J. Farm Sci., 37(1): (50-53) 2024

RESEARCH PAPER

Trends in net irrigated area from different sources in Karnataka

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(Received: February, 2023 ; Accepted: March, 2024)

DOI: 10.61475/JFS.2024.v37i1.12

Abstract: Agriculture plays a central role in India's economy, contributing significantly to its overall development. A key factor in boosting agricultural production is the availability of irrigation. In India, the total irrigated area has increased from 22.6 million hectares in 1950-51 to 71.6 million hectares in 2018-19 which is more than half of the country's net sown area. The main objective of the study is to analyse the extent of irrigated area by different sources in the state. For the study secondary data has been collected. The secondary data on irrigated area under different sources of irrigation in the state was collected from Karnataka Neeravari Nigama Limited (KNNL), Government of Karnataka and Director of Economics and Statistics (DES), and Karnataka at a Glance and from other published sources. The entire study period was divided into two periods as Period-I and Period-II (2001-02 to 2010-11 and 2011-12 to 2020-21) to analyse the performance of area irrigated by different sources in the state. The data were analysed using Compound Annual Growth Rate technique. The results revealed that the net irrigated area in Karnataka, analysed in two distinct periods has consistently exhibited a positive growth trajectory. The net irrigated area in Karnataka, exhibited consistent growth from 21,76,735 hectares in 2001-02 to 46,75,102 hectares in 2020-21, with a compound annual growth rate of 3.64 per cent. Notably, tubewells demonstrated the highest growth rate, experiencing a substantial increase of 14.62 per cent during the initial period. In contrast, the net irrigated area sourced from canals declined by 6.88 per cent, and that from tanks decreased by 1.28 per cent in the later period. This shift can be attributed to farmers practicing use of tube wells and bore wells as their primary and more reliable sources of water.

Keywords: Compound annual growth rate, Irrigation, KNNL, Net irrigated area

Introduction

Agriculture is the backbone of human civilization and plays a vital role in ensuring employment, food security, promoting economic development, environmental sustainability, preserving cultural heritage, and driving scientific and technological progress. India has a highly diverse agro-climatic conditions with a wide range of crops adaptability such as rice, wheat, sugarcane, cotton, fruits, vegetables, spices and plantation crops. Agriculture provides employment to over 50 per cent of the population and accounting for around 17 per cent of the country's GDP. Irrigation is a crucial component in agriculture, as it involves the application of water to crops to ensure their optimal growth and development for higher yield and income. Irrigation is a crucial aspect of agriculture in India, where a significant portion of the population depends on farming for their livelihood. India has a large network of irrigation systems that includes surface and ground water sources such as canals, wells, tanks, and tube wells (Ashok, 2019). However, the availability and efficiency of irrigation facilities vary greatly across different agro climatic regions of the country.

Water scarcity is a growing global concern with a projected scenario where over a third of the world's population could experience absolute water scarcity in the coming years. The region's most at risk include the semi-arid areas of Asia, the Middle East, and Sub-saharan Africa. Unfortunately, these regions already have a high population density and where considerable percentage of population is living below the poverty line, exacerbating the potential impact on their livelihoods. India in particular is facing a critical situation, as a significant and swiftly increasing portion of its population is already grappling with severe water scarcity.

In India, the total irrigated area has increased from 22.6 million hectares in 1950-51 to 71.6 million hectares in 2018-19 which is more than half of the country's net sown area. The increase in irrigation facilities after independence has been primarily driven by the construction of major irrigation projects and canal networks particularly in the northern and western regions of the country. Karnataka is the eighth largest state in India geographically covering an area of 1,91,791 square kilo meters (74,051 square miles). The gross irrigation potential of Karnataka as of 2019-20 is approximately 124.33 lakh hectares (12.40 million hectares). However, the net irrigated area in the state is around 35.29 lakh hectares (352,900 square kilo meters), which means that only about 28 per cent of the gross irrigation potential is being utilized. The major sources of irrigation in Karnataka are canals, tanks, tube wells, and wells which correspondingly account for about 7 per cent, 25 per cent, 25 per cent, 42.75 per cent respectively of the net irrigated area. Hence, the present study is attempted to analyse extent of irrigated area covered by surface and groundwater resources in the state of Karnataka.

Material and methods

Study area and sampling procedure

The main objective of the study is to analyse the extent of irrigated area by different sources in the state. For the study secondary data has been collected. The secondary data on irrigated area under different sources of irrigation in the state

was collected from Karnataka Neeravari Nigama Limited (KNNL), Government of Karnataka and Director of Economics and Statistics (DES), and Karnataka at a Glance and from other published sources. The data has been collected from the twenty years period from 2001 to 2020 to critically analyse the extent and significance of irrigation sources in the state of Karnataka. The entire study period was divided into two periods as Period-I (2001-02 to 2010-11) and Period-II (2011-12 to 2020-21) to analyse the performance of area irrigated by different sources in the state.

Analytical tools

Compound Annual Growth Rate

In order to analyze the growth in net irrigated area from different sources in Karnataka state compound growth rates were computed using the following model.

$Y_t = ab^t e^u$

Where,

Y_t = dependent variable (irrigated area) a = intercept term, b = (1+r) and 'r' is the compound growth rate, t = time, u = error term

The above model was expressed in Logarithmic form as,

Log Y= log a + t log b+ log u

This is of the following form

Qt = a + bt + Ut .. (2)

Where,

Qt = ln Y a = ln A b = ln B

Ut = ln Vt

The values of 'a' and 'b' were estimated by using Ordinary Least Squares Estimation technique. Later, the original 'A' and 'B' parameters in equation (1) were obtained by taking antilogarithms of 'a' and 'b' values as;

A = Antilog (a) , B = Antilog (b)

Average annual compound growth rate (%) was calculated as follows:

g = (B - 1) * 100

Results and discussion

The Table 1 explains on the irrigation sources in Karnataka over a ten-year period, from 2001-02 to 2010-11 (Period-I). It includes canals, tanks, tube wells, lift irrigation, other sources, and the total irrigated area in hectares for each year. Notably, the total irrigated area increased significantly during this period, from 21.77 lakh ha in 2001-02 to 31.72 lakh ha in 2010-11 with a mean irrigated area of 25.15 lakh ha indicating substantial growth (6.82%) in irrigated area in the state. Canals were the dominant source of irrigation, with a steady CAGR of 4.09 per cent while tube wells as a source of irrigation having second highest source showed a remarkable growth with a high CAGR of 14.62 per cent making it increasingly significant source. Lift irrigation with a mean irrigated area of 1.10 lakh ha also experienced moderate growth with a CAGR of 4.28 per cent annually while, tanks as a source of irrigation showed a minimal growth with the lowest CAGR of 0.45 per cent annum. The CDVI values revealed that tube wells witnessed significant high instability index of (22.07) under this source from the mean. Thus, canals and tubewells were the major sources in the state indicating their increasing importance.

The results in Table 2 represents irrigation sources in Karnataka during Period-II spanning from 2011-12 to 2020-21. The total irrigated area increased consistently over the years reaching 46.75 lakh hectares in 2020-21. This signified a significant growth in land under irrigation in the state. Canals on the other hand, displayed negative (6.88%) and however non significant during the period. Other sources also exhibited significant growth in irrigated area with a CAGR of 6.48 per cent, highlighting their emerging role in irrigation. The areas irrigated through canals, tanks, and lift irrigation have demonstrated a moderate degree of stability with instability indices of 15.96, 12.75, and 13.56, respectively. This analysis offers insights into the shifting dynamics of irrigation extent in Karnataka State (Narayanamoorthy, 2022).

The results in Table 3 provides irrigation sources in Karnataka during overall period from 2001-02 to 2020-21. The

Table. 1 Trend in net irrigated area from different sources in Karnataka (In hectares)

Period-I (2001-02 to 2010-11)						
Year	Canals	Tanks	Tube wells	Lift Irrigation	Other Sources	Total
2001-02	9,03,472	2,43,407	5,74,249	91,486	3,64,121	21,76,735
2002-03	7,72,674	1,82,963	4,47,712	94,312	3,10,087	18,07,748
2003-04	7,43,383	1,47,068	3,91,329	96,421	3,28,140	17,06,341
2004-05	9,48,564	1,76,696	4,27,024	98,215	3,85,883	20,36,382
2005-06	10,54,810	1,90,262	9,69,919	1,00,328	3,74,092	26,89,411
2006-07	10,30,438	1,91,691	9,55,216	1,10,311	3,96,729	26,84,385
2007-08	9,90,729	2,08,130	10,78,920	1,28,357	4,20,058	28,26,194
2008-09	10,61,338	2,06,047	11,39,885	1,28,432	4,24,041	29,59,743
2009-10	11,05,038	1,95,698	12,51,643	1,28,737	4,13,261	30,94,377
2010-11	11,56,782	1,97,047	12,80,523	1,19,642	4,18,171	31,72,165
Mean	9,76,722.8	1,93,900	8,51,642	1,09,624.1	3,83,458.3	25,15,348.1
CAGR(%)	4.09***	0.45	14.62***	4.28***	2.98***	6.82***
CDVI	8.38	13.37	22.07	6.07	6.22	10.88

Note: *** Indicates Significance at 1% level.

Other sources: Farm pond, other water harvesting structures.

Source: Karnataka at a Glance.

Table. 2 Trend in net irrigated area from different sources in Karnataka (In hectares)

Period-II (2011-12 to 2020-21)						
Year	Canals	Tanks	Tube wells	Lift Irrigation	Other Sources	Total
2011-12	11,78,232	1,77,762	12,77,637	1,00,876	3,83,383	31,17,890
2012-13	11,36,148	1,38,076	13,21,212	1,16,669	4,17,614	31,29,719
2013-14	12,53,141	1,53,972	13,21,601	97,319	4,15,526	32,41,559
2014-15	11,76,825	1,58,412	14,02,136	87,413	4,72,506	32,97,292
2015-16	9,27,813	1,46,541	13,99,313	1,19,240	3,93,684	29,86,591
2016-17	9,13,219	1,16,244	13,70,948	95,109	3,78,016	28,73,536
2017-18	9,44,874	1,25,613	14,14,333	1,00,432	3,81,274	29,66,526
2018-19	11,92,519	1,38,343	18,14,997	1,13,998	5,65,367	38,25,224
2019-20	12,61,769	1,38,464	18,63,111	1,25,943	6,49,613	40,38,900
2020-21	14,77,476	1,64,709	21,60,897	89,012	7,83,008	46,75,102
Mean	11,46,201.6	1,45,813.6	15,34,618.5	1,04,601.1	4,83,999.1	34,15,233.9
CAGR (%)	-6.88	-1.28	5.43***	0.23	6.48**	3.64**
CDVI	15.96	12.75	9.68	13.56	20.35	13.16

Note: *** Indicates Significance at 1% level, ** Indicates Significance at 5 % level.
Other sources: Farm pond, other water harvesting structures.
Source: Karnataka at a Glance.

Table. 3 Trend in net irrigated area from different sources in Karnataka

Overall (2001-02 to 2020-21)						
	Canals	Tanks	Tube wells	Lift Irrigation	Other Sources	Total
Mean	10,61,462.2	1,69,857	11,93,130.25	1,07,112.6	4,33,728.7	29,65,291
CAGR (%)	1.84***	-2.22***	7.64***	0.20	2.73***	3.70***
CDVI	13.08	14.18	18.73	13.62	18.14	12.63

Note: *** Indicates Significance at 1% level, ** Indicates Significance at 5 % level.
Other sources: Farm pond, other water harvesting structures.
Source: Karnataka at a Glance.

mean values show the average irrigation levels over the entire period. Notable insights include the following where canal irrigation exhibited a positive and significant increase relatively modest CAGR of 1.84 per cent indicating slow growth, while tanks saw a decreased growth (-2.22%). Tube wells experienced substantial and significant growth in area irrigated with CAGR of 7.64 per cent showing their increasing significance within state. Other sources also displayed notable growth of having 4,34 lakh ha covering under irrigation with a CAGR of 2.73 per cent. The CDVI values indicate varying degrees of instability from the mean, where tube wells witnessed the highest instability index of 18.73 followed by other sources put together (18.14).

The results presented in Tables 1, 2, and 3 offers crucial insights into the changing irrigation sources in Karnataka over the past two decades. In Table 1, the period from 2001-02 to 2010-11 witnessed a substantial increase in the total irrigated area, primarily driven by remarkable growth in tube well usage. Similar findings were reported by Gyanendrs (2020). Canals remained dominant, no doubt tube wells assumed increasing significance as irrigation source witnessed CDVI value indicating high instability index (22.07) from the mean. Table 2 from the period, 2011-12 to 2020-21, showed a continued expansion of the total irrigated area, with canals and tubewells as noteworthy sources for expanding irrigated area in the state with greater investment both public and private. The observed stability in the areas irrigated through canals, tanks, and lift irrigation methods underscores the transformation in irrigation dynamics. Table 3, encompassing the overall period, reiterates the slower annual growth (1.84%) in canal irrigation. The decline of tank irrigated area with a negative (-2.22%) growth, and the significant increase in tube wells irrigation (7.64%) emphasizing their increasing role in expanding irrigation in the state. Notably, tube wells exhibited the highest instability index (18.73), indicating substantial variability between years and was possibly due to regional disparities in groundwater availability. These findings illuminate the shift from canal-based irrigation to more adaptable and region-specific methods, emphasizing the need for sustainable water resource management strategies and technological innovations to support the ever-expanding agricultural sector in Karnataka (Biswas and Bhattacharya, 2019). These findings align with those reported by Ganesh (2015) in his research on irrigation trends in India, where the proportion of irrigated area using tanks decreased by 7 per cent during the 2011-12 study period.

Conclusion

In case of overall trend in net irrigated area from different sources in Karnataka, the study showed a significant growth in area under tubewell irrigation between 2001-02 and 2020-21, tube wells experienced the highest growth rate, and stood at a substantial growth 7.64 per cent. The study emphasised the significance of canals and tubewells as important and primary sources of irrigation apart from tanks and lift irrigation schemes. Considering the objective of bringing more and more area under irrigation there is a need integrated approaches to harness the available water resource potential in the state by promoting both public and private investment in irrigation sector for a strong farm economy in the state.

References

Ashok M B, 2019, Economic impact of Shiggaon lift irrigation project on farm economy in haveri district, Karnataka. *M.Sc. (Agri.) Thesis*, University of Agricultural Sciences, Dharwad, Karnataka, India.

Biswas S and Bhattacharyya B, 2019, A Time series modelling and forecasting of irrigated area under major crops in India using ARIMA models. *International Journal of Current Microbiology Applied Science*, 8(12): 2383-2398.

Gyanendra Singh, 2020, Trends in agricultural production as influenced by growth in irrigation resources in India. *World Water Policy,* 6 (2): 286-298.

Narayanamoorthy A, 2022, Temporal Trends and Regional Patterns in Development of Irrigation in India. *The Irrigation Future of India: Development, Resource and Policy*, 49-72.