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RESEARCH ARTICLE

Study on the Agricultural Landscape of Possible Opportunities and Imbalances for the Advancement of Agriculture in the Jhunjhunu District of Rajasthan, India

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Abstract

Objective: The primary goal of this study is to examine the potential for agricultural development in the Jhunjhunu district of Rajasthan, India. Development scheme implementers, social workers, and agricultural planners will gain insights from the study. The purpose of the recommendations is to aid in the formulation of an appropriate plan for agricultural development and opportunities within the research region. **Method:** The study conducts a longitudinal analysis of land use data (2021-22), covering the Jhunjhunu region. The sources documents and other documents serve as the data's primary source https://jankalyanfile.rajasthan.gov.in//Content/UploadFolder/OrderEntry/Stats/2023/Publication/O_221223_75c0a1b2-2f72-4708-b427-bd5a45af4c34.pdf, ensuring both quality and dependability. Variance analysis is one of the statistical tools used to assess the significance of changes made to each land use classification. Following that, an assessment of the data is conducted in order to draw conclusions about broad trends and their potential impact on Jhunjhun land usage. **Findings:** The current study has maintained its research objectives as agriculture is key economy that is affected by the environment. The distribution of crops by irrigated and non-irrigated methods in agricultural growth. It decreased to 7097 hectares and 0 hectare in Zaid Rabi for irrigated and non-irrigated areas, respectively. However, there was a slight increase to 36113 hectares and a continued rise to 244544 hectares in irrigated area. Additionally, there was a slight increase to 42747 hectares and a continued rise to 326435 hectares in non-irrigated area (Table 1; Figure 2). **Novelty:** Currently, it is getting harder to keep up with traditional basic business in all of Jhunjhunu district of Rajasthan, India in a timely and balanced manner. However, the Jhunjhunu district in Rajasthan, India, has seen more pollution and impacts from human activity than any other business. The regional disparity in agricultural

growth has been evaluated within the framework of Jhunjhunu district, taking into account geographical factors.

Keywords: Agricultural landscape; Opportunities and imbalances; Advancement of agriculture; Jhunjhunu district; Geographical factors

1 Introduction

Cropland expansion mostly affects biodiversity hotspots in Central and South America, while cropland intensification threatens biodiversity, especially in Sub-Saharan Africa, India and China[(1)]. India has traditionally been a farming nation. The last century has seen a dramatic simplification of global landscapes, driven largely by the expansion and intensification of agriculture[(2)]. Societal and policy trends are leading to major demands on food systems, including a transformation towards more sustainable and resilient farming systems[(3)]. The agricultural sector provides a living for almost 70% of the population. Agriculture is clearly impacted by numerous environmental and cultural elements. As a result, the diversity of agricultural development may be seen across the globe. The rapidly growing population and current food production systems have raised concerns about global food security and ecosystem sustainability[(4)]. Agricultural innovation is crucial for navigating the dynamic market landscape and overcoming the diverse challenges posed by the current economic climate[(5)]. Indeed, our estimates show that having insufficient renewable water resources available to fulfill the needs of plants may induce a minimum loss of capability to produce agricultural goods by approximately 4%[(6)]. The changing circumstances in rural areas, in particular, are putting pressure on land and water that are vital to food production at a time when human and livestock populations are increasing[(7)]. Feliciano, D., (2022) studied Factors influencing the adoption of sustainable agricultural practices: the case of seven horticultural farms. Farmers' awareness of the importance of soil was clear and governments should encourage farmers' involvement in the monitoring of soil health, as a mean of engaging them in the wider discussion about the implementation of sustainable land management, including climate change adaptation and mitigation[(8)]. Water shortages, variable rainfall patterns, soil erosion and degradation, restricted access to loans and agricultural inputs, low productivity, and the need for crop diversification are issues in Rajasthan agriculture[(9)]. Verburg et al., (2019) studied on beyond land cover change: towards a new generation of land use models. They have mentioned that land use models play an important role in exploring future land change dynamics and are instrumental in supporting the integration of knowledge in land system science. However, due to inadequate model evaluation and inadequate representation of the underlying socio-ecological systems, only moderate progress has been made in accomplishing these goals. They address how human agency, demand-supply interactions, and multi-scalar dynamics can be more accurately represented by land use models, as well as how learning from model evaluation can be accomplished[(10)]. Khinchi, (2020) reported on Agriculture and environment and state about the dependence on agriculture in the region, looking at the problems of the farmers, and new agriculture according to their capacity and geographical conditions[(11)]. Meena and Khinchi, (2023) reported on dynamic trends in land utilization: A case study of Sawai Madhopur District, 2017-2022. This study investigates the dynamic trends in land utilization over a five-year period from 2017 to 2022. They reported on significant trends and changes found by statistically analyzing land use data from a variety of categories, such as forest area, non-agricultural land, barren land, and others. The results show that there has been a significant increase in the area covered by forests, a sign of effective conservation efforts, and a consistent growth in the usage of non-agricultural land, a sign of continued urbanization and industrial expansion. This research adds to land utilization dynamics and emphasizes the

significance of sustainable land management techniques for both environmental and socioeconomic well-being[12].

Recently, in 2023, Khinchi and Meena studied on impact of agricultural land use changes on economic and social development and reported that investigates the impact of changes in agricultural land use on economic development, social development, and agricultural income in Sawai Madhopur, India. According to the parameter estimates derived from the SEM analysis, there are substantial correlations between changes in agricultural land use and social, economic, and agricultural income[13]. To understand how groundwater depletion affects staple grain (wheat, rice, maize, pearl millet, and sorghum) production in India, we ran district-level panel regressions using agricultural census, groundwater observation, and gridded weather datasets over a ten-year study period (2004–2013)[14]. In India, the pressure of the population on agriculture is very high. Research work done in the agricultural sector has led to the development of new agricultural technology to feed the increasing population and raise its economic level. As a result of the Green Revolution, the form of agriculture has moved towards modernization with the use of improved seeds, chemical fertilizers, pesticides, and modern agricultural equipment and this process is continuing. Even while its effects are not as scary right now, they are a sign of a major issue that may arise in the future. Thus, the ecology as a whole will get out of balance. As a result, human life and the entire living universe will be impacted. It must be managed by the development of agriculture.

1.1 Problem Statement

In India as a whole, it is currently getting harder to keep up with traditional core business in a timely and balanced manner. In actuality, agriculture is a business that is affected by the environment. However, the impact of human activity and pollution has increased in this particular business. The regional disparity in agricultural growth has been evaluated within the framework of Jhunjhunu district, taking into account geographical factors. Because its issues should be taken into account by conducting deep and micro research, this research paper will be more beneficial. To suggest the technology, to test it by implementing it at the district level and to use seeds and irrigation facilities and methods keeping in view the changing climatic conditions of rainfall, as well as to suggest watershed technology as per the terrain of the district, the impact of these techniques, agricultural development, their production, self-reliance of the farmer and to suggest the use of agricultural development techniques as per the condition of underground water level, is the aim of this research. Thus, the main objective of this research paper is to do a geographical comparative analysis of geographical conditions, underground water level, agricultural production, irrigation methods and their means at a small scale, economic and social conditions of the farmer. Rajasthani farmers have been cultivating land for ages. In this sense, it is possible to raise production per hectare several times while maintaining a high production rate when high-yielding crop varieties are planted with adequate soil management and the supply of vital nutrients to the plants.

1.2 Introduction to the study area

In the northeast of the Indian state of Rajasthan sits the Jhunjhunu district (Figure 1). The crop distribution in the Jhunjhunu district of Rajasthan, India, as a geographical study covering three types of crops from irrigated and non-irrigated areas is shown in Figure 1. Approximately 338 meters above sea level, the Jhunjhunu district is situated in the state of Rajasthan between 75°02 and 76°06’ east longitude and up to 27°38’ north latitude. Churu district to the northwest, Sikar district to the southwest, and Hisar and Mahendragarh districts of the state of Haryana to the northeast encircle Jhunjhunu district. The district covers 5928 square kilometers in total geographic area. With a total geographical size of 881.69 square kilometers, Malsisar Tehsil is the largest tehsil when viewed in terms of area. Chidawa, with a total land area of 513.52 sq km, is the smallest tehsil. Jhunjhunu is currently divided into 08 subdivisions and tehsils (Jhunjhunu, Malsisar, Buhana, Udaipurwati, Nawalgarh, Khetri, Chidawa and Surajgarh) from administrative point of view. There are also 06 (Mandawa, Bisau, Mukundgarh, Singhana, Gudhagaudji and Singhana) sub tehsils in the district. There are also 11 (Jhunjhunu, Alsisar, Buhana, Udaipurwati, Nawalgarh, Khetri, Chidawa, Surajgarh, Singhana, Pilani and Mandawa) Panchayat Samitis in the district. Similarly, there are Municipal Councils in the district. (Jhunjhunu) and 11 (Mandawa, Bagad, Bisau, Pilani, Vidya Vihar, Surajgarh, Chidawa, Khetri, Mukundgarh, Nawalgarh and Udaipurwati) municipalities. Study area According to the 2011 census, the total population of Jhunjhunu district is 2137045 which is 3.12 % of the total population of Rajasthan. As per the 2011 census, the population density in the district is 361 persons per square kilometer. Here only 22.89 % of the population lives in urban areas. While more than three-fourths of the population in the district still lives in rural areas. At present, the sex ratio here is 950 and the literacy rate is 74.13 %. The literacy rate of women and men in the district is 60.95 and 86.90 %, respectively. 16.88 % of the scheduled caste and 1.95 % of the scheduled tribe population live in the district.

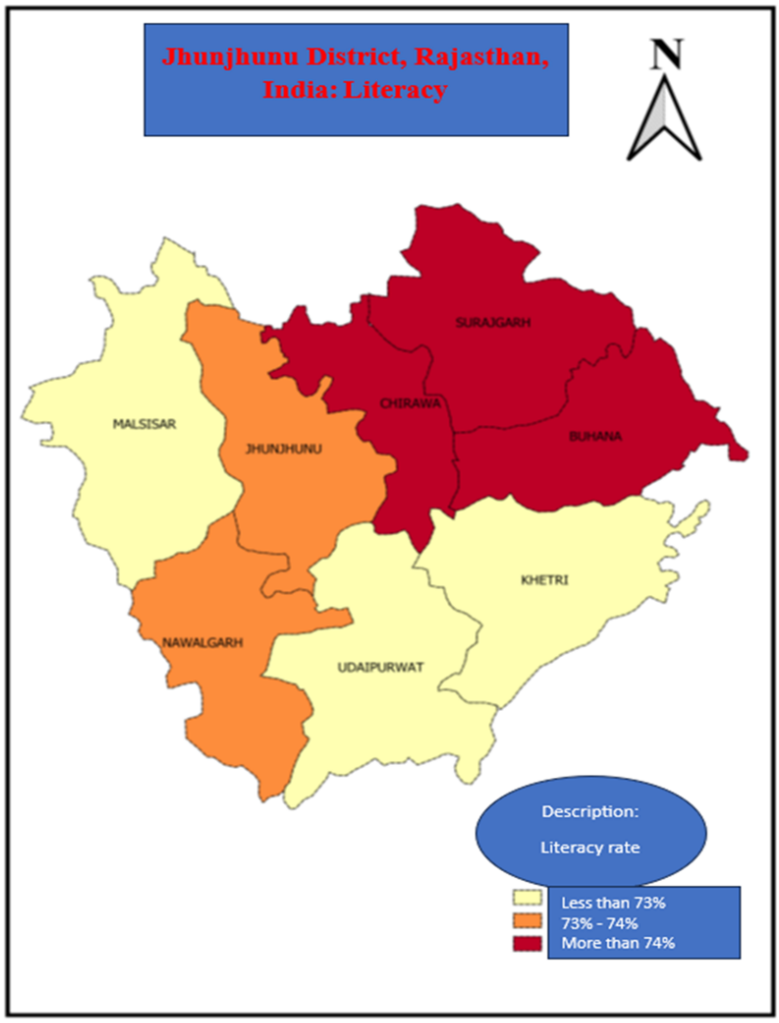

Fig 1. Study area: Jhunjhunu district of Rajasthan, India

1.3 Objectives of research work

Analyzing Jhunjhunu district's agricultural progress and opportunities is the primary goal of this study. Agricultural planners, social workers, and officials carrying out development projects can learn from the study. The goal is to provide recommendations so that a suitable plan can be created for agricultural growth and opportunities in the study area of Jhunjhunu district. To examine how the reporting area for forest area and land use has changed over time.

1. To look into the patterns over time of the land not available for cultivation and the area used for non-agricultural purposes.
2. To assess how permanent pastures and other grazing areas have changed over time, as well as arid and uncultivable territory.
3. To evaluate the alterations in the area covered by various tree crops and groves throughout time.

2 Methodology

The study conducts a longitudinal analysis of land use data from 2021 to 2022, covering the Jhunjhunu region, geographical coordinate of the studied area: latitude 27º 38' - 28º 31' longitude 75º 2' - 76º 6' and altitude 450 Mts. MSL, in northern east part of Rajasthan, Geographical area – 5, 92,671 ha, period of study: 2021 to 2022; Government documents and other documents

serve as the data's primary source: https://jankalyanfile.rajasthan.gov.in//Content/UploadFolder/OrderEntry/Stats/2023/Publication/O_221223_75c0a1b2-2f72-4708-b427-bd5a45af4c34.pdf, ensuring both quality and dependability. Variance analysis is one of the statistical tools used to assess the significance of changes made to each land use classification. Following that, an assessment of the data is conducted in order to draw conclusions about broad trends and their potential impact on Jhunjhun land usage.

2.1 Importance of research

The majority of people who work are working in agriculture, which is an extremely demanding industry. The natural world is the foundation of agriculture. Because these factors vary widely across the globe, attempts are made to alter them so that their usefulness can be maximized and that natural resources can be used to their fullest by reducing obstructive conditions and advancing land use, crop production, and technology in accordance with local geographic conditions. The district of Jhunjhunu is situated in Rajasthan's semi-desert area. By resolving land and agricultural-related issues, land productivity can be increased, raising district residents' standards of living. Additionally, by doing so, agricultural planners, administrators, and other relevant parties can decide on the best plan for the district's agricultural development schemes.

2.2 Research highlights

Keeping these in mind, the research objectives of the present study have been kept.

1. To assess the study of agricultural development and cropping pattern tehsil-wise in the district
2. To assess the study of current agricultural development and cropping patterns in the district
3. To suggest various schemes to strengthen the basic infrastructure of agriculture in the district
4. To identify the social, and economic obstacles in agricultural development
5. Contribution of agricultural loan programs in agricultural development at present

The systematic and scientific study of agricultural development under agricultural geography by agricultural geographers started only after 1925. Some important studies in this context are described below:

3 Results and Discussion

Agricultural activities depend on regional variations, local configuration of various elements of agriculture, various conditions found in the patterns of agricultural activities as well as the level of social, economic, and technical development of the farmer. The increase and decrease in the regional production of agricultural crops is the result of agricultural development, economic and technological reasons. As a result of agricultural development, farmers adopt new technology, mechanization, chemical fertilizers, new varieties of improved seeds, pesticides, medicines, the latest means of irrigation, etc. and ultimately it is reflected in the form of high production. Agricultural development has brought about a lot of change in the socio-economic sector in the district. Therefore, the curiosity to know the real status of agricultural development and regional imbalance in the district has increased. In order to evaluate the increasing agricultural development, prosperity, and welfare work in any region or area, it becomes necessary to study the regional imbalance of that region.

Table 1 presents the distribution of crops by irrigated and non-irrigated methods in agricultural growth. It is a geographical analysis of three crop kinds grown in irrigated and non-irrigated areas in Jhunjhunu district, Rajasthan, India. It varies to 7097 hectares and 0 hectare in Zaid Rabi, for irrigated and non-irrigated areas, respectively. However, there was a slight increase to 36113 hectares in Kharif and a continued rise to 326435 hectares in non-irrigated area. Additionally, there was a slight increase to 244544 hectares in rabi and a decrease to 42747 hectares in non-irrigated area. The table reflects an overall downward trend in irrigated and non-irrigated of Jhunjhunu district, Rajasthan, India.

Table 1. Crop wise distribution onirrigated and non-irrigated way in Jhunjhunu

Crop distribution on irrigated and non-irrigated way in agricultural development - A geographical study of Jhunjhunu district, Rajasthan, India				
S.No.	**Name of Crop**	**Irrigated**	**Non-Irrigated**	**Total**
1	Kharif	36113	326435	362548
2	Rabi	244544	42747	287291
3	Zaid Rabi	7097	0	7097
4	Total	287754	369182	656936

Figure 2 presents the distribution of crops by irrigated and non-irrigated methods in agricultural growth. It is a geographical analysis of three crop kinds grown in irrigated and non-irrigated areas in Jhunjhunu district, Rajasthan, India. The variation of Kharif crop to 36113 hectares and 326435 hectares in for irrigated and non-irrigated area, respectively. However, there was a slight increase to 244544 hectares in rabi and a continued decrease to 42747 hectares in irrigated area. Additionally, there was a better increase to 287754 hectares and a decreased to 369182 hectares in non-irrigated area. The Figure 3 reflects an overall downward trend in sub division wise distribution on tube wells (electricity operated) in the study area.

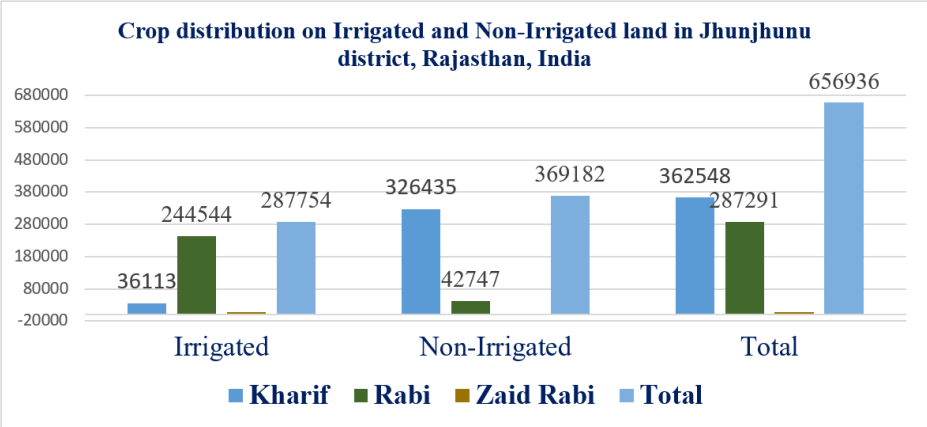

Fig 2. Crop wise distribution on irrigated and non-irrigated land in study area

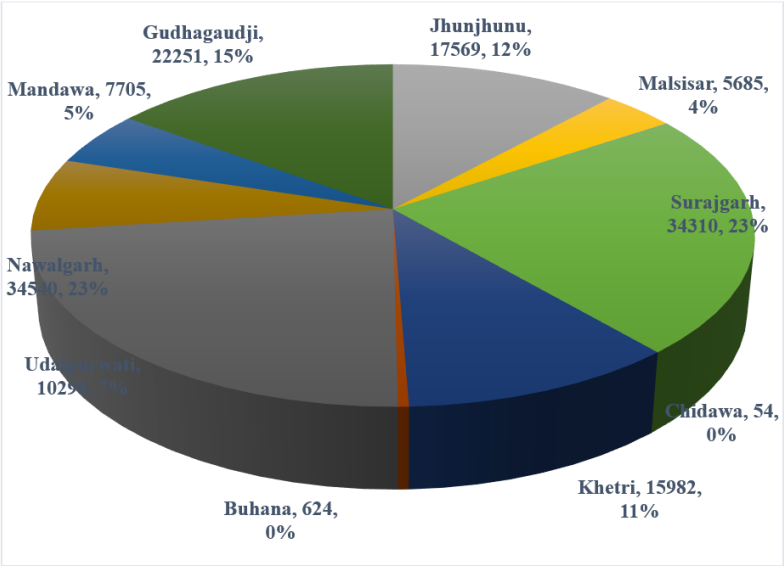

Fig 3. Sub division wise distribution on tube wells (electricity operated) in study area

Table 2 presents the distribution of crops by irrigated and non-irrigated methods in agricultural growth. It is a geographical analysis of eleven sub division in irrigated and non-irrigated areas in Jhunjhunu district, Rajasthan, India. It decreased to 24 hectares and 812 hectares inChidawa and Udaipurwati from tube wells (electricity operated, see the Figure 3) and from other wells (electricity operated, see the Figure 4), respectively. However, there was a slight increase to 7331 hectares in Mandawa and a continued rise to 13560 hectares in Khetri sub division area. Additionally, there was a slight increase to 8074 hectares in Malsisar sub division area and a continued rise to 34662 hectares in Nawalgarh sub division area. Table 3 reflects an overall downward trend (Sub division wise distribution) in irrigated and non-irrigated of Jhunjhunu district, Rajasthan, India.

Table 2. Net irrigated area wise distribution on irrigated and non-irrigated land

S. No.	Sub division	From Canals	From Ponds	From tube wells (electricity operated)	From other wells (electricity operated)	Net irrigated area
1	Jhunjhunu	0	0	15748	7281	23029
2	Malsisar	0	0	8074	3258	11332
3	Chidawa	0	0	24	29246	29270
4	Surajgarh	0	0	26917	32182	59099
5	Khetri	0	0	13560	1948	15509
6	Buhana	0	0	511	17628	18139
7	Nawalgarh	0	0	34662	7727	42389
8	Udaipurwati	0	0	9086	812	9898
9	Mandawa	0	0	7331	5282	12616
10	Gudhagaudji	0	0	16619	7195	23814
11	Total	0	0	132532	112562	245094

Table 3. Sub division wise distribution on irrigated and non-irrigated land

S. No.	Sub division	From Canals	From Ponds	From Tube wells (Electricity operated)	From Other wells (Electricity operated)	Net irrigated area
1	Jhunjhunu	0	0	17569	8185	25754
2	Malsisar	0	0	5685	5840	11554
3	Chidawa	0	0	54	34098	34152
4	Surajgarh	0	0	34310	40559	74869
5	Khetri	0	0	15982	2700	18682
6	Buhana	0	0	624	19232	18856
7	Nawalgarh	0	0	34540	8978	47518
8	Udaipurwati	0	0	10298	876	11174
9	Mandawa	0	0	7705	5576	13302
10	Gudhagaudji	0	0	22251	8671	30922
11	Total	0	0	153018	134736	287754

Figure 3 presents the distribution of net irrigated area-wise distribution on irrigated and non-irrigated ways in Jhunjhunu for agricultural growth. It is a geographical analysis of three crop kinds grown in irrigated and non-irrigated areas in Jhunjhunu district, Rajasthan, India. For irrigated and non-irrigated areas, it declined in Udaipurwati Sub division and Malsisar Sub division, respectively. However, there was a minor increase in agricultural imbalance in Jhunjhunu. Furthermore, the Gudhagaudji Sub division in the non-irrigated region increased well in Jhunjhunu district of Rajasthan, India. Both irrigated and non-irrigated, are showing an overall declining trend, as shown in Figure 4. Figure 5 reflects an overall downward trend in irrigated and non-irrigated of Jhunjhunu district, Rajasthan, India.

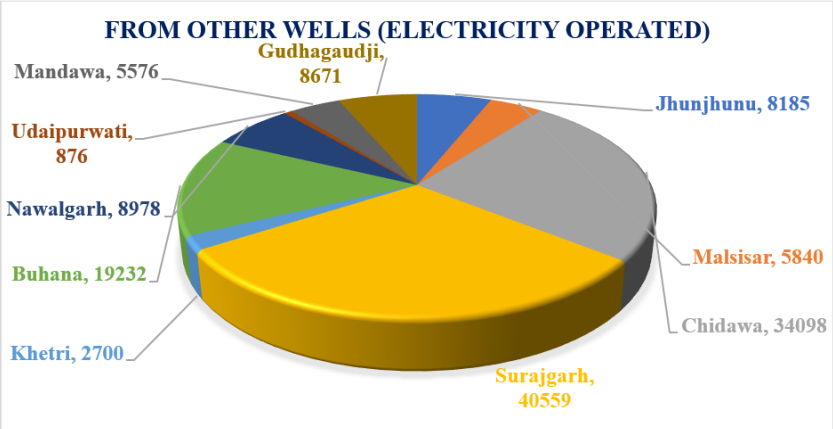

Fig 4. Sub division wise distribution on other wells (Electricity operated) in study area

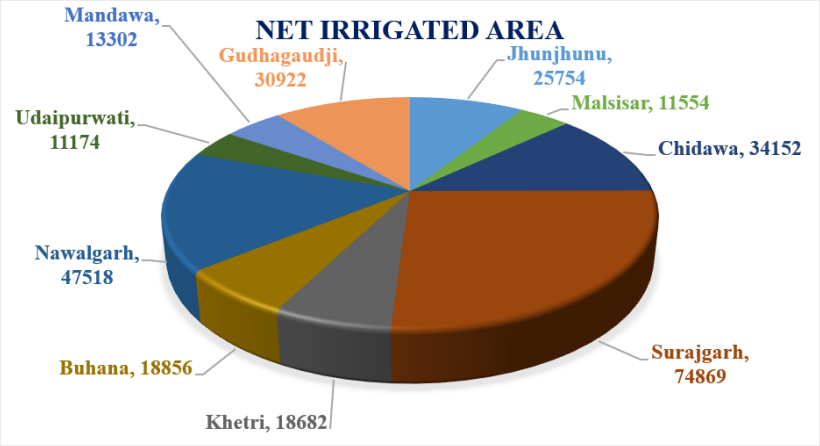

Fig 5. Net irrigated area distribution

4 Conclusion

This study's main objective is to examine agricultural potential and advancements in Rajasthan, India's Jhunjhunu area. The study offers insights that development project authorities, social workers, and agricultural planners might apply. The goal is to provide suggestions for the appropriate planning of agricultural growth and opportunities in the area that is being studied. In light of these, the current study has retained its original research objectives. Maintaining traditional core business in a timely and balanced manner is becoming increasingly difficult in India overall. Agriculture is, in fact, a business that is impacted by environmental factors. But more pollution and the effects of human activity than any other industry have been witnessed in Rajasthan, India's Jhunjhunu area.

Future Scope of Study

The current study's research aims have been maintained in light of these. Evaluate the research on cropping patterns and agricultural growth at the tehsil level in Jhunjhunu district. Evaluate the district's present cropping pattern and agricultural development study. Many plans have been put up to improve the district's fundamental agricultural infrastructure. Identifying and proposing solutions for the social and economic barriers to agricultural development. Information and communication technology's current role in agricultural growth.

Statement of Competing Interests

The authors declare that none of the work reported in this study could have been influenced by any known competing financial interests or personal relationships.

Data accessibility

Every piece of information has been included in the manuscript and the addendum.

Declaration of generative AI and AI-assisted technologies in the writing process

The authors employed GPT 4 in order to enhance the manuscript's language and readability during the preparation process. Following their use of this tool/service, the writers took full responsibility for the publication's content and reviewed and amended it as necessary.

Authors Contributions Statement

Each and every part of this study project, including its conception, planning, data collection, analysis, interpretation, and revision, has been contributed to by authors Shyam S. Khinchi and Amit Kumar. Each author has participated in experiments, reviewed the article, interpreted data, checked the work for grammar and spelling, and designed the study. Furthermore, author

Shyam S. Khinchi has contributed as a corresponding author, mentor, and supervisor of the study activity. The submitted version has the approval of all authors.

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