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Spatial-Temporal Variation of Agricultural Efficiency in Dharashiv (Osmanabad) District: A Geographical Analysis

Dr. Chikram M. W.

Abstract

This research investigates the spatial and temporal variation in agricultural efficiency across Dharashiv (Osmanabad) district, Maharashtra, employing Bhatia's method to analyze data from the periods 2000–2004 and 2014–2018. By assessing the yield indices and crop area proportions for ten major crops, the study classifies tehsils into high, moderate, and low efficiency zones. The analysis reveals notable disparities in agricultural performance, shaped by irrigation availability, rainfall distribution, and soil characteristics. The findings offer practical insights for policymakers and stakeholders to support targeted interventions and promote sustainable agricultural development in the region.

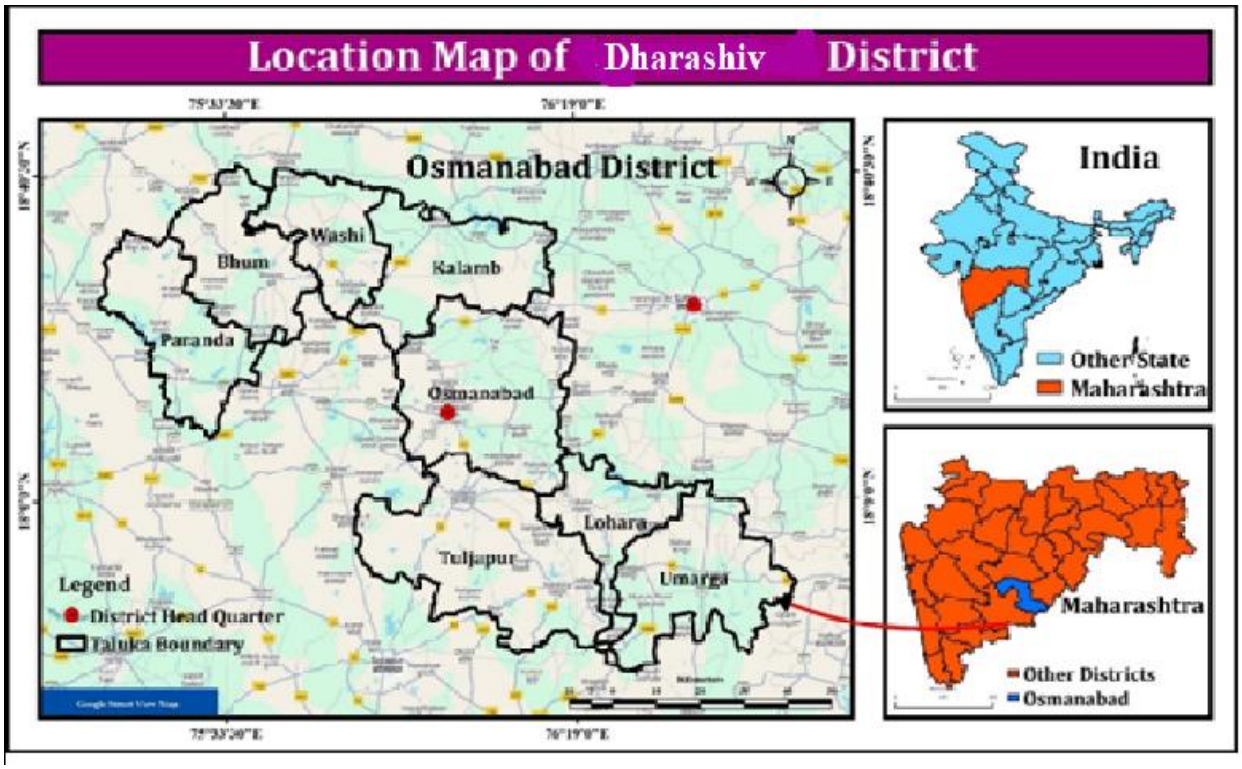
Keywords: *Agriculture, efficiency*

Introduction

Agriculture remains the backbone of the Indian economy, playing a critical role in transforming the socio-economic structure of rural society. It is a dynamic sector that continues to evolve through diversification, shaped by agro-climatic conditions, technological inputs, and socio-economic infrastructure. Agricultural efficiency serves as a key indicator of development, reflecting the productivity of land and the effectiveness of resource utilization (Dey & Mistri, 2018). Agriculture significantly contributes to overall development by ensuring food security, fostering secondary and tertiary sectors, increasing rural income, and improving rural welfare. This growth also triggers socio-cultural progress, as higher rural incomes tend to promote literacy and education, thereby supporting broader social transformation (Munir, 1992).In geographical studies, agricultural efficiency is defined as the output per unit of cultivated land. According to Bhatia (1967), it is measured by the combined performance of various crops, each weighted according to its share in the total cropped area. Agricultural efficiency helps in understanding the spatial pattern of productivity and is crucial in evaluating agricultural practices across regions. Measuring efficiency is particularly important in a developing country like India for several reasons. Firstly, agriculture involves intensive use of resources such as land, labor, and capital. Secondly, identifying inefficiencies allows farmers to minimize costs and optimize inputs. Thirdly, efficiency assessment highlights areas where productivity can be improved through technology, better practices, or management reforms. Fourthly, it facilitates comparisons across farms, regions, and systems, helping identify best practices and guiding policy formulation. Fifthly, enhancing efficiency contributes to sustainability by conserving resources and reducing waste. Lastly, it offers critical insights for decision-making in agricultural economics, guiding both farmers and policymakers (Jana et al., 2023).

The Study Region:

Dharashiv (Osmanabad) district is located in the Marathwada region of Maharashtra State. Geographically, the district lies between 17°39′45″ and 18°42′30″ North latitude and 75°18′30″ and 76°46′15″ East longitude. It is bounded to the south-west by Solapur district, to the north-west by Ahmednagar district, to the north by Beed district, and to the south by Bidar and Kalaburagi (Gulbarga) districts of Karnataka State. The total geographical area of the district spans 7,512 square kilometers. In terms of administrative ranking, Osmanabad stands 24th in area among the districts of Maharashtra. Of this, 248 square kilometers (3.20%) is designated as urban area, while the remaining 7,321 square kilometers (96.80%) constitutes rural area. The district stretches approximately 280 kilometers from east to west and 240 kilometers from north to south. Topographically, Dharashiv (Osmanabad) lies on the Deccan Plateau at an average elevation of 600 meters above mean sea level. A substantial portion of the district is traversed by the Balaghat Ranges, resulting in an uneven terrain interspersed with pockets of low-lying plains. For administrative convenience, the district is subdivided into eight tehsils: Dharashiv (Osmanabad), Tuljapur, Omerga, Lohara, Kalamb, Bhum, Paranda, and Washi. The district comprises a total of 729 villages.



Objectives:

The main objective of the present study is to analyze agriculture efficiency in Dharashiv (Osmanabad) district.

Data Collection and Methodology:

The present paper is based on secondary sources of data comprising of the district census handbook, gazetteers, socio-economic review, and district statistical Abstract of Dharashiv district. To assess the agricultural efficiency of different tehsils in Osmanabad district, Bhatia's method (1967) has been applied for two time periods: 2000–2004 and 2014–2018. Ten major crops were selected, and weights were assigned based on the area devoted to each crop. Using this methodology, the tehsils have been classified into high, moderate, and low agricultural efficiency categories.

The formula used for calculating agricultural efficiency as per Bhatia's method is as follows:

$$Lya = \frac{Yc}{Yr} X\,100$$

Where,
Lya = Yield index of crop "a" in the areal unit (e.g., tehsil)
Yc = Hectare yield of crop "a" in the areal unit (local yield)
Yr = Hectare yield of crop "a" in the entire region (regional average yield)

$$Ap\ (Ei) = \frac{Lya\,X\,Ca + Lya\,X\,Cb \ldots\ldots\ldots\ldots Lyn\,X\,Cn}{Ca + Cb \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots + Cn}\ X\,100$$

Where,
Ap is the agriculture productivity (efficiency index)
Lya, lyb. ---------- lyn are the yield indices of various crops.
Ca, Cb. ---------- Cn are the percentage of cropland under different crops.

Result and Discussion:

Agricultural Efficiency in Dharashiv District during 2000-2004:

Table 1.1 presents the agricultural efficiency index for Dharashiv (Osmanabad) district during the period 2000–2004, revealing notable spatial variations across tehsils. The efficiency values ranged from 86.02 to 102.87. The high agricultural efficiency was recorded in Washi, Kalamb, Tuljapur, Umarga, Paranda, and Dharashiv (Osmanabad) tehsils, each exhibiting values above 97.24. The higher efficiency in Kalamb, Tuljapur, Umarga, Paranda, and Osmanabad can be attributed to the development of surface irrigation facilities, while Washi tehsil benefited from the presence of fertile soils in the Manjra River basin. In contrast, low agricultural efficiency was observed in Lohara and Bhum tehsils, where values were below 91.63, indicating relatively poor agricultural performance during the study period.

Agricultural Efficiency in Dharashiv (Osmanabad) District during 2014-18:

Table 1.1 indicates that during the period 2014–2018, the agricultural efficiency index in the study region varied across tehsils, ranging from 91.74 to 137.00. Figure 4.4 B shows that high agricultural efficiency was recorded in Paranda, Dharashiv (Osmanabad), and Kalamb tehsils, with values above 121.90. In Paranda, this was due to the surface irrigation provided by the Sina Kolegaon major irrigation project. In Dharashiv (Osmanabad), higher rainfall contributed to better agricultural development, while in Kalamb, the presence of fertile soil in the Manjra River basin and the development of surface irrigation facilities played a major role. Moderate agricultural efficiency was observed only in Bhum tehsil, with an index of 107.26. Low agricultural efficiency was recorded in Lohara, Washi, Umarga, and Tuljapur tehsils, with values below 106.82. In Lohara, this was due to uncertain rainfall; in Washi, limited surface irrigation development; in Umarga, poor development of perennial irrigation; and in Tuljapur, the low percentage of fertile soils.

Table No. 1.1: Agricultural Efficiency Index by Bhatia's Method in Dharashiv (Osmanabad) District During 2000-2004 and 2014-2018

Sr. No.	Tehsil	Agricultural efficiency 2000-04	Agricultural efficiency 2014-18	Change Agricultural efficiency
1	Bhum	88.74	107.26	18.51
2	Kalamb	100.05	132.87	32.82
3	Lohara	86.02	91.74	5.72
4	Dharashiv (Osmanabad)	102.87	136.00	33.13
5	Paranda	102.41	137.00	34.59
6	Tuljapur	100.15	95.97	-4.18
7	Umarga	100.50	95.37	-5.13
8	Washi	98.40	93.45	-4.96

Source: *Compiled by Researcher on the basis of District Socio Economic Review and Statistical Abstract of Dharashiv (Osmanabad) District 2000-04 to 2014-18*

Change of Agriculture Efficiency in Dharashiv (Osmanabad) District during 2014-2018:

Table 1.1 indicate that during the investigation period, the district experienced both positive and negative changes in agricultural efficiency. High positive changes were observed in Paranda, Dharashiv (Osmanabad), and Kalamb tehsils, with values above 24.96, due to the same factors mentioned above. A moderate positive change was recorded in Bhum tehsil, with a value of 18.51, while a low positive change was found in Lohara tehsil, with 5.72, attributed to underdeveloped perennial irrigation. High negative changes were recorded in Umarga and Washi tehsils, with values above 4.80, due to uncertain rainfall. Tuljapur tehsil showed a low negative change of 4.18 in agricultural efficiency.

Conclusions:

The analysis of agricultural efficiency in Dharashiv (Osmanabad) district over the two study periods reveals both positive and negative shifts across tehsils. High positive changes were seen in Paranda, Dharashiv (Osmanabad), and Kalamb, primarily because of improved irrigation facilities, favorable rainfall, and fertile soils. Moderate gains occurred in Bhum, while Lohara saw only a slight improvement, likely due to limited perennial irrigation. In contrast, Umarga and Washi experienced notable declines, largely attributed to uncertain rainfall and inadequate irrigation development, with Tuljapur showing only a minor negative change. These findings underscore the critical role of irrigation infrastructure, soil quality, and rainfall in shaping agricultural efficiency. Targeted policy interventions addressing these factors can help foster balanced and sustainable agricultural growth across the district.

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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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