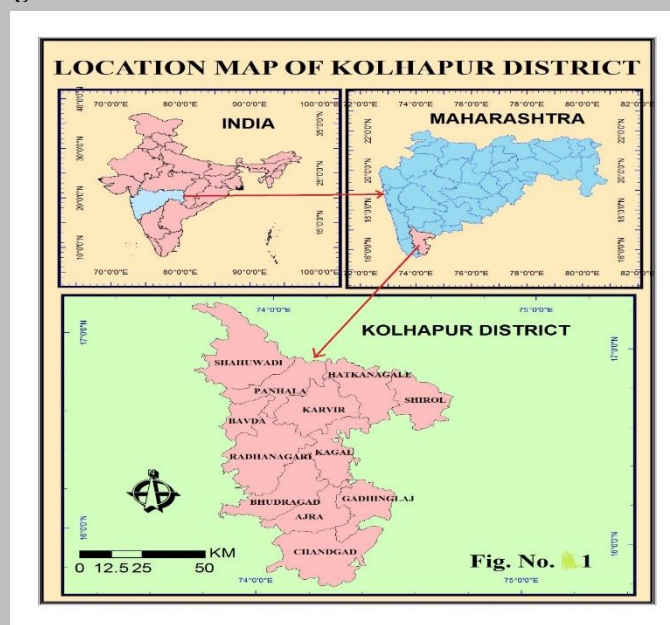
Keywords: Dairy Cooperatives, Location Quotient, Cooperative Density Index, Spatial Distribution, Regional Disparities.

Introduction

The dairy cooperative movement has significantly contributed to rural economic development in India by organizing small and marginal milk producers into structured institutional frameworks. Through assured procurement, fair pricing, veterinary services, and market linkage, dairy cooperatives have strengthened income stability and reduced the role of intermediaries. Maharashtra is one of the leading states in cooperative-based agricultural development, and Kolhapur district has developed a strong dairy cooperative network supported by favorable agro-climatic conditions, irrigation facilities, and an active cooperative tradition.

Dairy Development Cooperative Societies (DDCS) function as primary-level institutions that connect milk producers with processing units and organized markets. However, the distribution of these societies is not uniform across all tahsils. Variations in physical environment, agricultural development, accessibility, and socio-economic conditions have created spatial disparities in cooperative concentration and membership strength.

Study Region



Kolhapur district is the most developed district of Southern-western part of Maharashtra. The absolute location of district is 15° 43' to 17° 17' North Latitude and 73° 40' and 74° 42' East Longitude. It is surrounded by Sangli district to its North and East, Belgaum district of Karnataka to its South and Sindhudurg district to the West. The Sahyadri ranges to the west and Warana River to the North forms the natural boundaries. The geographical area of districts is 7685 square kilometres, For the administrative purpose the district is divided into 12 Tehsils. The population of the study region is 38, 76, 001 persons, according to 2011 census.

Objectives Of the Study

1. To analyze the tahsil-wise distribution of dairy cooperative societies in Kolhapur district.
2. To measure cooperative density and spatial specialization using CDI and LQ.
3. To examine the relationship between number of societies and membership.
4. To identify regional disparities and suggest policy measures.

Data Source and Methodology

1. Data Source

The study is based on secondary data for the year 2024–2025 obtained from District Dairy Development Records, Kolhapur. The dataset includes tahsil-wise number of Dairy Development Cooperative Societies across 12 tahsils.

2. Methodology

To examine spatial distribution and institutional disparities, the study employs the following quantitative techniques:

1. Cooperative Density Index (CDI)

$$CDI = \frac{S_i}{S} \times 100$$

Where:

S_i = Number of societies in i th tahsil

S = Total societies in district (6,238)

CDI represents the percentage share of each tahsil in total district cooperatives.

2. Location Quotient (LQ)

$$LQ = \frac{(S_i/S)}{(1/n)}$$

Where:

n = Total number of tahsils (12)

$1/n$ = Equal distribution benchmark (8.33%)

Interpretation:

- $LQ > 1 \rightarrow$ High specialization
- $LQ = 1 \rightarrow$ Average distribution
- $LQ < 1 \rightarrow$ Low concentration

3. Pearson's Correlation Coefficient

$$r = \frac{\sum(X - \bar{X})(Y - \bar{Y})}{\sqrt{\sum(X - \bar{X})^2 \sum(Y - \bar{Y})^2}}$$

Where:

X = Number of societies

Y = Membership

This measures the institutional relationship between cooperative expansion and member participation.

Results and Analysis

Tahsil-wise Distribution

1. Distribution of Dairy Cooperative Societies

Kolhapur district has a strong dairy cooperative network with a total of 6,238 dairy cooperative societies, reflecting the district's robust rural economy and cooperative movement. The spatial distribution of these societies, however, shows noticeable inter-tahsil variation. The highest concentration is observed in Karvir (952 societies), followed by Radhanagari (775), Kagal (707), and Panhala (684). Karvir alone accounts for 15.26% of the total dairy cooperatives in the district, making it the leading tahsil in dairy development. This dominance may be attributed to better infrastructure, irrigation facilities, market accessibility, and proximity to urban demand centers. In contrast, the lowest concentration is recorded in Gaganavda (148 societies) and Hatkanangale (299 societies), where physiographic constraints, limited agricultural land, or alternative economic activities may have restricted cooperative expansion. Overall, the distribution pattern indicates a central concentration of dairy cooperatives with relatively lower presence in peripheral and hilly regions, highlighting spatial disparities in dairy-based rural development.

Table: -1
Tahsil-wise Dairy Development Cooperative Societies and Total number of members in Kolhapur District 2024-2025

Sr. No.	Tahsils	Number of Dairy Development Cooperative Societies	Total number of members
1	Shahuwadi	484	18700
2	Panhala	684	38755
3	Hatkanangale	299	21974
4	Shirol	333	14778
5	Karvir	952	48541
6	Gaganbavda	148	12222
7	Radhanagari	775	39101
8	Kagal	707	37680
9	Bhudargad	653	22250
10	Ajra	328	30386
11	Gadhinglaj	418	57485
12	Chandgad	457	22304
	Total	6238	364176

2. Distribution of Total Membership

The distribution of total membership in dairy cooperative societies across Kolhapur district (2024–25) shows significant spatial variation. In terms of membership strength, the leading tahsils are Gadhinglaj (57,485 members), Karvir (48,541 members), Radhanagari (39,101 members), Panhala (38,755 members), and Kagal (37,680 members). Among these, Gadhinglaj stands out as it records the highest membership despite having only 418 societies, indicating a larger average membership per society and suggesting strong cooperative participation and dairy activity concentration in the region. Karvir, being economically and agriculturally developed, also maintains a high membership base consistent with its large number of societies. In contrast, lower membership levels are observed in Gaganbavda (12,222 members) and Shirol (14,778 members), where geographical constraints, smaller rural population, or alternative economic activities may limit cooperative participation. Overall, the pattern reveals that while the number of societies influences membership strength, regional socio-economic and agricultural factors significantly determine the scale of member participation in dairy cooperatives.

Cooperative Density Index (CDI)

The CDI analysis reveals that five tahsils contribute more than 50% of total cooperative societies, indicating institutional concentration in selected regions.

Location Quotient (LQ) Analysis

The analysis indicates high specialization ($LQ > 1$) in **Karvir (1.83)**, **Radhanagari (1.49)**, **Kagal (1.36)**, **Panhala (1.32)**, and Bhudargad (1.26). These values suggest that dairy cooperatives are more concentrated in these tahsils compared to the district average, reflecting strong agricultural infrastructure, irrigation facilities, and a well-established cooperative movement. In contrast, low specialization ($LQ < 0.8$) is observed in Gaganbavda (0.28), Hatkanangale (0.57), Shirol (0.64), and Ajra (0.63), indicating weaker relative concentration of dairy activities. These lower values may be associated with physiographic constraints, industrial diversification, or limited agricultural resource bases. Overall, the LQ analysis clearly demonstrates spatial imbalance, with dairy specialization concentrated primarily in agriculturally developed and centrally located tahsils, while peripheral and less developed regions exhibit lower levels of specialization. This clearly indicates spatial imbalance and concentration in agriculturally developed tahsils.

Correlation Analysis

The Pearson correlation coefficient between number of societies and membership is:

$$r = 0.61$$

After applying the correlation method to the tahsil-wise data (6,238 societies and 3,64,176 total members) This indicates a moderate positive correlation between the number of societies and membership. It means that, in general, tahsils with a higher number of dairy cooperative societies tend to have higher membership. However, the relationship is not perfectly strong because some tahsils deviate from the general trend. For instance, **Gadhinglaj** has comparatively fewer societies but very high membership, indicating larger average membership per society. Similarly, **Ajra** shows high membership relative to its number of societies.

Thus, the correlation analysis reveals that while the expansion of societies contributes to increased membership, other socio-economic factors such as population size, dairy intensity, and cooperative efficiency also significantly influence member strength.

Regional Disparities and Suggest Policy Measures

The study reveals clear regional disparities in dairy cooperative development across Kolhapur district. Tahsils such as Karvir, Radhanagari, Kagal, and Panhala show high concentration and specialization, while

Gaganbavda, Hatkanangale, Shirol, and Ajra exhibit lower cooperative presence. This imbalance is influenced by differences in agriculture, irrigation, infrastructure, and socio-economic conditions.

To reduce disparities, policy measures should focus on strengthening infrastructure, improving veterinary and extension services, providing financial support for new societies, and promoting dairy development in backward and hilly tahsils. Region-specific planning is essential for achieving balanced and inclusive dairy growth in the district.

Conclusion:

The study reveals that Kolhapur district has a strong dairy cooperative structure with 6,238 societies and 3,64,176 members. However, the distribution is spatially uneven. Tahsils such as Karvir, Radhanagari, Kagal, and Panhala show high specialization and institutional concentration, whereas Gaganbavda and Hatkanangale exhibit low cooperative presence. The moderate positive correlation ($r = 0.61$) between number of societies and membership indicates that while expansion of societies generally increases membership, regional socio-economic factors also influence cooperative strength. Overall, balanced regional planning is necessary to reduce disparities and ensure inclusive dairy development across all tahsils.

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Conflicts of interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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